EB-2019-0242

Association of Major Power Consumers of Ontario ("AMPCO")

Kingston CoGen Limited Partnership ("KCLP")

Panel 4 – Brian Rivard

Examination in Chief Compendium

November 28, 2019

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TAB I

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November 21, 2019

Delivered by Email, RESS and Courier

Ms. Christine Long, Registrar and Board Secretary
Ontario Energy Board
P.O. Box 2319, 27th Floor
2300 Yonge Street
Toronto, ON M4P 1E4

Dear Ms. Long:

Re: Application for Review of an Amendment to the Independent Electricity System Operator Market Rules
Board File No. EB-2019-0242
Kingston CoGen Limited Partnership – Revised Figures to Affidavit Evidence

Upon subsequent review of the Affidavit of Brian Rivard, filed on November 8, 2019 in the subject proceeding, Dr. Rivard noted that there were inadvertent errors in some figures included therein.

In particular, Figures 1 through 4 in the evidence as filed contain the following errors:

- The tables in Figures 1 through 4 refer to “ABC Corp.” and “XYZ Corp.” but should instead refer to “DR Corp.” and “GEN Corp.”, respectively;
- In Figures 3.A and 3.B, GEN Corp’s Marginal Cost in the table “With Generator” is listed as -$380. It should be -$320;
- In Figure 4.B, DR Corp’s Net IESO Settlement is listed as $10,200. It should be -$9,800. This error is carried down in the table “With Generator” for DR Corp. The calculations have been revised accordingly;
- In Figure 4.B, GEN Corp’s Net IESO Settlement is listed as -$200. It should be -$30,200; and
- The numbers in negative are in black. They should be in red, pursuant to paragraph 37.

Please find enclosed the updated Affidavit and a supplementary document containing only the revised figures to reflect these changes.

Yours very truly,

BORDEN LADNER GERVAIS LLP

Per:

Original signed by Ewa Krajewska

Ewa Krajewska

cc: John Vellone, BLG
John Windsor, Northland Power Inc.
James Hunter, IESO
Colin Anderson, AMPCO
Ian A. Mondrow, Gowling WLG
Michael Bell, OEB Staff
Intervenors of Record

EB-2019-0242

IN THE MATTER OF the *Ontario Energy Board Act, 1998*, S.O. 1998, c. 15, Sched. B, as amended;

AND IN THE MATTER OF an Application by the Association of Major Power Consumers in Ontario, pursuant to section 33 of the *Electricity Act, 1998, S*.O. 1998, c. 15, Sched. A and Rule 17 of the Ontario Energy Board *Rules of Practice and Procedure* for review of amendments to the Independent Electricity System Operator market rules related to the implementation of a Transitional Capacity Auction (MR- 00439-R00-R05).

AND IN THE MATTER OF a notice of motion by the Association of Major Power Consumers in Ontario, pursuant to section 33 of the *Electricity Act, 1998, S*.O. 1998, c. 15, Sched. A and Rule 17 of the Ontario Energy Board *Rules of Practice and Procedure* to stay the operation of amendments to the Independent Electricity System Operator market rules pending determination of the Application.

AFFIDAVIT OF
Brian Rivard, Adjunct Professor at the Ivey Business School and
Research Director of the Energy Policy and Management Centre, Western University

November 8, 2019
Revised: November 21, 2019

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N.	Exhibit “N”	Paper by David Brown and David Sappinton published in the Journal of Regulatory Economics in 2016

TAB 1

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I, Brian Rivard, of the Town of Paris, in the Province of Ontario, MAKE OATH AND SAY AS FOLLOWS:

A. INTRODUCTION

A.1 Q: Please state your name and occupation.

1. My name is Brian Rivard. I am Adjunct Professor at the Ivey Business School at Western University and the Research Director of the school's Energy Policy and Management Centre.

A.2 Q: For whom are you testifying in this proceeding?

2. I am testifying on behalf of Kingston CoGen Limited Partnership ("KCLP"). Attached hereto as **Exhibit "A"** is a signed copy of Form A pursuant to the Ontario Energy Board's (the "Board") Rules of Practice and Procedure.

A.3 Q: What is your educational background?

3. I hold a Ph.D. and M.A. in Economics from Western University. My field of specialization is industrial organization with an emphasis on the study of competitive markets, economic efficiency, and regulatory economics. I also have a B.A. in Economics from the University of Windsor.

A.4 Q: What is your professional background?

4. A copy of my curriculum vitae is attached hereto as **Exhibit "B"**. I began my career working as an Economist and then as a Senior Economist at the Canadian Competition Bureau. The Competition Bureau is the agency responsible for enforcing the Canadian *Competition Act* and protecting the Canadian economy against anti-competitive business conduct such as collusion or price fixing, abuse of dominant position, and anti-competitive mergers. My primary function as an Economist at the Competition Bureau was to conduct economic analysis in support of the Bureau's various enforcement actions.

5. After briefly working as a Senior Economic Consultant for the economic consulting firm, LECG, I joined the Independent Electricity System Operator ("IESO") (then called the Independent Electricity Market Operator) in 2000 as a Senior Economic Advisor in the Market Assessment and Compliance Division, reporting to the Market Surveillance Panel. Within this role, I was responsible for monitoring the Ontario electricity market for anomalous conduct, including abuses of market power or gaming, and for structural or market design deficiencies.

6. In 2006, I was promoted to Manager of Economics with the responsibility of conducting analysis of the effects of changes in wholesale electricity market design or government policy on the efficient operation of the IESO's wholesale market.

7. In 2010, I assumed the role of Manager of Regulatory Affairs and Sector Policy Analysis. In this role, I represented the IESO on the ISO-RTO Council ("IRC") as a member and Chair of the IRC's Market Committee. The IRC is a member group of North America's competitive wholesale market operators.[1] I was the Chair of the Market Committee at the time the United States Federal Energy Regulatory Commission (the "Commission") issued its Final Rule in Docket No. RM10-17-000, Order No. 745, *Demand Response Compensation in Organized Wholesale Energy Markets* ("FERC Order No. 745").[2]

8. In 2013, I was appointed the position of Director of Markets. As Director of Markets, I was responsible for evolving the design of the Ontario electricity market to ensure it operated fairly and efficiently. As Director, I oversaw the transition of the responsibility for administering demand response programs from the Ontario Power Authority

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[1] In addition to the IESO, the IRC includes the Alberta Electric System Operator ("AESO"), the California Independent System Operator Corporation ("CAISO"), the Electric Reliability Council of Texas, Inc., ("ERCOT"), ISO New England, Inc., ("ISO-NE"), the Midcontinent Independent System Operator, Inc. ("MISO"), the New York Independent System Operator, Inc. ("NYISO"), PJM Interconnection, L.L.C., ("PJM") and the Southwest Power Pool ("SPP").

[2] Being Tab 8 to the IESO's Book of Authorities in Response to AMPCO's Request for a Stay, dated November 5, 2019, available online at: http://www.rds.oeb.ca/HPECMWebDrawer/Record/657752/File/document [FERC Order No. 745].

("OPA") to the IESO. I initiated the design and implementation of the IESO Demand Response Auction ("DRA").

9. In 2015, I left the IESO to join Charles River Associates International as a Principal in their Energy Practice. I advised clients on a variety of issues, most notably competitive wholesale market design, market power and market manipulation issues.

A.5 Q: What is your current position?

10. I am Adjunct Professor and Research Director of the Energy Policy and Management Centre for the Ivey Business School at Western University. My primary role at Ivey is to further the mission of the Energy Centre which is to:

   a. Contribute to energy policy-making through the production and dissemination of evidence-based research and analysis on major policy issues affecting the electricity, gas, oil and pipeline sectors in Canada;

   b. Provide a transparent and reliable forum for industry, government, academia, and interested stakeholders to discuss and exchange ideas on energy sector development and policy; and

   c. Educate students, executives, and government officials on national and global energy sector issues.

A.6 Q: What other professional experiences do you have?

11. I serve as a peer reviewer for the Energy Journal. I am a Member of the International Association of Energy Economists. I am an occasional lecturer at Ryerson University and Osgoode Hall Law School.

A.7 Q: Have you previously submitted testimony before Board or other regulatory agencies?

12. I provided oral testimony before the Board on behalf of the IESO in EB-2007-0040 (regarding the 3x Ramp Rate). I provided written and oral testimony before the

Commission on behalf of Shell Energy North America (US), L.P. in Docket No. EL02-71-057.

A.8 Q: What is the purpose of your testimony in this proceeding?

13. I was retained by counsel for KCLP to review the Association of Major Power Consumers of Ontario's ("AMPCO") Notice of Appeal (the "Appeal") to Market Rule Amendments MR-00439-R00-R05 (the "Amendments") and supporting evidence, and to offer my independent views on the economic merit of AMPCO's position in this proceeding.

14. The Amendments enable the evolution of the IESO's DRA into a Transitional Capacity Auction ("TCA") that will allow non-contracted and non-regulated generators ("non-committed dispatchable generators") to participate in future capacity auctions alongside Demand Response ("DR") resources.

15. The focus of the Appeal is the appropriate level of compensation for DR resources. The IESO provides non-committed dispatchable generators an energy payment if / when the generators respond to an IESO instruction to produce energy based upon their offered price. Under the Amendment, DR resources will not receive an energy payment (or "utilization payment") when DR resources respond to an IESO instruction to reduce their energy consumption (an "economic activation").[3] AMPCO claims that this

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[3] Application for Review of an Amendment to the Independent Electricity System Operator Market Rules, Notice of Appeal, EB-2019-0242, filed September 26, 2019, available online at: http://www.rds.oeb.ca/HPECMWebDrawer/Record/653723/File/document, at para. 12. The terms "energy payment" and "utilization payment" are used interchangeably in the proceeding material. For clarity, a ***utilization payment*** is a payment made to a demand response market participant that responds to an instruction from the system operator (IESO) to reduce the amount of electricity (energy) that they are consuming. The instruction from the IESO to a demand response resource to reduce energy consumption is referred to as an ***energy activation***. For this reason, utilization payments are sometimes referred to as ***activation payments***. Utilization payments at the wholesale market-clearing price are called ***energy payments***. A DR resource could receive an energy activation instruction from the IESO as part of the IESO's economic dispatch process, called an ***economic activation***, as a test of the DR resources capability, or for reliability or emergency reasons. The issue in the Appeal is compensation for economic activation. The IESO plans to compensate DR resources if the IESO instructs the resource to reduce consumption to test the resources capability or for reliability and emergency reasons.

represents inequitable and unfair treatment of DR resources, places DR resources at a competitive disadvantage to non-committed dispatchable generators in the TCA, and results in a TCA that is unfair and inefficient, and effectively anticompetitive and discriminatory. AMPCO also contends that the Commission, in FERC Order No. 745, has definitively recognized "that failure to compensate DR resources for such services is unjust and unreasonable."[4]

16. Counsel further asked that I address the issue the Board raised in Procedural Order No. 2. The Board stated that "it is particularly interested in receiving evidence that describes the experience with compensation for DR in markets in other relevant jurisdictions, and the extent to which that experience is informative in the context of the Amendments having regard to any pertinent differences such as differences in market design or structure."

17. Specifically, my evidence will:

a. analyze the economic merit of AMPCO's assertions of inequitable and unfair treatment, competitive disadvantage, and the negative impacts on competition and efficiency; and

b. identify pertinent similarities or differences between the United States wholesale markets and the Ontario market, such as differences in market design or structure, to inform the Board of the applicability of FERC Order No. 745 to Ontario and in the context of the Amendments.

A.9 Q: How is your testimony organized?

18. The remainder of my testimony consists of three parts. In Part B, I offer my analysis of the economic merit of AMPCO's assertions. In Part C, I summarize the conclusions of FERC Order No. 745 and identify unique aspects of the Ontario market that should

[4] *Ibid* at para. 36.

inform a conclusion on the applicability of the Order to Ontario. In Part D, I provide my summary conclusions.

A.10 Q: What are your conclusions?

19. In my opinion, the Amendments provide an equitable treatment of TCA participants. I give evidence that demonstrates the Amendments afford fair and equitable treatment to TCA participants, do not place DR resources at a competitive disadvantage to non-committed dispatchable generators, and promote fair and efficient competition to the benefit of Ontario consumers. I further conclude that the application of FERC Order No. 745 in Ontario will not achieve the effects the Commission intended when it issued its decision. This is due to several unique aspects of the Ontario electricity market, each of which I will speak to herein.

B. AMPCO'S ASSERTIONS ARE VOID OF FACTUAL SUPPORT AND LACK ECOMOMIC MERIT

B.1 Q: What is your understanding of the basis of AMPCO's appeal?

20. The basis of AMPCO's appeal is that generators receive a payment for energy services provided (economic activations) but DR resources do not. AMPCO asserts that this represents "an inequity in treatment between generation resources and DR resources."[5] AMPCO further asserts that this unequitable treatment puts "DR resources at a competitive disadvantage to generators"[6] in the TCA and would allow generators to "effectively and unfairly displace"[7] DR resources in the TCA. AMPCO concludes that this would "undermine competition"[8] and is "inimical to the IESO's own objective of

[5] *Ibid* at para. 4.

[6] *Ibid* at para. 22.

[7] *Ibid* at para. 4.

[8] *Ibid* at para. 14.

enhancing competition for the benefit of consumers."[9] The failure to compensate DR resources for economic activations "would result in a capacity market that is unfair and inefficient, and effectively anticompetitive and discriminatory."[10]

B.2 Q: What evidence has AMPCO provided to establish competitive disadvantage?

21. AMPCO's assertion of competitive disadvantage is articulated in the Affidavit of Mr. Colin Anderson at paragraphs 12 through 19. Mr. Anderson reasons as follows:

a. In the existing DRA, the only revenue stream available to participants is a capacity payment (called an availability payment). There are currently no payments made for energy activations. If the TCA proceeds in December 2019, non-committed dispatchable generators will qualify for an availability payment and an energy payment when economically activated. DR resources will still only qualify for an availability payment.[11]

b. Non-committed dispatchable generators will be able to submit a capacity offer into the TCA taking into account their anticipated energy payments. They will be able to set a capacity offer price that is lower by the amount of their anticipated energy payments. DR resources will not have the same opportunity.[12]

c. DR resources incur "legitimate costs" when they are economically activated to curtail demand. If they do not receive an energy payment, they will not be able to recover these costs.[13]

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[9] *Ibid* at para. 25.

[10] *Ibid* at para. 45.

[11] Affidavit of Colin Anderson, sworn October 11, 2019, available online at: http://www.rds.oeb.ca/HPECMWebDrawer/Record/655144/File/document, at para. 12.

[12] *Ibid* at para. 14

[13] *Ibid* at para. 19.

d. DR resources will have two options on how to deal with this. First, they can include the anticipated cost of activation in their capacity offer price. This would put DR resources at a competitive disadvantage to non-committed dispatchable generators that do not have to include these costs in their capacity offer price. Second, they could omit including the anticipated cost of activation in their capacity offer price, but then risk not recovering these costs when economically activated.[14]

B.3 Q: If a market participant cannot recover legitimate cost in the market does that not place it at a competitive disadvantage to others that can recover their cost?

22. From an economic perspective, if a DR resource incurs a cost when economically activated to curtail demand that it would ***avoid*** if it continued to consume, then it could be competitively disadvantaged by the Amendments. However, AMPCO has provided no factual evidence or even conceptual evidence that explains the nature, magnitude or legitimacy of these ***avoidable*** costs.

23. By contrast, a natural gas fired generator could provide both conceptual and factual evidence that it incurs a fuel cost when economically activated in order to produce energy that it can avoid (save) by not producing. This evidence is readily and publicly available, and is the basis for the energy payments made to these generators.

B.4 Q: Why does it make economic sense to pay a generator an energy payment for economic activation?

24. In order to induce a generator to produce energy, it must receive a payment that allows it to recover its avoidable cost of activation. If it did not receive a payment, it would be in its economic interest not to produce to avoid incurring the fuel cost. To induce efficient energy production, the IESO pays generators the energy market-clearing price to cover these costs.[15] The market-clearing price is designed to reflect the cost to

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[14] *Ibid.*

[15] The IESO currently operates a "two-schedule" pricing and dispatch energy market, which is described in the IESO's "The Single Schedule Market Backgrounder." In the two-schedule system, the physical limitations of the

produce one more MW of electricity (marginal cost), or the value to reduce one more MW of consumption (marginal willingness to pay) on the system. Paying generators this price incentivizes only those generators whose avoidable cost of economic activation is less than the market price. This is how the IESO manages the efficient use of the province's generation assets.

B.5 Q: Based on your experience in the electricity industry, what types of costs might a DR resource incur with an economic activation?

25. To my knowledge, the only cost that a DR resource may incur with an economic activation is the value of lost consumption, or what is sometimes called the value of lost load.[16] The value of lost load is the amount a consumer would be willing to pay to avoid disruption of service (i.e., to maintain its level of consumption). If a DR resource receives an energy activation when its value of lost load is greater than the price it would pay to consume, it would incur a legitimate cost from activation that it could have avoided if it had continued to consume. In this instance, the cost from activation would equal the difference between the value of lost load and the price the DR resource would have paid had it consumed.

B.6 Q: Does AMPCO provide evidence that DR resources are at risk of incurring this cost with an economic activation?

26. No. In fact, the IESO market rules provide DR resources the means to manage this risk. Two types of DR resources can participate in the TCA and the IESO's energy market: dispatchable loads and Hourly Demand Response ("HDR") resources.

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system are ignored in the "pricing" schedule that sets an Ontario-wide market price and establishes the most economic set of resources to meet demand. This requires a second "dispatch" schedule that includes the physical limitations of the system. The result is there are times when resources who cleared the market based on economics are told they cannot proceed, and others that were initially unsuccessful are told they are required to run in order to reliably meet demand. The differences between the two-schedules requires a complex system of out-of-market compensation to some participants.

[16] Navigant's Demand Response Discussion Paper, being Exhibit "I" to the Affidavit of David Short, sworn October 25, 2019, available online at: http://www.rds.oeb.ca/HPECMWebDrawer/Record/656576/File/document ["Navigant Report"]. The Navigant Report considers the costs associated with curtailment of a DR resource. This is the only type of cost they identified.

27. Dispatchable loads submit hourly energy bids to the IESO that define the quantities of energy they are willing to consume at different price levels. They receive dispatch instructions from the IESO every 5-minutes based on these energy bids. When they consume, they pay the market-clearing price (the 5-minute price) for the amount they consume. When the market-clearing price is above the price in their energy bid, they receive an economic activation to reduce their demand as per the amount stated in their energy bid. Dispatchable loads that are successful in the TCA are eligible to receive an availability payment by submitting and maintaining energy bids in the day-ahead through to real-time markets during a defined availability window that changes between the summer and winter months but generally covers the expected peak demand hours on business days. The energy bid prices must be greater than $100/MWh but less than $2,000/MWh, which is the maximum market-clearing price. As long as the price in the dispatchable load's energy bid reflects their value of lost load, they are not at risk of incurring a cost from an economic activation; they will only be economically activated when the market price exceeds their value of lost load.

28. HDR resources also submit hourly energy bids. When they consume, HDR resources pay the Hourly Ontario Energy Price ("HOEP"). In order to receive an availability payment, HDR resources must submit energy offers within the hours of availability. HDR resources receive a "standby report" in advance of a potential economic activation between 15:00 EST of the day ahead until 07:00 EST on the dispatch day, if the IESO's pre-dispatch schedules signal they could be curtailed for the hours of availability. In this instance, HDR resources must continue to submit energy bids for the dispatch day consistent with their capacity obligation. HDR resources are economically activated when the pre-dispatch 3-hour ahead price is greater than their energy bid price. The HDR resource is notified that they will be economically activated by receiving an Activation Notice approximately 2.5 hours before the start of the first dispatch hour to which it relates. HDR resources may be activated once per day for up to four consecutive hours. Attached hereto as **Exhibit "C"** is a copy of IESO Market Manual 4, which sets out the rules for activating HDR resources at section 7.2. Like dispatchable loads, HDR resources can manage the risk of incurring a cost associated with lost load from an

economic dispatch through their energy price bid. As the IESO evidence indicates, HDR resources have been economically activated on only one occasion since the implementation of the DRA.

B.7 Q: In response to Board Staff Interrogatory question 1, AMPCO provided a list of costs related to curtailment. What are your views on the nature of these costs?

29. AMPCO identified two types of costs related to economic activation under the heading "Cost per Curtailment." AMPCO called the first set of costs "lost opportunity". These costs all influence the price the DR resource is willing to pay to consume, i.e. the value of lost load. AMPCO indicates that there are several things to consider in establishing the value of lost load for a DR resource, and these things vary over time, even day to day and hour to hour. However, these costs all should be captured in the DR resource's energy bid price. As discussed above, the DR resource can avoid incurring a lost opportunity cost by properly estimating its value of lost load and using this estimated value for its energy bid price. This is not to say that it is easy to estimate the value of lost load, and that there is not a risk that the estimate is wrong and that there is ex post regret that they bid too low or too high. This is possible in the same way it is possible that when a generator submits an energy offer with an expectation of its fuel costs and operating conditions: they guess wrong and fail to recover some costs.

30. AMCPO calls the second set of costs "semi-variable costs," which included labour cost and other overhead costs for the production facility. These costs are costs that the DR resource must incur to ensure that they are available as a capacity resource to respond to an economic dispatch. These costs are not avoided if the DR resource is not economically activated. These are costs that can be avoided only if the DR resource chooses not to be available. I would call these costs fixed avoidable costs. For example, if they wanted to operate as a non-dispatchable load, they may require fewer staff on shift to monitor for dispatch instructions from the IESO. These costs should be recovered through the availability payment and not through an energy payment. This is no different than the types of costs that a non-committed generator may incur to make

sure a generator is available to respond to an IESO dispatch. Non-committed dispatchable generators would also need to recover these types of fixed avoidable costs if they choose to sell capacity and be available for dispatch by the IESO. They would include these costs in their capacity offer price, not in their energy offer price.

B.8 Q: If a generator receives an energy payment for balancing supply and demand, but a DR resource does not, is this not inequitable treatment, and does it not place the DR resource at a competitive disadvantage?

31. Contrary to AMPCO's assertion, I contend that *providing* DR resources an energy payment for economic activations would represent *inequitable treatment* and afford DR resources a *competitive advantage* over non-committed dispatchable generators in the TCA. I come to this conclusion by applying the concept of horizontal equity and by way of example.

B.9 Q: What is horizontal equity?

32. *Horizontal equity* requires that people who are alike in all relevant respect be treated the same. It corresponds to common notions of fair play and non-discrimination. For example, if two people have the same pre-tax income, they would have equal after-tax incomes. *Vertical equity* holds that people who differ in relevant respects should often be treated differently. This notion of equity is more contentious. Vertical equity is typically concerned with the "preferred" distribution of wealth in society. What represents the "preferred" distribution of wealth is a normative question that requires a value judgement. For example, it can be argued that those who earn higher pre-tax income *should* pay higher taxes.

B.10 Q: How does this concept of equity draw you to conclude that providing DR resources an energy payment would be inequitable?

33. I come to this conclusion through an example. The example is an adaptation of the example the IESO presented to stakeholders in the Demand Response Working Group

on March 11, 2018 to elicit views on the issue of the equal treatment of "negawatts and megawatts."[17]

34. Consider two companies, DR Corp. and GEN Corp. DR Corp. consumes 6 MW of electricity. Its value of lost load is $10,000/MWh. DR Corp. also owns a behind-the-meter generator. The generator has a capacity of 4 MW. It incurs a cost of $100/MWh to generate electricity. DR Corp. also incurs a fixed cost of $1,000 to staff and maintain the generator so that it is available to produce electricity when needed. If DR Corp. chose not to maintain the generator to be available to produce electricity, it would avoid incurring this cost. This makes the $1,000 a fixed avoidable cost. GEN Corp. is exactly the same as DR Corp. with one arbitrary exception: GEN Corp. is electrically connected to the IESO market metered separately as a load and a generator, while DR Corp. is connected by meter to the IESO market as a load with its generator operating behind the meter. Figure 1 depicts the situation for both companies.

35. To simplify the discussion, assume there is just one hour in the year and based on the prevailing supply and demand conditions, the two companies expect the energy market price to be $100/MWh. Both companies plan to compete in the IESO TCA. DR Corp., because it is metered with the IESO as a load, competes as a DR resource and can offer 4 MW of capacity (the amount of net-metered load it is capable of decreasing through use of its behind-the meter generator). If successful in the TCA, DR Corp. will be obligated to submit an energy bid in the IESO's energy market for 4 MW. The energy bid price that DR Corp. will submit is equal to $100/MWh as it will be less costly to use its generator to self-supply its demand than to buy energy from the IESO energy market at a price higher than $100/MWh. GEN Corp. competes as a non-committed generator and can offer 4 MW of capacity in the TCA. If successful in the TCA, GEN Corp. will

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[17] IESO Presentation to Demand Response Working Group on Utilization Payments Discussion, dated March 1, 2018, being Exhibit "J" to the Affidavit of David Short, sworn October 25, 2019, available online at: http://www.rds.oeb.ca/HPECMWebDrawer/Record/656576/File/document at 10-14 ["IESO March 1 Presentation"]. A "negawatt" is a unit of energy saved, such as through the curtailment of demand. This issue of whether a "negawatt" and a "megawatt" are functionally and economically equivalent is a contentious issue. The issue was addressed in FERC Order No. 745 where Commissioner Moeller disagreed with the Commission majority that the two were equivalent.

be obligated to submit an energy offer in the IESO's energy market for 4 MW. The energy offer price it will submit is $100/MWh, which is its marginal cost of generation.

36. Assume in the first instance, as per the Amendments, DR resources do not receive an energy payment for an economic activation. What will be the capacity offer price of each company? I answer this with reference to Figure 1.A.

Figure 1: DR Corp. and GENCorp. are identical in all relevant aspects

Figure 1.A: No Energy Payments for DR Resources

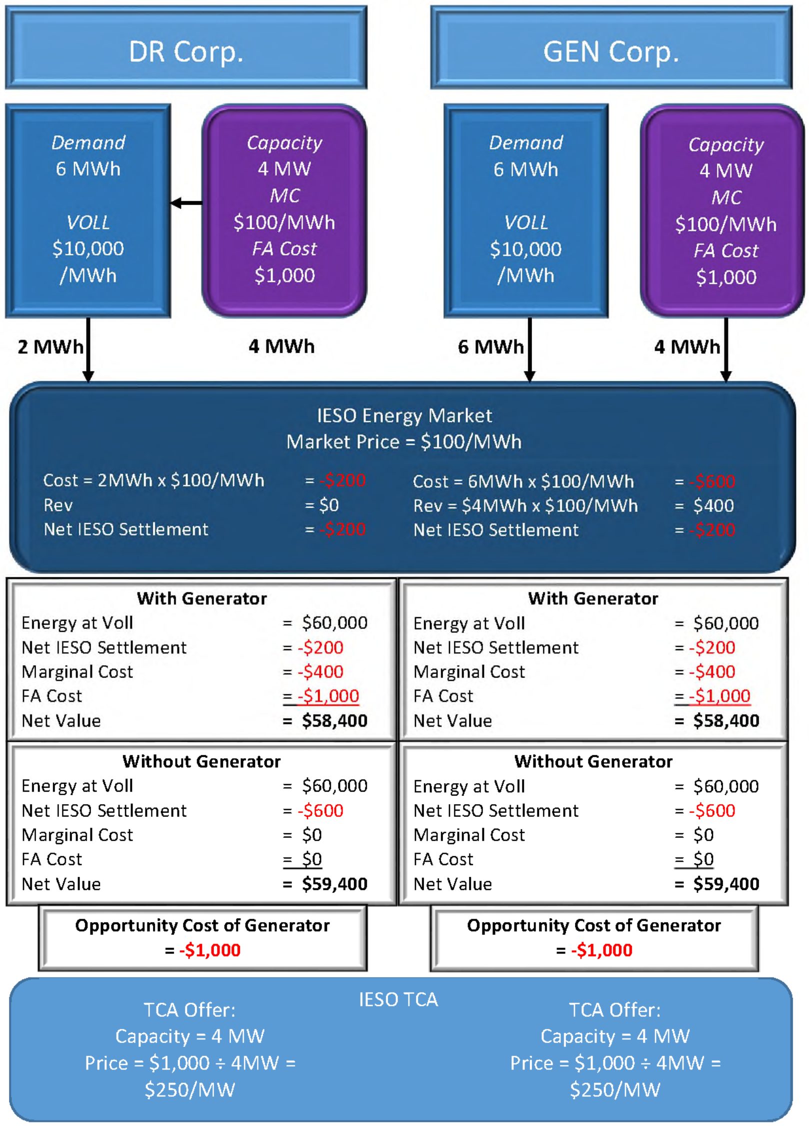
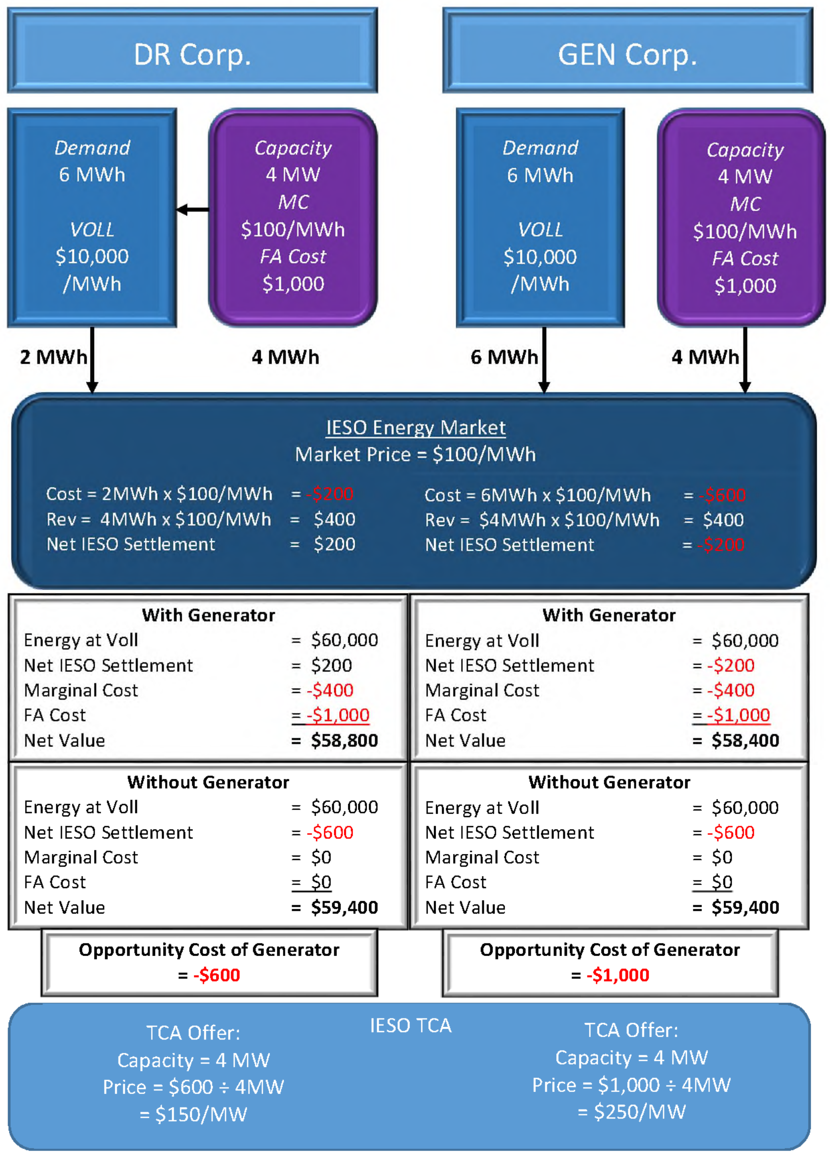


Figure 1.B: Energy Payments for DR Resources



37. With an expected market price of $100/MWh, DR Corp. anticipates that it will receive an economic activation to reduce its net-metered load by 4 MWh. It will not receive an energy payment for this activation, so as AMPCO argues, it will not be able to incorporate this revenue in the calculation of its capacity offer price. DR Corp. will make an energy payment to the IESO of $100/MWh x 2 MWh = $200 for its net-metered demand. It will incur a cost of $100/MWh x 4 MWh = $400 to generate electricity to

supply the balance of its 6 MWh of consumption. It will incur the fixed avoidable cost of $1,000 to ensure the generator is available. Overall, DR Corp. will realize a net value of $58,400 for its activities. These calculations are listed in the box for DR Corp. titled "With Generator" in Figure 1.A (numbers in red are negative values).

38. For it to be profitable for DR Corp. to participate in the TCA, the net value it realizes if successful must be greater than the net value it would realize by shutting down its generator and buying all of its electricity from the IESO. This net value is calculated in the box for DR Corp. titled "Without Generator" in Figure 1.A and is equal to $59,400. The net opportunity cost of DR Corp of participating in the TCA is the difference between these two values and is equal to -$1,000. That is, DR Corp. can increase its net value by $1,000 by shutting down its generator and saving the fixed avoided cost of $1,000 to maintain the availability of the generator. Therefore, to keep the generator available, it must recover this amount in the TCA through the availability payment. DR Corp. will submit a capacity offer price of $250/MW for 4 MW of capacity with the hope of recovering the fixed avoided cost of making the generator available. If it is not successful in the TCA, it will shut down the generator.

39. With an expected market price of $100/MWh, GEN Corp. anticipates that it will receive an economic activation to generate 4 MWh of energy. The IESO will pay GEN Corp. the market price per MWh of energy produced for a total energy payment equal to $400. As AMPCO conjectures, GEN Corp. can anticipate earning this energy revenue when calculating its capacity offer price. **<u>However, it costs GEN Corp. $400 to generate the electricity.</u>** What GEN Corp. factors in to its capacity offer price is not the revenue it earns, but the net revenue it earns which is the difference between the energy payment and variable energy cost. This is the "benefit" that GEN Corp. receives by participating in the energy market. As I will discuss more below, it is important to draw the distinction between the energy payment and the net revenue when considering the AMPCO's assertion of competitive advantage. In this case, the market price and GEN Corp.'s marginal cost are equal; GEN Corp. earns zero net revenue. Like DR Corp., GEN Corp. computes its capacity offer price based on the difference between the net value it realizes

from making its generator available and the net value it realizes if it shuts down the generator, which is -$1,000. GEN Corp. submits a capacity offer price in the TCA equal to $250/MW, the same as DR Corp. This is what we might expect given that DR Corp. and GEN Corp. are identical but for the arbitrary physical positioning of their meters.

40. Assume now that contrary to the Amendments, DR resources are paid the market price for an economic activation. How does this affect each company's participation in the TCA and in the energy market? This is presented in Figure 1.B above.

41. First, note that by receiving the market price for an activation, DR Corp. has an incentive to lower its energy bid price. It will be optimal to use its generator to self-supply its demand whenever the market price is greater than half its marginal generation cost (i.e., market price > $50/MWh). To see this, assume the market price is $51/MWh, and DR Corp. does not use its generator to self-supply. DR Corp. pays $51/MWh x 6 MWh = $306 to the IESO. If instead, DR Corp. does use its generator to self-supply, it pays only $51/MWh x 2 MWh = $102 to the IESO to consume, receives an energy payment for economic activation equal to $51/MWh x 4 MWh = $204, and incurs a generation cost of $400 for a net cost of $298. It is better off to self-supply when the energy market price is $51/MWh. By this reasoning, DR Corp.'s net cost of participation in the IESO market if it self-supplies is lower whenever the market price exceeds $50/MWh. As a result, DR Corp. will lower its energy bid price to $50/MWh from $100/MWh.

42. Now assuming that DR Corp.'s lower energy bid price does not result in a lower energy price (which it could), it will now factor this additional energy payment into its capacity offer price calculation. As Figure 1.B demonstrates, the net value to DR Corp. increases when it is eligible for an energy payment for an economic activation. DR Corp. requires a smaller capacity offer price of $150/MW in order to cover its fixed avoided cost of making its generator available. This capacity offer price is lower than the capacity offer price of GEN Corp.

B.11 Q: Can you summarize what this example demonstrates of AMPCO's assertions of inequality and competitive disadvantage?

43. Yes. The example shows that AMPCO's assertions are incorrect. In my example, DR Corp. and GEN Corp. are identical but for the physical placement of a meter; an arbitrary and irrelevant difference. Horizontal equity requires like treatment for people (or corporations) that are alike. When DR resources do not receive an energy payment for an economic activation, DR Corp. and GEN Corp., whom are identical, are treated alike for their participation in the IESO markets and realize the same net value for their activities. When DR resources receive an energy payment for an economic activation, DR Corp. avoids the cost of consuming by reducing its net-metered load (a benefit). At the same time, it receives a payment from the IESO to avoid this cost (a second benefit). This amounts to a double benefit for the energy service provided (as evidenced by DR Corp.'s willingness to submit an energy bid price that is half its marginal generation cost). As a result, DR Corp. realizes a higher net value than GEN Corp. for participation in the IESO markets, even though the two companies are identical. The preferential treatment gives DR Corp. a competitive advantage over GEN Corp. in the TCA. What amounts to a double benefit for the energy service allows DR Corp. to cover more of its fixed avoided cost through the energy market. DR Corp requires less in the way of an availability payment to cover these costs and hence they can submit a lower capacity offer price than GEN Corp. in the TCA.

B.12 Q: What other conclusion do you draw through this example?

44. Through this example, I can demonstrate that contrary to AMPCO's assertions, paying DR resources an energy payment for economic activations would harm fair and efficient competition. With only slight modifications to the example I described above, I can show that providing DR resources an energy payment for economic activations can lead to more expensive resources being selected before less expensive resources in the TCA and more expensive resources being dispatched ahead of less expensive resources in the energy market.

45. In Figure 2, I assume DR Corp. incurs a fixed avoided cost of $1,100 to staff and maintain its generator to ensure it is available to produce electricity, which is $100 higher than the previous example. DR Corp. is now a higher cost capacity resource than GEN Corp. DR Corp. will have to recover $100 more in the TCA than GEN. If as per the Amendments, DR resources do not receive an energy payment for economic activations, DR Corp. will submit a capacity offer price of $275/MWh in the TCA. It has less chance of success in the TCA than GEN Corp. From the perspective of promoting fair and efficient competition, this is the desired outcome; the least cost capacity resource is selected ahead of the higher cost resource. If in the alternative, DR resources are provided an energy payment for economic activations, DR Corp. can anticipate a benefit of reducing its energy payment to the IESO and receiving an energy payment from the IESO for doing so, (i.e., a double benefit). This reduces the amount of fixed avoided cost that it must recover through the TCA by $400. DR Corp. is now able to reduce its capacity offer price to $175/MW, which is lower than GEN Corp.'s capacity offer price of $250/MW. DR Corp. now has an advantage over GEN Corp. in the TCA, even though it is the higher cost capacity resource. As a result, it is possible that DR Corp. is successful in the TCA and GEN Corp. is not. GEN Corp. would be forced to shut down its generator. This would be a wasteful and inefficient use of the province's resources. Providing DR resources an energy payment for economic activations would be harmful to fair and efficient competition.

Figure 2: DR Corp. has a higher fixed avoided cost

Figure 2.A: No Energy Payments for DR Resources

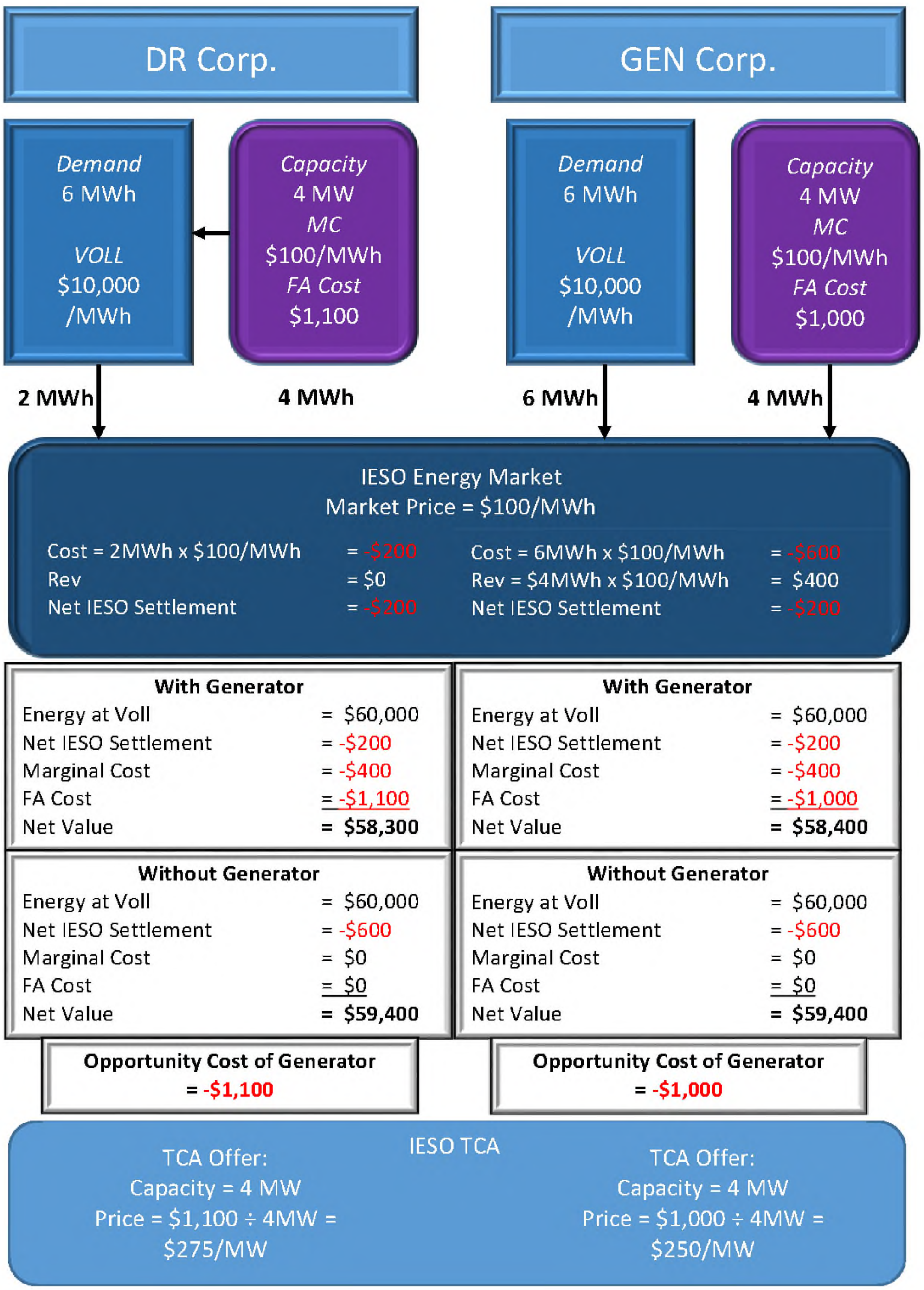


Figure 2.B: Energy Payments for DR Resources

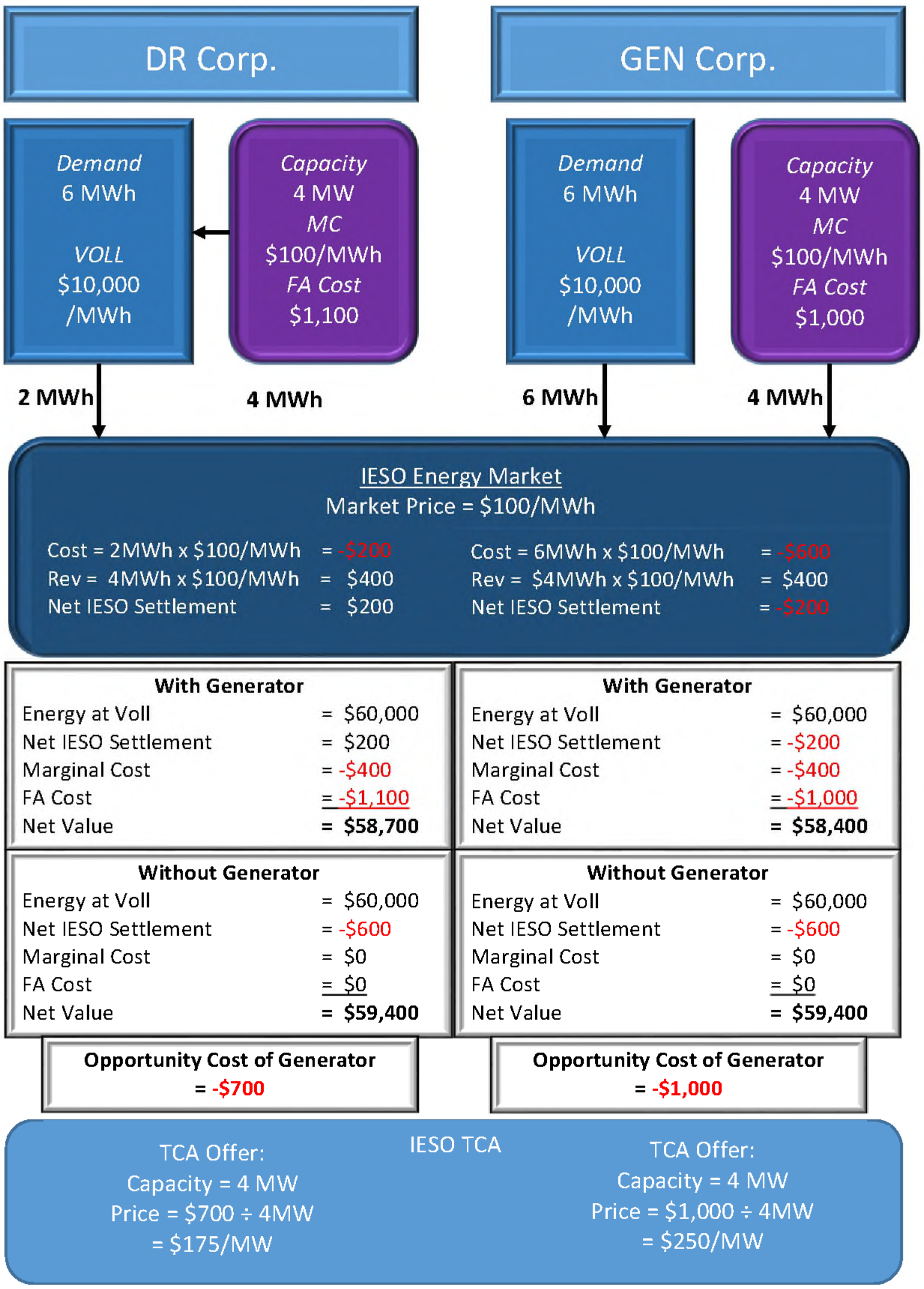


Figure 3: GEN Corp. has a lower marginal generation cost

Figure 3.A: No Energy Payments for DR Resources

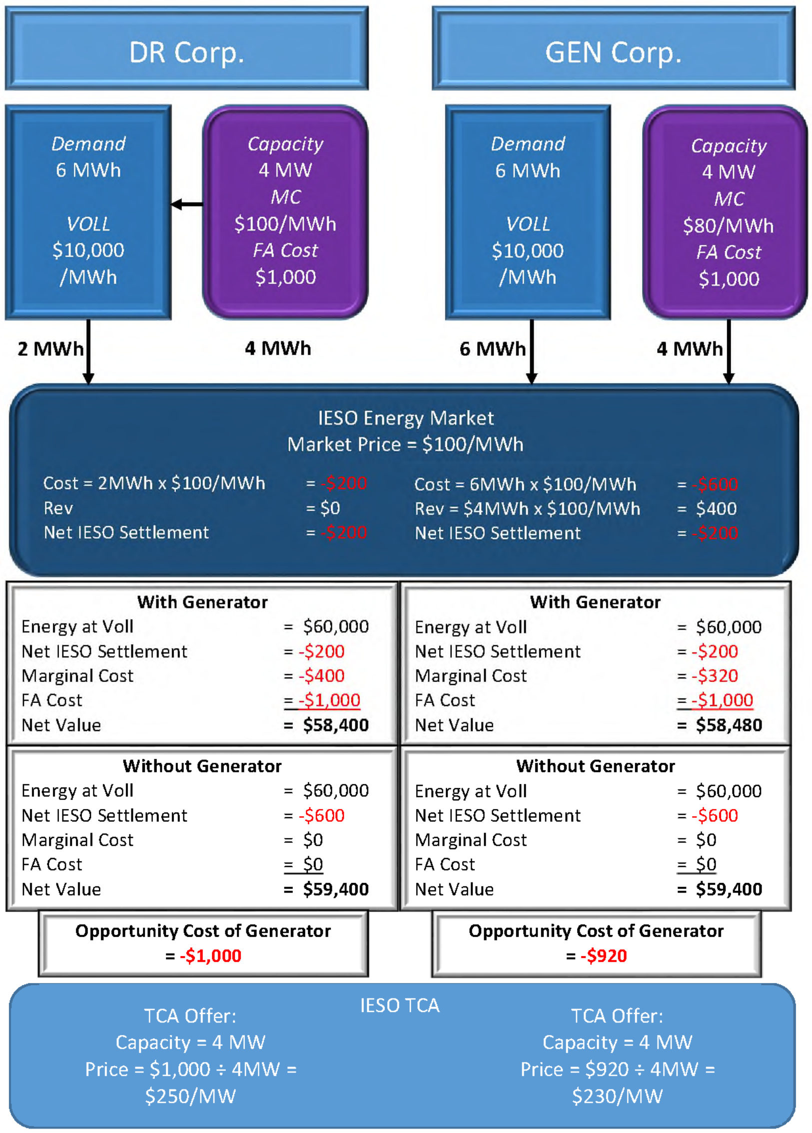
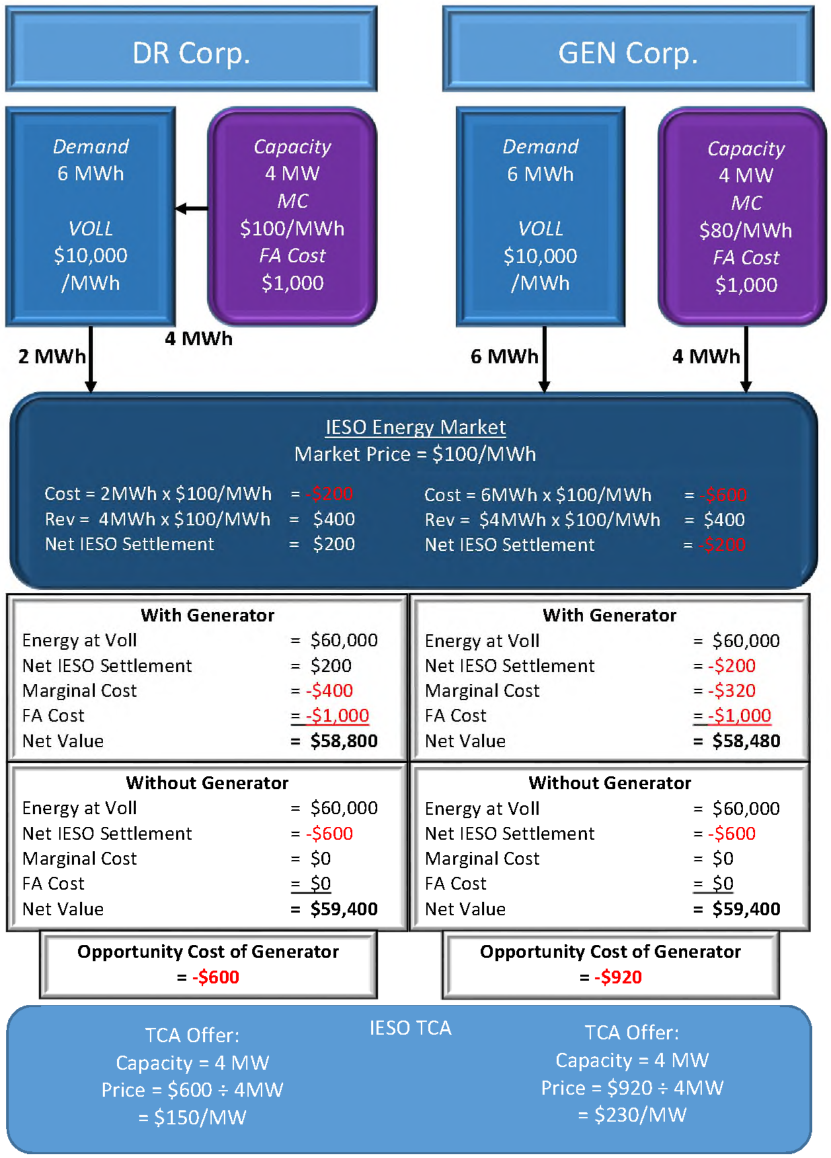


Figure 3.B: Energy Payments for DR Resources



46. In Figure 3, I modify the original example by assuming GEN Corp. has a marginal generation cost of $80/MWh, which is lower than the $100/MWh marginal generation cost of DR Corp. In this case, GEN Corp earns a net revenue equal to the difference between the energy market price of $100/MWh and its marginal generation cost of $80/MWh; a benefit of $20/MWh that it can contribute to the recovery of its fixed avoided cost of making the generator available. It can factor this amount into its capacity offer price. Again, I draw a distinction between the net revenue and the full energy

payment; GEN Corp. will factor only the net revenue into its capacity price calculation as this is the only true benefit it receives from the energy market.

47. If DR resources are provided an energy payment for economic activations, Figure 3 illustrates that DR Corp. will submit a lower capacity offer price than GEN Corp. That is, because of the double benefit DR. Corp. receives from activation (a benefit for the energy payment it avoids and a benefit for the energy payment it receives) it has a competitive advantage over GEN Corp. It is also the case that because DR Corp. lowers its energy bid to $50/MWh, (half of its marginal generation cost) it will be dispatched ahead of GEN Corp. for energy. This is not only harmful to fair and efficient competition in the TCA, it leads to the inefficient dispatch of the province's generation resources, which is in conflict with the IESO's least cost dispatch objective.

B.13 Q: In your examples, you did not consider the effects of the Global Adjustment. How does the Global Adjustment affect your conclusions?

48. The manner in which consumers are charged the Global Adjustment will also provide certain DR resources a competitive advantage in the TCA over non-committed dispatchable generators, even if DR resources are not provided energy payments for an economic activation as per the Amendments.

49. The Global Adjustment is an accounting mechanism through which the fixed costs to build and maintain generation assets in the province and to deliver Ontario's conservation programs are recovered from Ontario electricity consumers. It is, at a high level, calculated as the differences between payments made to generators at the wholesale market price and payments made through regulation or contract that differ from the market price. The Global Adjustment was established in 2005 as a means to attract private investment in new generation capacity and to offer Ontario consumers price stability. The Global Adjustment has become the largest component of an average consumer's electricity cost, representing between 45 to 60 percent of a typical electricity bill. Attached hereto as **Exhibit "D"** is a copy of a policy brief I authored on this subject.

50. The Industrial Conservation Initiative ("ICI") is a government policy that defines how the costs in the Global Adjustment are allocated to different classes of consumers. Large consumers, known as Class A consumers, are charged global adjustment on the basis of their share of the total system demand during the highest five peak hours of the year. Class A consumers include consumers with an average monthly peak demand greater than 1 MW and consumers in certain manufacturing and industrial sectors, including greenhouses with an average monthly demand greater than 500 kilowatts (kW). Smaller consumers, known as Class B consumers, pay Global Adjustment as a monthly fee based on the kilowatt-hours of electricity they consume in the month, or as part of their regulated time of use prices. I understand that most AMPCO members qualify as a Class A consumer.

51. The Board's Market Surveillance Panel has shown that the ICI provides Class A consumers with an extreme price incentive to reduce their demand in the expected system peak demand hours to avoid paying the Global Adjustment. This will provide DR resources that are Class A consumers a competitive advantage over non-committed dispatchable generators in the new TCA. I demonstrate this in Figure 4. Attached hereto as **Exhibit "E"** is the Market Surveillance Panel's Report.

52. Figure 4 assumes the same characters for DR Corp. and GEN Corp. as Figure 1, except it also considers the effects of the incentives provided by the ICI. Both DR Corp. and GEN Corp. qualify as a Class A consumer. Assume that both companies anticipate the Global Adjustment charge to be $5,000/MWh. The Global Adjustment is charged based on the metered quantity consumed at the level of the IESO (i.e., based on metered quantities at the transmission level). As a result, DR Corp. can avoid Global Adjustment charges by self-suppling its demand and reducing its net-metered quantity with the IESO to 2MWh. GEN Corp. cannot avoid Global Adjustment by generating. As Figure 4.A demonstrates, even if DR resources are not provided an energy payment for economic activations, DR Corp. has an extreme incentive to generate electricity to avoid $5,000 x 4MWh = $20,000 in Global Adjustment charges. This decreases the opportunity cost of not incurring the fixed avoided cost to maintain the availability of its generator by

$20,000. DR Corp. is clearly better off by maintaining the availability of its generator; it will do so even if it does not earn an availability payment through the TCA. DR Corp. can offer a capacity price of $0/MWh in the TCA. In effect, the ICI rewards DR resources that are also Class A consumers by compensating them twice for making their generator available; once through the avoidance of the Global Adjustment (which recovers the capacity cost of the committed generator) and once through the availability payment. As Figure 1.B demonstrates, paying DR resources an energy payment for an economic activation would only further DR Corp.'s competitive advantage over the non-committed generator of GEN. Corp.

Figure 4: Effects of the Global Adjustment

Figure 4.A: No Energy Payments for DR Resources

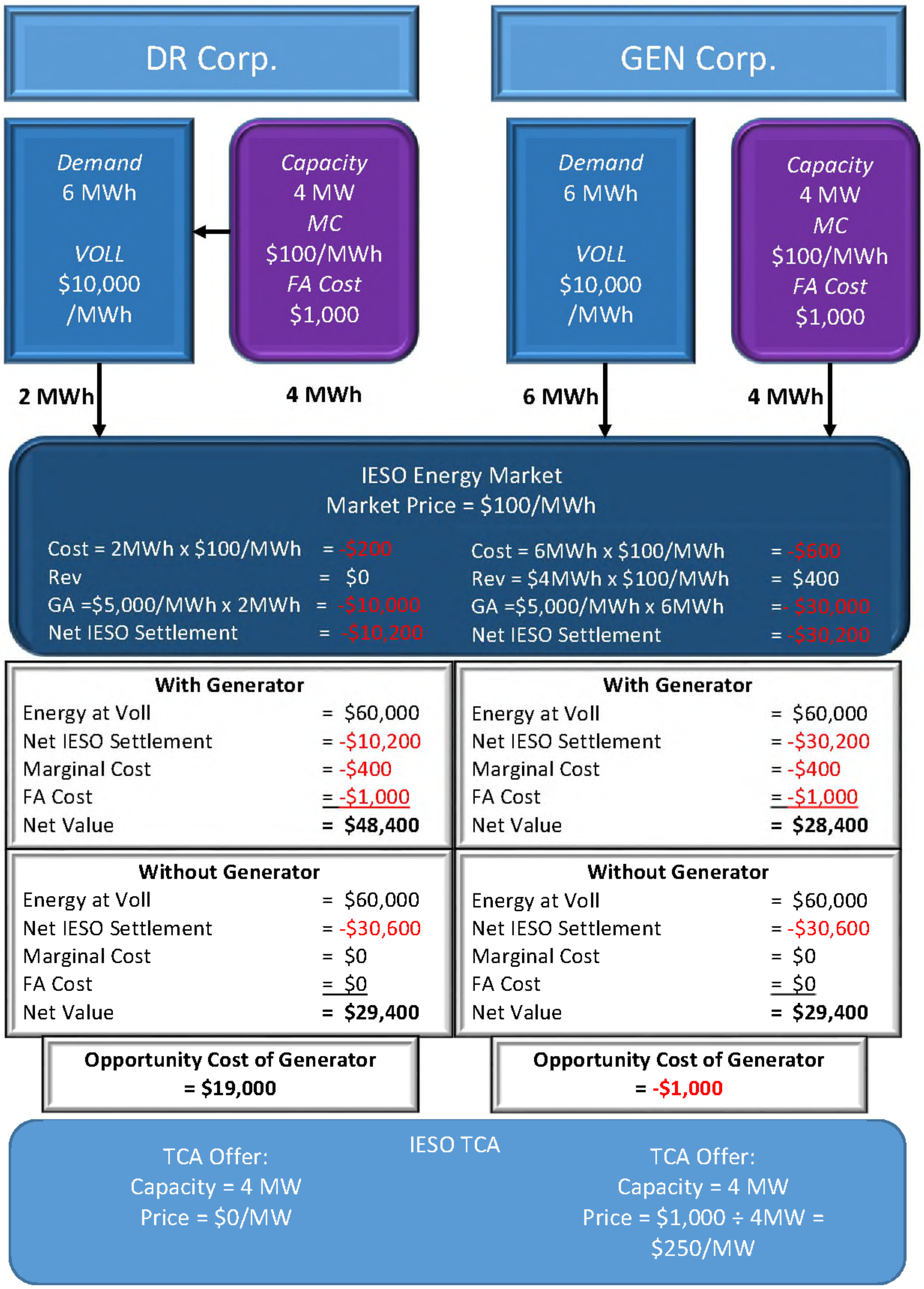
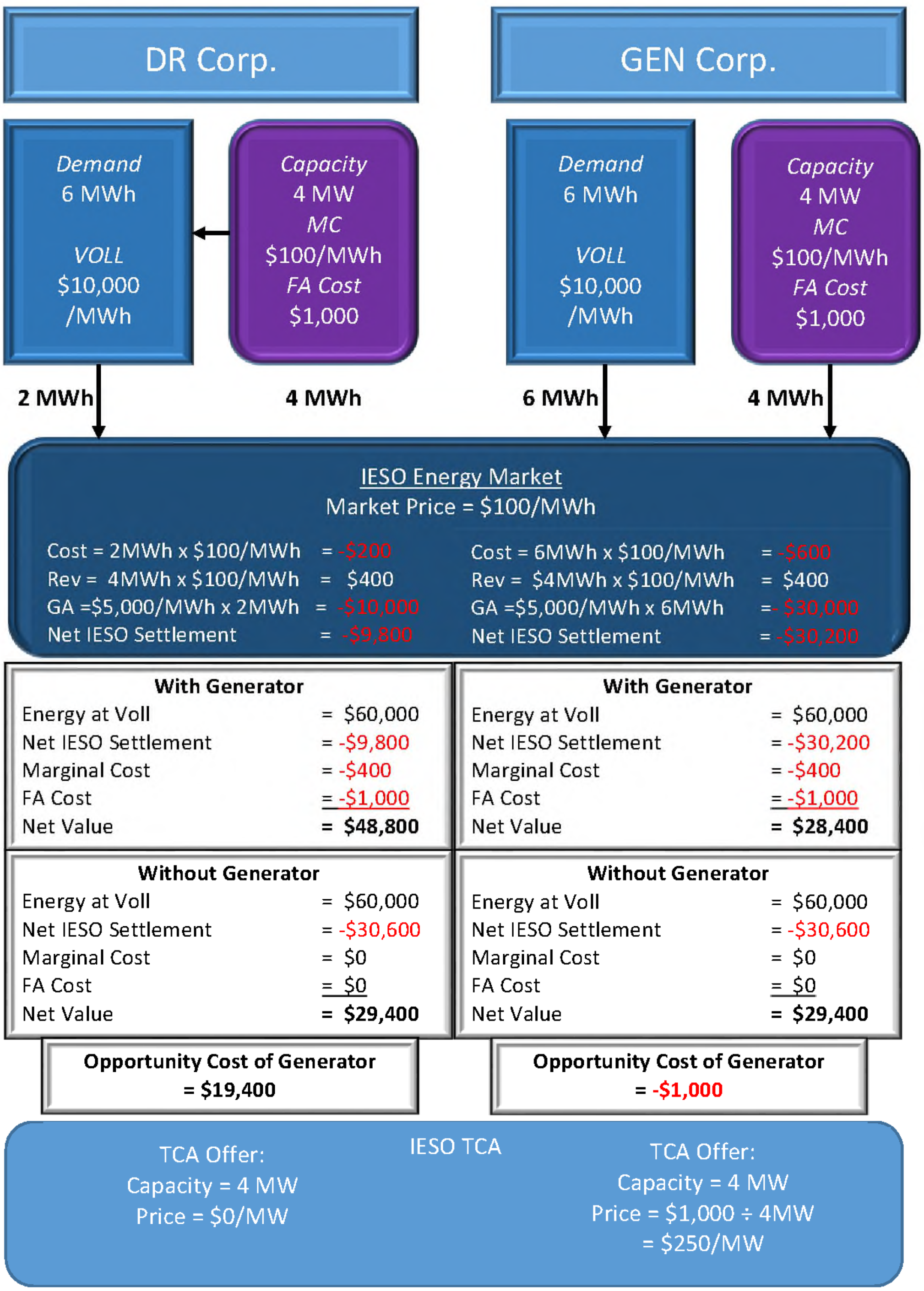


Figure 4.B: Energy Payments for DR Resources



C. APPLICATION OF FERC ORDER NO. 745 IN ONTARIO WILL NOT ACHIEVE THE COMMISSION'S INTENDED EFFECTS

C.1 Q: Can you briefly describe the conclusions of FERC Order No. 745

53. Yes. FERC Order No. 745 addressed the issue of compensation of DR resources in Regional Transmission Organization ("RTO") and Independent System Operator ("ISO") organized wholesale energy markets in the United States.[18] The Commission concluded that when a DR resource satisfies two conditions, it "must be compensated for the service it provides to the energy market at the market price for energy, referred to as the locational marginal price (LMP)."[19] ***First,*** the DR resource must have the capability to provide the service, which is described as displacing a generation resource in a manner that serves to balance supply and demand. ***Second***, the payment of the market price to the DR resource for the provision of the service must be "cost-effective" as determined by a "net-benefits test."

C.2 Q: What was the basis for the Commissions' conclusion?

54. The key objective of FERC Order No. 745 was to "remove barriers to participation of demand response resources in organized wholesale electricity markets."[20] FERC Order

[18] FERC Order No. 745 at para. 9 focused on "customers or aggregators of retail customers providing, through bids or self-schedules, demand response that acts as a resource in organized wholesale energy markets".

[19] *Ibid* at para. 2.

[20] *Ibid* at para. 5. The Commission states this objective is "consistent with national policy requiring facilitation of demand response." It references Energy Policy Act of 2005, Pub. L. No. 109-58, § 1252(f), 119 Stat. 594, 965 (2005):

> "f) FEDERAL ENCOURAGEMENT OF DEMAND RESPONSE DEVICES.—It is the policy of the United States that time-based pricing and other forms of demand response, whereby electricity customers are provided with electricity price signals and the ability to benefit by responding to them, shall be encouraged, the deployment of such technology and devices that enable electricity customers to participate in such pricing and demand response systems shall be facilitated, and unnecessary barriers to demand response participation in energy, capacity and ancillary service markets shall be eliminated. It is further the policy of the United States that the benefits of such demand response that accrue to those not deploying

No. 745 was promulgated on the premise that "active participation by customers in the form of demand response in organized wholesale energy markets helps to increase competition in those markets."[21] Ensuring the competitiveness of organized wholesale energy markets is "integral to the Commission fulfilling its statutory mandate" and to ensuring "just, reasonable, and not unduly discriminatory or preferential rates."[22] The Commission observed that prior to the Order, "the level of compensation for demand response" varied from market to market, and that "some existing, inadequate compensation structures hindered the development and use of demand response." The Commission acknowledged that customers "must have confidence that appropriate price signals will be sustained by stable competitive pricing structures, before they will make an investment in demand response." Attached hereto as **Exhibit "F"** is a copy of the Commission's Notice of Proposed Rule Making in which these observations were made.

C.3 Q: Did the Commission elaborate on the types of barriers to DR resources that it was concerned with, and how FERC Order No. 745 would eliminate those barriers?

55. The Commission reasoned that "[d]ue to a variety of factors, demand responsiveness to price changes is relatively inelastic in the electric industry and does not play as significant a role in setting the wholesale energy market price as in other industries."[23] The Commission cited as barriers:

> "the lack of a direct connection between wholesale and retail prices, lack of dynamic retail prices (retail prices that vary with changes in marginal wholesale costs), the lack of real-time information sharing, and the lack of market incentives to invest in enabling technologies that would allow

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such technology and devices, but who are part of the same regional electricity entity, shall be recognized."

[21] *Ibid* at para. 9.

[22] *Ibid* at para. 8.

[23] *Ibid* at para. 57.

> electric customers and aggregators of retail customers to see and respond to changes in marginal costs of providing electric service as those costs change."

The Commission concluded, "paying LMP can address the identified barriers to potential demand response providers."[24]

C.4 Q: You indicated that for DR resources to be eligible for compensation it must be cost-effective as determined by the FERC net benefits test. Can you explain this test?

56. Yes. The Commission recognized that paying DR resources the market price to curtail demand would have two effects. First, paying DR resources the market price would encourage more participation of these resources in the energy market. Their participation would involve an energy bid in the wholesale market. Additional energy bids in the market would lead to a lower wholesale energy price whenever a DR resource's bid was selected in the energy market ahead of a generator offer. All other consumers (non-DR consumers) would realize a benefit from the lower price. Second, these non-DR consumers would have to make an additional payment to the DR resource equal to the market price times the amount of demand curtailed. The net benefits test is satisfied when the savings the non-DR consumers realize from the lower wholesale price are greater than the additional payment they must make to DR resource. FERC Order No. 745 refers to this as the "the billing unit effect of dispatching demand response."[25] In this sense, paying DR resources is deemed cost effective if it leads to lower bills for all non-DR consumers.

C.5 Q: Is this how an economist would define "cost-effective"?

57. No. As many commentators noted in the FERC proceeding, in economics, an outcome would be defined as cost-effective if it leads to society making the best use of its

[24] *Ibid* at para. 58.

[25] *Ibid* at para. 3.

available resources. Economist call this an allocatively efficient outcome. An allocatively efficient outcome maximizes the benefits to all participants. This is sometimes called "total surplus" which is equal to the sum of consumers' surplus (the difference between what they are willing to pay and the price they pay) and producers' surplus (the difference between the price they receive and avoided variable cost). The IESO's dispatch model seeks to maximize allocative efficiency or total surplus. The net benefits test seeks to maximize the benefit to non-DR participants, or non-DR consumers' surplus and comes at the expense of producers' surplus. Promoting efficiency is also a purpose of the *Electricity Act, 1998*.

C.6 Q: Do you see any implications for the IESO or Ontario consumers if the IESO were required to apply a net benefits test in order to pay DR resources the market-clearing price?

58. Yes. If the intent of the FERC net benefit test is to compensate DR resources only when it results in a reduction in the bills of non-DR consumers (non-DR consumers' surplus), then the IESO would have to take into account the effect of the Global Adjustment in this calculation. This has two implications for the IESO and Ontario consumers. First, it means that (all else held constant) the net benefits test will be satisfied less frequently (if ever) than in the United States markets.[26] Second, it adds additional complications for the IESO in implementing the test that the United States RTO/ISOs did not have to encounter. Furthermore, as several commenters noted in the FERC proceeding, "cost-effective" as defined by the net benefits test, and "allocative efficiency" are different things. An additional implication of Ontario implementing the net benefit test is that it could, if ever satisfied, contribute to a less efficient dispatch of resources and less efficient use of the province's generation resources. This is a point I already established above.

[26] This same point was recognized in Section 3.2 of the "Navigant Report".

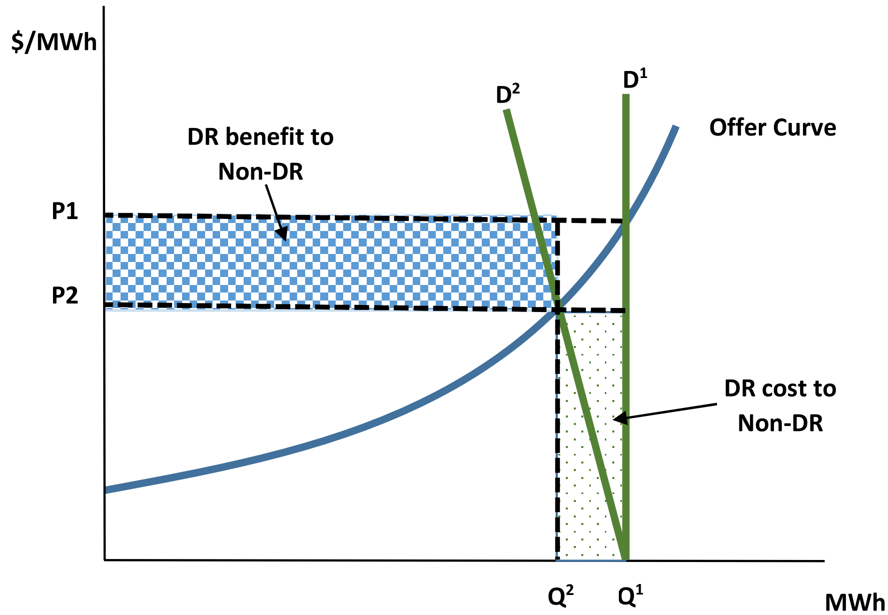
C.7 Q: Can you explain why the Global Adjustment means the net benefits test is not likely to be satisfied on Ontario?

59. Yes. This can be explained with reference to Figure 5. In Figure 5, an hourly offer curve and an hourly demand curve (labeled D^1) are drawn. The demand curve D^1 is drawn under the assumption that DR resources are not provided an energy payment for an economic activation. The market-clearing price is determined as the intersection of the hourly offer curve and the hourly demand curve, which is P^1 in Figure 5. This illustration is based on a figure contained in the Californian ISO's final proposal for implementation of FERC Order No. 745, which is attached hereto as **Exhibit "G".**

60. Paying a DR resource the market-clearing price for an economic activation changes the DR resource's incentives for participation in the market. This was the desired effect of the Commission in FERC Order No. 745. As I outlined above, in the Ontario context, if a DR resource is paid the market price for an economic activation, it will be incentivized to submit a lower energy bid price.[27] This causes the demand curve to become more "elastic" and shift downward. This is represented by the new hourly demand curve D^2 in Figure 5. The lower DR resources' energy bids mean that the market clears at the lower price of P^2.

[27] This point was discussed in the "IESO March 1 Presentation" at 5.

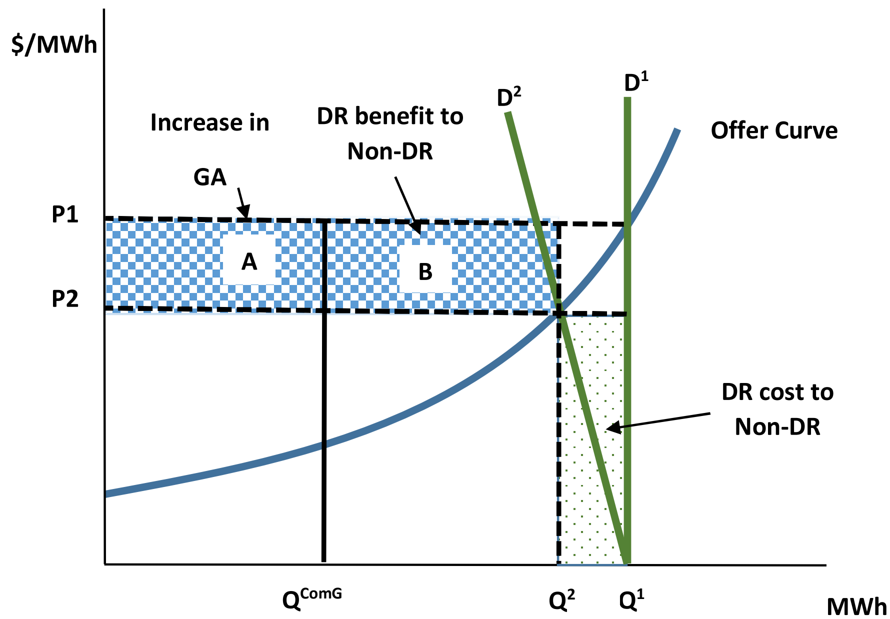
Figure 5: The Net Benefits Test under FERC Order No. 745



61. The FERC net benefits test is satisfied if the savings the non-DR consumers realize from the lower wholesale price are greater than the additional payment they must make to DR resources. Under the FERC model, this occurs when the shaded blue area is greater than the shaded green area in Figure 5.

62. If the net benefits test were applied to Ontario, the IESO would have to incorporate the effects of payments made to contracted and regulated ("committed") generators by non-DR consumers through the Global Adjustment. As discussed above, the Global Adjustment includes differences between payments made to generators at the wholesale market price and payments made through regulation or contract that differ from the market price. If providing DR resources an energy payment for economic activations lowers the market-clearing price as the Commission expected in FERC Order No. 745, in Ontario, a portion of the benefit non-DR resources get from the lower energy price will be offset by an increase in the payments the same consumers have to make to committed generators through the Global Adjustment. This means that all else held constant, the net benefits test condition for compensating DR resources will be satisfied less often in Ontario than in the United States. This is illustrated in Figure 6.

Figure 6: The Net Benefits Test illustrated for Ontario



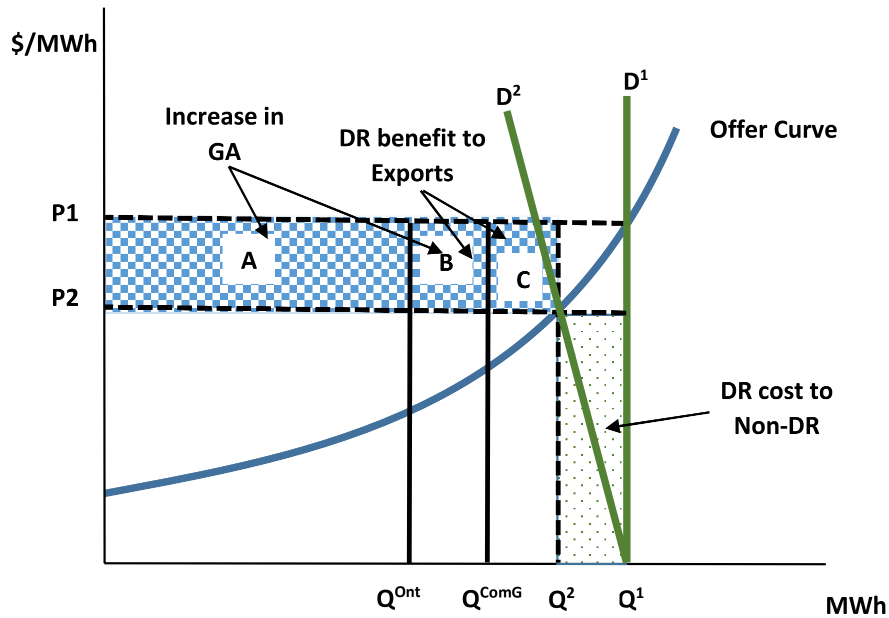
63. In Figure 6, the amount of supply provided by committed generators is Q^{COMG}. When lower energy bid prices of DR resources cause the energy market price to fall from P^1 to P^2, the amount of net revenues earned by the committed generators falls in proportion to the price decrease (the area marked as A in Figure 6). The decline in net revenue is fully offset by higher payments to the committed generators as per their contract terms or regulated rates. Non-DR consumers cover these higher payments through higher Global Adjustment charges. As a result, the benefit that non-DR consumers receive from the lower energy price is reduced by the amount A; they realize the smaller benefit represented by area B. Since the net benefit is smaller in Ontario, it is less likely that the net benefits test condition will be satisfied in Ontario.

C.8 Q: Are there conditions in Ontario in which the net benefits test is certain to fail?

64. Yes. Ontario is a large net exporter. Exporters do not pay the Global Adjustment. In many hours, committed generators are required to produce to meet both the Ontario demand and the export demand. When the amount of energy provided by committed

generators exceeds the Ontario demand, energy price decreases caused by lower DR resource energy bids would lead to an increase in Ontario non-DR consumers' Global Adjustment charges that exceeds benefits they realize from lower energy market prices. That is, exports would realize the benefit of the lower market prices, but because Ontario consumers must cover the higher Global Adjustment charges, they would be worse off, even before paying DR resources not to consume. This is illustrated in Figure 7.

Figure 7: Sufficient condition for Net Benefits Test failure in Ontario,



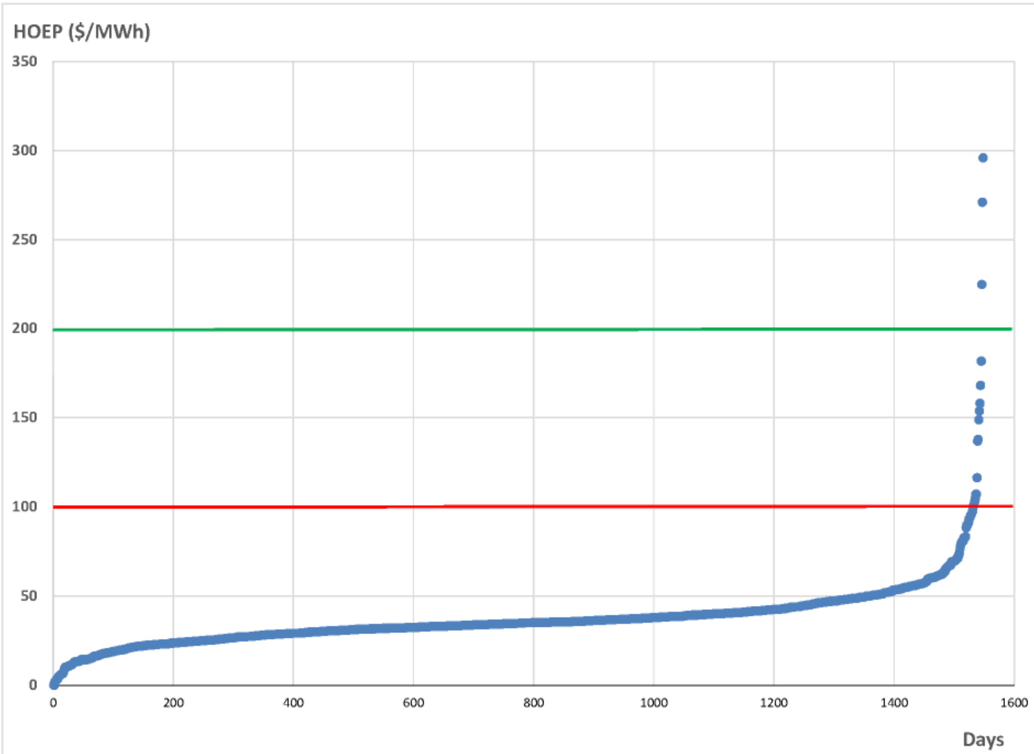
65. In Figure 7, the Ontario non-DR consumers' demand is Q^{ONT}. The difference between Q^2 and Q^{ONT} is export demand. The amount of energy produced by committed generators is Q^{COMG}, which is greater than the Ontario non-DR consumers' demand. The benefit that non-DR consumers realize from the energy price reduction is represented by the area A. However, the amount of Global Adjustment that these consumers will have to pay increases by the area A + B. Ontario non-DR consumers are made strictly worse off by compensating DR resource for economic activations. They are made worse off even before accounting for the amount they have to pay to DR resources for economic activations (the green shaded area).

C.9 Q: Have you done any analysis that could provide the OEB some guidance on the likelihood that the net benefits test would be satisfied in Ontario?

66. Yes. The IESO provided me with hourly data for the period January 1, 2018 to October 28, 2019 which is attached hereto as **Exhibit "H"**. The data included hourly HOEP and hourly quantities of Ontario non-dispatchable demand, Ontario dispatchable load demand, committed generation output, non-committed generation output, exports and imports for a total of 15,984 hours. I calculated the number of hours when output from committed generators exceeded Ontario non-dispatchable demand plus dispatchable load demand (the sufficient condition for the net benefits test to fail in Ontario). There were 14,436 hours out of 15,984 hours (90.3% of hours) in which the output of committed generators exceeded the Ontario demand between January 1, 2018 and October 28, 2019. The net benefits test would have failed in these hours.

67. In the remaining 1,548 hours (9.7% or hours) when Ontario demand was greater than the output of committed generators, I considered the likelihood that compensating DR resources for economic activations would lead to sufficient reductions in DR resources' energy bid prices to cause a decrease in the energy market price. If DR resource energy bid prices remain relatively high, then it is not likely a price decrease could occur and hence a net benefit to non-DR consumers is not possible. Figure 8 provides some insights in the number of hours that this might be possible. Figure 8 ranks the 1,548 hours between January 1, 2018 to October 28, 2019, in which Ontario demand exceeded committed generation output, from lowest HOEP to highest HOEP.

Figure 8: HOEP in hours with Ontario demand greater than committed generation Output, January 1, 2018 to October 28, 2019



68. First, DR resources must submit energy bid prices that are greater than $100/MWh. Compensating DR resources for economic activations could not have a net benefit in hours when the HOEP was less than $100/MWh because DR resource energy bid reductions could not fall below this price level. HOEP exceeded $100/MWh in only 17 of the 1,548 hours (0.106% of all hours in the data set).

69. IESO analysis found in a presentation to the Demand Response Working Group indicated the following:

> The historical contracting programs required DR energy bids to be priced at $200/MWh. Once the $200 price requirement was removed for HDR resources, the IESO observed that the majority of DR bids were priced by participants much higher than $200/MWh. This implies DR

participant's value of energy consumption is much higher than this level.[28]

70. If we consider prices above $200/MWh as the benchmark for a possible price effect, there were only 3 of the 1,548 hours (0.019% of the total hours in the data set) in which the HOEP exceed this benchmark.

71. Overall, recent historical data suggest that the net benefits test would rarely, if ever, be satisfied in Ontario (0.019% of the time).

C.10 Q: You also said that there would be additional complications for the IESO to implement the FERC net benefits test. What are the additional complications?

72. FERC Order No. 745 required the RTO/ISO's "to develop a mechanism as an approximation to determine a price level at which the dispatch of demand response resources will be cost-effective."[29] Essentially, the ISO and RTOs are required to use historic offer data, adjusted to reflect resource availability and fuel costs, to create a representative aggregated supply curve for a trade month.[30] This representative curve is used to determine "the monthly threshold price corresponding to the point along the supply stack beyond which the overall benefit from the reduced LMP resulting from dispatching demand response resources exceeds the cost of dispatching and paying LMP to those resources."[31] The ISO and RTOs must post this threshold price on their website and update it on a monthly basis.

73. As discussed above, the IESO will require additional information to implement the net benefits test in Ontario. They will require a forecast of Ontario non-DR load, the production of committed generation and the amount of net exports. Realistically, these values will change often during the month, which makes the use of a representative

[28] "IESO March 1 Presentation" at 7.

[29] FERC Order No. 745 at para. 4.

[30] This is described in Exhibit "G".

[31] FERC Order No. 745 at para. 4.

supply stack and a monthly price test less practical. Furthermore, applying a blunt monthly test is more likely to lead to false positives and harm to Ontario consumers given the unique conditions and relative infrequency in which the net benefits test is likely to be satisfied. The IESO would likely have to identify improvements to the way the nets benefits test is implemented in Ontario compared to the United States to limit false positives.

C.11 Q: Do you think there are any other aspects of the Ontario market that should inform a decision of whether or not to apply FERC Order No. 745 in Ontario?

74. Yes. As I outlined above, the key objective of FERC Order No. 745 was to "remove barriers to participation of demand response resources in organized wholesale electricity markets."[32] The Commission stated in its Notice of Proposed Rule Making that:

> "Despite the benefits of demand response and various efforts by the Commission, ISOs and RTOs to address barriers to and compensation for demand response participation, demand response providers collectively play a small role in wholesale markets. After several years of observing demand response participation in ISO and RTO markets with different, and often evolving, demand response compensation structures, the Commission is concerned that some existing, inadequate compensation structures have hindered the development and use of demand response."[33]

75. FERC Order No. 745 further describes the types of barriers to demand response participation that concerned the Commission. These barriers primarily related to the disconnect that existed at the time between wholesale and retail prices and the lack of incentives this created for the investment in the capability to be price responsive.[34]

[32] *Ibid* at 113.

[33] Exhibit "F" at para. 9.

[34] FERC Order No. 745. This was a point made by Commissioner Moeller on his dissenting opinion: "the lack of dynamic prices at the retail level is the primary barrier to demand response participation."

FERC Order No. 745 sought to remedy these barriers by providing DR resources additional compensation.[35]

76. However, the types of barriers to demand response the Commission was concerned with at the time of FERC Order No. 745 do not seem relevant to present day Ontario. First, as Navigant noted in a report prepared for the IESO:

> "It is important to note that Ontario is different from many U.S. jurisdiction in that many of the DR resources are wholesale market participants or large customers that are exposed to real-time electricity prices as opposed to retail prices. This means that Ontario DR customers avoid the entire real-time electricity price when curtailing and are exposed to high price spikes. When DR providers are only exposed to retail rates as they are in many U.S. jurisdictions, they are unlikely to have the same avoided cost benefit when curtailing during spikes in prices."[36]

77. Second, Ontario has already done a great deal to help DR resources recover the costs of investments needed to enable their participation in wholesale markets. As early as 2007, the IESO (formerly the OPA) recognized the capacity value of DR resources and implemented the DR3 program. The DR3 program procured DR resources through multi-year standard offer contracts that paid DR resources both an availability payment and a utilization payment. The proceeds of the availability payment could contribute in the investment in meters and control systems that would enable price responsiveness. It

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[35] *Ibid.* Commissioner Moeller in his dissenting opinion challenged the majority on this point. Commissioner Moeller stated in his dissent:

> "The Rule [FERC Order No. 745] finds that "greater uniformity in compensating demand response resources" is required and as justification for its action, references the existence of various barriers that limit the participation of demand response in the energy markets. The majority ultimately concludes that these barriers can be removed by better equipping demand response providers with the financial resources to invest in enabling technologies. This is to say that the majority believes that paying demand resources more money will help overcome these barriers and encourage more participation. The Rule, however, never clearly explains how the existence of barriers, in turn, justifies a payment of full LMP to demand resources."

[36] "Navigant Report".

also helped fund investments made by load aggregators to sign-up and compensate consumers that could reduce demand upon an activation from the IESO. In 2015, the former OPA DR3 program was integrated into the IESO-administered market through a program called capacity backed demand response and through the DRA. This provided further learning for the IESO and DR resources on how demand response could respond to economic activations. DR resources were provided availability payments for providing the capacity service, which again could be used to fund investments in the technologies needed to enable demand response. These availability payments were made during a time when Ontario had more than enough capacity to meet its obligations. This means Ontario consumers paid to help remove the barriers to demand response when it did not need the capacity. Arguably, as evidenced by the number of DR resources that now participate in the DRA, Ontario has been successful in removing the types of barriers to demand response participation in the wholesale market that were the focus of FERC Order 745.

78. Third, the ICI has been very effective at stimulating demand response during peak demand periods. The Market Surveillance Panel estimates that "ICI participants reduced their consumption by 42% during peak demand conditions in 2016."[37] They do so to reduce the amount of Global Adjustment that they pay. The Panel "estimates that by reducing consumption by one megawatt during each of the five peak demand hours in 2016, a Class A consumer would have saved approximately $520,000 in Global Adjustment charges."[38] The benefit from reducing peak hour consumption are so significant, it "creates an incentive for Class A consumers to invest in new generating or storage capacity located at their facilities."[39]

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[37] Exhibit "E" at 2.

[38] *Ibid* at 8.

[39] *Ibid* at 16.

C.12 Q: Are you aware of any research that demonstrates the effect that FERC Order No. 745 has had on the United States wholesale markets?

79. Yes, in the short time that I had to prepare this testimony, I conducted a non-exhaustive scan of the academic literature and reports prepared by the RTOs, ISOs and their market monitors for empirical evidence on the effects and implications of the implementation of FERC Order No. 745. I was surprised to find only a few reports or academic papers on the topic.

80. Monitoring Analytics LLC, the market monitor for PJM, prepare quarterly and annual reports on the PJM market. They dedicate a section in the reports specifically to demand response. Attached hereto as **Exhibit "I"** and **Exhibit "J"**, are the 2015 and 2019 Quarterly State of the Market Reports. The 2015 report states that FERC Order No. 745 "increased incentives to participate" in the PJM economic demand response program.[40] Figure 6-2 shows a sudden increase in both credits paid to economic demand response and economic MWh reductions starting in April 2012, when PJM implemented the Order No. 745. The 2019 report includes the same Figure 6-2, which shows the elevated levels of credits, and MWh reductions largely continued through 2019 and then subsided, although they are still above the April 2012 levels.[41]

81. The reports also provide the monthly net benefits test threshold prices. Threshold prices have never exceeded $34.07/MWh since April 2012 when PJM implemented Order No. 745.[42]

82. Steve Dahlke and Matt Prorok published a paper in the Energy Journal in 2019 that estimated the consumer savings, CO_2 emission reductions, and price effects that *could* be achieved in the MISO electricity market through the removal of regulatory and market rule barriers to market-based deployment of DR. This paper is attached hereto as **Exhibit "K"**. They argue that even after implementation of FERC Order No. 745,

[40] Exhibit "I" at 213.

[41] Exhibit "J" at 297.

[42] *Ibid* at 300.

there continue to be barriers to DR participation in MISO and that considerable consumer savings and CO_2 emissions could be realized through the removal of the barriers. Through their analysis, they uncover a shortcoming of the FERC net benefits test. They note that DR resources that reduce their consumption in a peak hour because of an economic activation often shift their consumption to future off-peak hours. The shift in consumption increases the price in the future hours and reduces some of the benefits to non-DR resources. That is, "deploying demand response resources that pass the net benefits test in the hour they were deployed actually increased overall costs after taking into account the off-peak increase of energy."[43]

83. Kai Van Horn et al, published a paper in the Electricity Journal in October 2013 that also identified shortcomings in the net benefits test and proposed improvements to the test. This paper is attached hereto as **Exhibit "L"**. Van Horn et al, argue the failure of the net benefits tests "to integrated the impacts of transmission is a significant limitation that has unintended consequences for the total benefits which DR resources may bring to the system and for the distribution of those benefits among the buyers in the system."[44]

84. Xu Chen and Andrew N. Kleit published a paper in the Energy Journal in 2016 (attached hereto as **Exhibit "M"**) that provided empirical result to show how incentive-based DR programs can be "manipulated" to inflate customer baseline load measurement. They suggest, "policy makers in FERC, RTOs and states regulatory agencies consider the threat of manipulation when modifying DR market rules following the Supreme Court's recent upholding of the FERC Order 745."[45]

85. Finally, David Brown and David Sappington published a paper in the Journal of Regulatory Economics in 2016 that derives an optimal DR policy and uses the optimal

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[43] Exhibit "K" at 258.

[44] Exhibit "L" at 152.

[45] Exhibit "M" at 201.

policy to estimate the welfare losses that can arise under FERC Order No. 745. This paper is attached hereto as **Exhibit "N"**. They show that the implementation of Order No. 745 overcompensates DR resources and "reduces welfare well below the level secured by the optimal DR policy."[46] They argue that the policy offered by the critiques to FERC Order No. 745, to compensate DR resources the difference between LMP and the retail rate provided higher welfare than compensation at full LMP as per the FERC Order No. 745.

D. SUMMARY CONCLUSIONS

D.1 Q: Can you summarize for the Board the key findings of evidence?

86. Yes. The evidence in my testimony demonstrates the following.

87. First, the Amendments provide an equitable treatment of TCA participants. Horizontal equity requires that like people be treated alike. I show by way of example, that two identical companies, which differ only by the arbitrary placement of their meters, are treated exactly alike under the Amendment; *horizontal equity*. I then show that compensating DR resources for an economic activation provides preferential treatment to the company that operates a behind-the meter generator; *horizontal inequity*. The company that operates the behind-the-meter generator, DR Corp. is provided preferential treatment because it benefits twice when it reduces its net-demand with the IESO: first, it reduces the energy payment it makes to the IESO, and second, it receives a payment from the IESO for doing so.

88. In my opinion, applying the horizontal equity test is a more accurate way of assessing equitable treatment, than a test of functional equivalence in service provided, which is the test I understand AMPCO has asked the Board to rely on in this matter. As my example demonstrates, both DR Corp. and Gen Corp. are functionally equivalent in terms of their capability of balancing supply and demand on the IESO controlled grid;

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[46] Exhibit "N" at 265.

one by reducing demand and one for producing electricity. Doing so fails to recognize that DR Corp. is effectively compensated twice for reducing demand while GEN Corp. receives no net benefit for producing electricity (i.e., it earns zero net revenue). I argue that when designing fair and efficient electricity markets, it is important to understand the underling incentives of participants.

89. Second, the Amendments do not place DR resources at a competitive disadvantage to non-committed dispatchable generators in the TCA as per AMPCO's assertion. To the contrary, pay DR resources the market price for economic activations would place non-committed-generators at a competitive disadvantage. Through examples, I show that paying DR resources the market price for an economic activation compensates them twice for their demand reduction. This double benefit would allow them to bid lower in the energy market, and offer lower capacity prices in the TCA to the disadvantage of non-committed generators. Furthermore, I demonstrate that DR resources that are Class A consumers already have a competitive advantage over non-committed generators in the TCA since they can avoid paying Global Adjustment as a capacity resource. This later point creates incentives for large-consumers to invest in behind-the-meter generation at a cost greater than the cost to operate and maintain a non-committed generator facility.

90. Third, the Amendment is consistent with the promotion of fair and equitable competition as it provides the proper incentives for DR resources to operate efficiently within the TCA and the IESO's energy market.

91. Fourth, the presence of the Global Adjustment means that the FERC net benefits test will rarely if ever be satisfied in Ontario. Furthermore, there would be significant complications for the IESO to implement the net benefits test in Ontario due to the Global Adjustment. In my opinion, the evidence shows that there is no net benefit to even further studying the merits of the application of the net benefits test in Ontario.

92. Fifth, Ontario has made significant progress towards reducing the types of barriers to DR resources that concerned the Commission at the time of FERC Order No. 745. In

my opinion, providing DR resources energy payments for economic activations is not required to overcome any legitimate barriers to DR resources, to the extent there are any remaining barriers.

93. With this I conclude my testimony.

SWORN before me at the Town of Paris, in the Province of Ontario, this 21st day of November, 2019	)	
A Commissioner for Taking Affidavits	)	**Brian Rivard**

Lauren Theresa Daniel, a Commissioner, etc., Province of Ontario, while a Student-at-Law. Expires April 8, 2022.

TAB A

This is Exhibit **"A"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc., Province of Ontario, while a Student-at-Law. Expires April 8, 2022.

FORM A

Proceeding: EB-2019-0242

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is Brian Rivard. I live at the Town of Paris, in the Province of Ontario .

2. I have been engaged by or on behalf of Borden Ladner Gervais LLP to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:

(a) to provide opinion evidence that is fair, objective and non-partisan;

(b) to provide opinion evidence that is related only to matters that are within my area of expertise; and

(c) to provide such additional assistance as the Board may reasonably require, to determine a matter in issue.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date: November 8, 2019

Signature

TAB B

This is Exhibit **"B"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc., Province of Ontario, while a Student-at-Law. Expires April 8, 2022.

Brian Rivard
3025 Redstart Dr, Mississauga, Ontario, L5L 2N1
Home: 905-997-6380, Cell: 437-333-4913
brian.rivard27@gmail.com

EDUCATION

1996 Ph.D. in Economics, University of Western Ontario
Fields of Concentration: Industrial Organization, Monetary Economics
1990 Master of Arts in Economics, University of Western Ontario
1989 Bachelor of Arts in Economics, University of Windsor

PROFFESSIONAL HISTORY

Adjunct Professor and Research Director of the Energy Policy and Management Centre

Richard Ivey School of Business at Western University
May 2018 to Present

- Contribute to energy policy-making through the production and dissemination of evidence-based research and analysis on major policy issues affecting the electricity, gas, oil and pipeline sectors in Canada
- Provide a transparent and reliable forum for industry, government, academia, and interested stakeholders to discuss and exchange ideas on energy sector development and policy
- Educate students, executives, and government officials on national and global energy sector issues.

Principal

Charles River Associates International
July 2015 to May 2018

- Provide economic and financial consulting services to corporations, law firms and government agencies on energy market issues relating to asset valuation, market strategy and analysis, corporate strategy and contract disputes and litigation
- Lead the Canadian energy practice for CRA, responsible for marketing and client outreach
- Select consulting experiences include:

- For Alberta's Market Surveillance Administrator, co-authored a report with Adonis Yatchew that assessed the integration of different climate policy options in the Alberta wholesale energy market and the potential effects of the large scale deployment of renewables on the ability of the market to continue to function fairly, efficiently and in an openly competitive manner

- Provided economic and regulatory support to EPCOR Utilities Inc, on the competitive implications on distribution franchise arrangement in the Application to the Ontario Energy Board by Union Gas Limited for an Order for Approval of Union Gas Limited's Distribution System Expansion Projects Proposal EB-201500179

- Managed the analysis and co-authored the expert report related to the valuation of a natural gas generation plant in Ontario, post the expiry of its contract with the Independent Electricity System Operator

- Providing expert economic consulting services to the Market Assessment and Compliance Division of the Independent Electricity System Operator on the development of an internal market impact analysis framework

- Providing expert economic opinion to the Market Assessment and Compliance Division of the Independent Electricity System Operator of the market and financial impacts of an alleged breach of the market rules (alleged market manipulation)

- Advised two Ontario wholesale market participants in the development of an internal compliance plan

- With Robert Cary, advising the Independent Electricity System Operator on the implications for the introduction of a Cap and Trade regime on gas generation contracts

- With Christopher Russo, contributed to the preparation of expert testimony for a Quebec based energy trading company on a matter involving breach of contract

- With Seabron Adamson, prepared expert testimony on behalf of three small hydroelectric generators in a Power Purchase Agreement renewal dispute with Hydro-Quebec

- Provided testimony on issues related to market power and market manipulation before the Federal Energy Regulatory Commission, on behalf of a major US energy company

- Provided advice and prepared a report on capacity market design to the Alberta Electricity System Operator

- Prepared report for the Alberta Utilities Commission on the economic fundamentals of capacity markets

- Prepared advice and prepared a report for the Alberta Department of Energy on governance arrangements in jurisdictions with capacity markets

- Conducting a benchmarking study for NextEra of development costs for North American transmission projects comparable to the proposed East-West transmission line

- Providing expert testimony on behalf of the IESO on a litigation matter before the Supreme Court involving the recovery of the Global Adjustment

- Providing expert advice to the IESO on the interactions between IESO contracts and the Market Renewal Initiatives

Director, Markets
Independent Electricity System Operator
May 2013 to July 2015

- Responsible for leading the corporate vision on evolution of the Ontario wholesale electricity market
- Led corporate external stakeholder efforts on market-related issues
- Led and mentored a team of 25 market analysts
- Managed $1-million program budget
- Represented the IESO on the IESO Technical Panel

Manager, Regulatory Affairs and Sector Policy Analysis
Independent Electricity System Operator
April 2010 to May 2013

- Responsible for providing economic analysis of the impacts of changes to the IESO market rules or market design, government policies, and other industry initiatives
- Responsible for representing the corporation's interest in all regulatory matters
- Led team of 12 regulatory, market and legal analysts
- Represented the IESO on government relations matters

Manager, Economics
Independent Electricity System Operator
January 2006 to April 2010

- Conducted economic and financial analysis of changes to the Ontario electricity market and government policy

- Provided strategic advice to IESO CEO and Board of Directors on market-related matters

Director of Economic Analysis
Bell Canada Enterprise
April 2005 to January 2006

- Responsible for economic arguments made in Bell Canada's regulatory filings
- Conducted economic analysis on matters related to product development

Special Economic Advisor
Independent Electricity System Operator
November 2000 to April 2005

- Conducted analysis of the Ontario electricity market performance and participant behaviour

Senior Economist
LECG-Navigant Consulting Inc.,
May 1999 to November 2000

- Provided economic consulting services to legal and corporate clients in competition policy matters

Economist, Senior Economist
Canadian Competition Bureau
August 1993 to May 1999

- Conducted economic analysis of potential violations of the Canadian Competition Act

Other Professional Experiences

Part-Time Instructor
Ryerson University and Osgoode Hall Law School

- Offer courses on the law and economics of energy markets

Journal Referee

- Peer reviewer for the Energy Journal and Guest Editor, International Conference Energy Forum Special Issue

PAPERS PUBLISHED

"Integration of Renewables into the Ontario Electricity System," (with Adonis Yatchew), *The Energy Journal*, 2016.

"Recent Developments In Competition Policy: The IPEGs," (with Chantale LaCasse), *Canadian Competition Record*, spring of 2001.

"Antitrust Policy Towards EFT Networks: The Canadian Experience in the *Interac* Case," (with R. Anderson), *Antitrust Law Journal*, Vol. 67, issue 2 July 1999.

"Interac, Essential Facilities and Access to Electronic Funds Networks: A Comment on Mathewson and Quigley," (with Roger Ware), *Canadian Competition Record*, Vol. 18, No. 4, winter 1998.

"Monopolistic Competition, Increasing Returns and Self-fulfilling Prophecies," *Journal of Economic Theory*, Vol. 6, No. 2, April 1994.

CHAPTERS IN BOOKS

"Economic Evidence of Market Power and Market Manipulation in Energy Markets," (with Robin Cohen, David Hunger, and Christopher Russo) in Gordon E. Kaiser (ed.), *The Guide to Energy Market Manipulation* (London: Global Competition Review, La Business Research, 2018).

"Intellectual Property Rights and International Market Segmentation in the North American Free Trade Area," (with R. Anderson, P. Feuer and M. Ronayne) in *Competition Policy and Intellectual Property Rights in the Knowledge-Based Economy.* Edited by R. Anderson and N. Gallini. Calgary: University of Calgary Press, 1998, pp. 397-429.

"The Competition Policy Treatment of Shared EFT Networks: The *Interac* Case," (with R. Anderson) in the Proceedings of 34th Annual Conference on Bank Structure and Competition on *Payments Systems In the Global Economy: Risks and Opportunities*, 1998.

OTHER PROFESSIONAL ACTIVITY

- Chair, ISO-RTO Council Markets Committee, a ten-member organization of North America's Electricity System Operators
- Graduate of University of Toronto - Rotman School of Management, Advanced Management Program - Change Management 2015

TAB C

This is Exhibit **"C"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc., Province of Ontario, while a Student-at-Law. Expires April 8, 2022.

PROCEDURE

Market Manual 4: Market Operations

Part 4.3: Real-Time Scheduling of the Physical Markets

Issue 56.0

This procedure provides guidance to *Market Participants* on the Real-time scheduling process in the *IESO-administered physical markets*.

Disclaimer

The posting of documents on this website is done for the convenience of *market participants* and other interested visitors to the *IESO* website. Please be advised that, while the *IESO* attempts to have all posted documents conform to the original, changes can result from the original, including changes resulting from the programs used to format the documents for posting on the website as well as from the programs used by the viewer to download and read the documents. The *IESO* makes no representation or warranty, express or implied, that the documents on this website are exact reproductions of the original documents listed. In addition, the documents and information posted on this website are subject to change. The *IESO* may revise, withdraw or make final these materials at any time at its sole discretion without further notice. It is solely your responsibility to ensure that you are using up-to-date documents and information.

This *market manual* may contain a summary of a particular *market rule*. Where provided, the summary has been used because of the length of the *market rule* itself. The reader should be aware, however, that where a *market rule* is applicable, the obligation that needs to be met is as stated in the "Market Rules". To the extent of any discrepancy or inconsistency between the provisions of a particular *market rule* and the summary, the provision of the *market rule* shall govern.

Document ID	IMP_PRO_0034
Document Name	Part 4.3: Real-Time Scheduling of the Physical Markets
Issue	Issue 56.0
Reason for Issue	Issue released in advance of Baseline 42.1
Effective Date	October 15, 2019

Document Change History

Issue	Reason for Issue	Date
For history prior to 2011, refer to version 40.0		
For history prior to December 2014, refer to versions 50.0 and prior		
40.0	Issue released in advance of Baseline 33.0	December 8, 2014
41.0	Issue released for Baseline 33.0	March 4, 2015
42.0	Issue released for Baseline 33.1	June 3, 2015
43.0	Issue released for Baseline 34.0	September 9, 2015
44.0	Issue released for Baseline 34.1	December 2, 2015
45.0	Issue released for Baseline 35.0	March 2, 2016
46.0	Issue released in advance of Baseline 36.0	June 21, 2016
47.0	Issue released in advance of Baseline 36.1	October 26, 2016
48.0	Issue released in advance of Baseline 36.1	December 1, 2016
49.0	Issue released for Baseline 37.0	March 1, 2017
50.0	Issue released for Baseline 37.1	June 7, 2017
51.0	Issue released in advance of Baseline 38.0	August 1, 2017
52.0	Issue released for Baseline 38.0	September 13, 2017
53.0	Issue released for Baseline 38.1	December 6, 2017
54.0	Issue released in advance of Baseline 40.1	November 14, 2018
55.0	Issue released in advance of Baseline 41.1	April 30, 2019
56.0	Issue released in advance of Baseline 42.1	October 15, 2019

Related Documents

Document ID	Document Title
MDP_PRO_0027	Market Manual 4.2: Submission of Dispatch Data in the Real-Time Energy and Operating Reserve Markets
PRO-324	Market Manual 4.6: Real-Time Generation Cost Guarantee Program

Table of Contents

List of Figures

List of Tables

Table of Changes

Reference (Paragraph and Section)	Description of Change
Section 5.1.2	Updated section to reflect the transition from the Demand Response Auction to the Transitional Capacity Auction
Section 7.2	Updated section to reflect the transition from the Demand Response Auction to the Transitional Capacity Auction

Market Manuals

The *Market Manuals* consolidate the market procedures and associated forms, standards, and policies that define certain elements relating to the operation of the *IESO-administered markets*. Market procedures provide more detailed descriptions of the requirements for various activities than is specified in the “Market Rules”. Where there is a discrepancy between the requirements in a document within a *Market Manual* and the *Market Rules*, the *Market Rules* shall prevail. Standards and policies appended to, or referenced in, these procedures provide a supporting framework.

Market Procedures

The “Market Operations Manual” is Series 4 of the *Market Manuals*, where this document forms “Part 4.3: Real-Time Scheduling of the Physical Markets”.

– End of Section –

1. Introduction

1.1 Purpose

This document provides *market participants* with the information necessary to support the *real-time schedule* for the *physical markets*. The *IESO* determines *dispatch instructions* for each *registered facility*[1] and *boundary entity* as described in this procedure, as the primary means of coordinating the real-time operation of the *physical markets*.

This procedure addresses:

- The release of the real-time schedule to registered market participants that relates to their registered facilities and boundary entities,
- The release of general real-time schedule to all *market participants*,
- The determination and issuance of dispatch instructions for boundary entities, in the form of interchange schedules to control area operators,
- The determination and issuance of dispatch instructions for registered facilities to registered market participants by the *IESO*, and
- The determination and issuance of standby and activation notices for *hourly demand response (HDR)* resources, in the form of standby and activation reports.

1.2 Scope

This *market manual* is intended to provide *market participants* with a summary of the steps and interfaces between *market participants*, the *IESO*, and other parties during the process for determining the *real-time schedule* for the *physical markets*. The procedural workflows and steps described in this document serve as a roadmap for *market participants* and the *IESO*, and reflect the requirements set out in the *market rules* and applicable *IESO* policies and standards.

This procedure only addresses the process for determining the *real-time schedule*. This procedure does not address the pre-dispatch process[2] that provides inputs into the process for determining the *real-time schedule*.

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[1] *Facilities* that are registered with the *IESO* as *boundary entities* to import or export electricity are referred to as *boundary entities* in this procedure. The term '*registered facility*' is used to describe those *facilities* within Ontario that have been registered by *market participants* with the *IESO*.

[2] For more information on the pre-dispatch process, see Market Manual 4.2: Submission of Dispatch Data for the Real-Time Energy and Operating Reserve Markets.

The *IESO* endeavours to ensure that the correct inputs are provided to the *dispatch algorithm*[3] that calculates the *security*-constrained economic *dispatch* (i.e., the *real-time schedule* of *energy* and *operating reserve*). The *IESO* undertakes regular *security* and *adequacy* assessments:

- To identify events that are likely to occur and adjust the inputs to the *Dispatch* Scheduling and Optimization (DSO) tool so that the resultant set of *dispatch instructions* ensure the *security* and *adequacy* of the *IESO-controlled grid*, and
- To identify events that have occurred to which the routine *dispatch* process will be unable to respond in a manner that continues to ensure the *reliability* of the *IESO-controlled grid*. In such situations, the *IESO* may alter the inputs to the DSO and/or intervene in the routine *dispatch* process by manually altering the *dispatch instructions* to ensure *reliability*. In some extreme cases, the *IESO* may have to suspend normal market operations[4].

1.3 Roles and Responsibilities

Responsibility for establishing the *real-time schedule* in the *physical markets* is shared among:

- **Registered Market Participants** having dispatchable generation or load facilities that are responsible for:
    - Accepting or rejecting *dispatch instructions* or *release notifications* issued by the *IESO*,
    - Following accepted *dispatch instructions*, and
    - Notifying the *IESO* as soon as possible of circumstances that will result in its *facility* not following its *dispatch instructions* to an extent that is material (as defined in Market Manual 4.2, Appendix C).
- **Registered Market Participants** having *HDR* resources that are responsible for:
    - Monitoring standby reports to determine if a standby notice is received,
    - Following *dispatch instructions* in the form of activation notices, and
    - Notifying the *IESO* as soon as possible of circumstances that will result in its *facility* not following its *dispatch instructions* to an extent that is material (as defined in Market Manual 4.2, Appendix C).
- **Registered Market Participants** having boundary entities that are responsible for:
    - Revising and re-submitting *dispatch data* for *boundary entities* when quantities scheduled for those transactions by other *control areas* are less than the quantity offered or *bid* into the Ontario market,
    - Creating and submitting e-Tags for their interchange transactions,

[3] The *dispatch algorithm* is run through the *Dispatch* Scheduling and Optimization (DSO) tool operated by the *IESO*.

[4] The process of *market suspension* is set out in Market Manual 4.5: Market Suspension and Resumption.

  - Viewing their *interchange schedules* published by the *IESO* to the *market participant* Interface or verbally confirming *interchange schedules* for a *boundary entity* with the *IESO* where the *interchange schedule* differs from the published schedule,
  - Revising and resubmitting e-Tags when *interchange schedule* quantities differ from the quantity provided on the e-Tag, and
  - Cancelling e-Tags submitted for linked[5] wheeling through transactions whose import and/or export component did not get scheduled for the *dispatch hour*.

- ***Control Area operators*** in areas adjacent to the Ontario *control area* who are responsible for confirming or rejecting the feasibility of *interchange schedules* provided by the *IESO*, and
- The ***IESO*** which is responsible for:
  - Releasing *real-time schedule* information, *market schedule* information, *market prices* and related operational information to *registered market participants*,
  - Publishing dispatch instructions for market participants with boundary entities in the form of interchange schedules,
  - Identifying and removing from schedule linked wheeling through *interchange schedules* whose import and/or export component did not get scheduled for the dispatch hour.
  - Issuing and confirming *dispatch instructions* verbally to *market participants* with *boundary entities* where the *interchange schedule* is different from the published schedule,
  - Issuing dispatch instructions to registered facilities that are not boundary entities,
  - Issuing dispatch advisories, on a reasonable efforts basis, to registered facilities that are not boundary entities, as per *Market Rule* Chapter 7, Section 7.1.6 (*MR* Ch. 7 Sec. 7.1.6).
  - Identifying circumstances where emergency actions are required to maintain the *reliability* of the *IESO-controlled grid*,
  - Informing *market participants*, as soon as practicable, whenever a published *market price* is an administrative price.

1.4 Contact Information

Changes to this public *market manual* are managed via the *IESO* Change Management process. Stakeholders are encouraged to participate in the evolution of this *market manual* via this process.

To contact the *IESO*, you can email *IESO* Customer Relations at customer.relations@ieso.ca or use telephone or mail. Telephone numbers and the mailing address can be found on the IESO website (http://www.ieso.ca/corporate-ieso/contact). Customer Relations staff will respond as soon as possible.

– End of Section –

[5] Linked wheeling transactions are described in Market Manual 4.2, Section 2.5.4.

2. Participant Workstation and Dispatch Workstation

Market participants are required to operate a *participant workstation* and a *dispatch workstation* for the purposes of supporting the process of determining the *real-time schedule*. The *participant workstation* is connected to the Participant Network. *Market participants* submit *bids* and *offers* to the *IESO* via the *participant workstation*, as described in Market Manual 4.2. Valid *bids* and *offers* are then passed to the *IESO's* Market Interface System (MIS) for the purposes of determining the *real-time schedule*. *Dispatch instructions* for *boundary entities*, in the form of the *interchange schedule*, are published via the *Market Participant* Interface, a component of the *participant workstation*.

The *dispatch workstation* is connected to the Real-Time Network, which supports real-time operation of the power system. *Dispatch instructions* for *registered facilities* are submitted to *market participants* via their *dispatch workstation*.

For more information on the system and software requirements for the *participant workstation* and the *dispatch workstation*, refer to Market Manual 6: Participant Technical Reference Manual.

– End of Section –

3. Determining Real-Time Schedules

The *IESO* uses a range of information to determine the *real-time schedules*, including:

- Dispatch data submitted by registered market participants,
- The registered *generation facility's* maximum ramp rate from the IESO Registration Solution,
- The registered *generation facility's* minimum loading point from the IESO Registration Solution (*MR* Ch. 7 Sec. 2.2.6A), and
- The following registered *generation facility's* characteristics from the IESO Registration Solution (*MR* Ch. 7 Sec. 2.2.6A),
    - Forbidden region data, and
    - Period of steady operation data.
- A default value of zero for the minimum loading point, forbidden region and period of steady operation if none has been registered with the *IESO* with respect to this information.
- Predictions of load for the next sixty-minutes, calculated automatically[6] every five-minutes,
- Generator and transmitter outage information provided by market participants,
- Transfer limits for interconnected interties,
- Total *operating reserve* requirements (10-minute spinning, 10-minute non-spinning, 30-minute) determined by the *IESO*,
- *Local area* reserve requirements (if any), determined by the *IESO*,
- Operating *security* and thermal limits on transmission *facilities*,
- Scheduled interchange for the hour, calculated by the last pre-dispatch run of the DSO[7],
- The output level of each *generator* and the withdrawal levels of each *dispatchable load* and *HDR* resource at the beginning of the *dispatch interval* are set at the *IESO's* best estimate of their actual values, as determined from real-time system data and the *real-time schedule* for the preceding *dispatch interval*,
- *Variable generation* five-minute supply forecast, and
- Such other available information as the *IESO* determines appropriate.

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[6] At the discretion of the *IESO,* we may manually adjust the Ontario *demand* forecast to account for limitations of our automated load predictor to accurately forecast expected load profiles.

[7] The DSO is run with a one-hour time-step in pre-dispatch mode for all the remaining hours of today and, from 16:00 EST on, for all the hours of tomorrow. *Interchange scheduled* by the DSO for the next hour is confirmed with adjacent *control areas* and ramped at or near the top of the hour. Scheduled interchange for the hour is provided as an input to the real-time DSO to calculate the five-minute *dispatch instructions* for internal Ontario resources.

The *IESO* uses this information and the *dispatch algorithm*[8] to determine a *security*-constrained economic *dispatch* schedule for each five-minute *dispatch interval and* to determine anticipated schedules for a number of advisory intervals within the study period. Daily *energy* limits are not taken into account in determining *real-time schedules*.

The real-time constrained *dispatch* schedule, only, utilizes a two-step optimization technique to determine a *security*-constrained economic *dispatch* schedule for a number of critical intervals over a forward-looking study period. For each real-time constrained *dispatch* schedule, critical intervals are selected by the *IESO* from the study period based on selection criteria defined in the Multi-Interval Optimization Functional Requirements document.

There are currently up to 11 critical intervals selected within a study period of 55 minutes. The first critical interval is always the *dispatch interval*, and the remaining critical intervals are advisory intervals. Both the length of the study period and the number of advisory intervals are configurable and may be changed by the *IESO* in the event of significant improvement or degradation of either computer software and hardware performance or the accuracy of predicted demand values (*MR* Ch.7, App. 7.5, Sec. 2.11.3*).*

In the event of a malfunction of the multi-interval optimization algorithm the *IESO* may switch to single interval optimization. During such periods new *dispatch* advisory reports will not be issued. The *IESO* will issue a system message to notify *market participants* whenever single interval optimization is being used.

It should be noted that the *dispatch* advisory reports issued to registered dispatchable *market participants* only include the schedules for the advisory intervals and not for the *dispatch interval*.

The *IESO* will review the output from the *dispatch algorithm* and may manually adjust the *real-time schedule* to reflect control actions that are required to address events that the *IESO* assesses:

- Will have a material impact on the *IESO-controlled grid*, and
- Occur in a timeframe in which the *dispatch algorithm* and market mechanisms cannot respond.

Such events may include:

- Unplanned outages of facilities,
- Rapid changes to *security limits*,
- Unexpected *demand* changes,
- Limitations of the load predictor to accurately forecast Ontario *demand* for the next interval,
- Area reserve inadequacies,
- Voltage problems, or
- Variable generation ramp events.

To resolve such problems, the *IESO* may intervene in the routine *dispatch* process, where the *IESO* judges that such intervention is viable. In such situations, the *IESO* will manually adjust the *dispatch instructions* that result from the *real-time schedule* generated through the *dispatch algorithm* and issue these adjusted *dispatch instructions*. Where an assessment determines that such intervention

[8] The real-time DSO uses the *constrained IESO-controlled grid* model.

is not viable, the *IESO* will suspend normal market operations (see Market Manual 4.5: Market Suspension and Resumption).

– End of Section –

4. Determining Market Information

Within five minutes following the end of each *dispatch interval*, the *IESO* uses the *dispatch algorithm* to determine the *market schedule* and the *market prices* for that *dispatch interval*. For the purpose of determining the *market schedule* and *market prices* for any *dispatch interval*, the *IESO* uses the same information and data that was used to determine the *real-time schedule* for that *dispatch interval*, except that (*MR* Ch. 7, Sec. 6.4):

- The unconstrained *IESO-controlled grid* model is used,
- The initial conditions used for any *dispatch interval* in the *market schedule* are the final conditions of the *market schedule* for the preceding *dispatch interval*,
- The total *demand* (including losses) to be satisfied within a *dispatch interval* in the *market schedule* are set at the *IESO's* best estimate of its actual value, as determined from real-time system data,
- Total system *energy* losses determined in the *real-time schedule* are represented as an increase in *non-dispatchable load* within the *IESO control area*,
- Any *registered facility* in respect of which a *forced outage* has been detected during a *dispatch interval* are recognized by an adjustment to the input data,
- The estimated deviations between scheduled quantities and actual quantities are represented as a change in *non-dispatchable load* in the *IESO control area*[9],
- The *market schedule* reflects *dispatch* adjustments[10] computed using scheduled injections from the constrained schedule, outlined in *MR* Ch. 7, App 7.5, and
- The *demand* in the *market schedule* will be adjusted when the *IESO* initiates a voltage reduction (3% or 5%) and/or *non-dispatchable* load cuts (rotational, *emergency* or manual load shedding), by an amount expected to offset the impact of the control action (*MR* Ch. 7 Sec. 3.2.1.12).

<u>Note:</u> When the *IESO* undertakes an emergency control action consisting of a voltage reduction and/or *non-dispatchable* load cuts for local or global reasons, the *IESO* will adjust the *demand* in the *market schedule* as soon as practical, considering the nature of the operating conditions at the time, by an amount expected to offset the impact of the control action. The *IESO* will not consider any action resulting in a *demand* reduction of 50 MW or less as a control action for the purposes of this manual.

– End of Section –

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[9] Until such time that locational pricing is implemented in the *IESO-administered markets*, in determining the *market schedule* and *market prices* for any *dispatch interval*, the *IESO* shall not have regard to the estimated deviations between scheduled quantities and actual quantities.

[10] These dispatch adjustments will not be considered in determining the *market schedule* and *market prices* for any *dispatch interval* until the date indicated in the previous footnote.

5. Releasing Real-Time and Market Information

5.1 Publication of Real-Time Schedule Information

The *IESO* releases information in support of the *real-time dispatch process*, including *real-time schedules*, *market schedules* and *market prices*. Information relating to specific *registered facilities*, HDR resources, and *boundary entities* is released to the *registered market participant* for that *facility*. Other information relating to the general status of the system is released to all *market participants*.

5.1.1 Registered Facilities (other than boundary entities and HDR resources)

As soon as practical but no later than the start of the *dispatch interval* to which it relates, for each *registered facility* that is a *dispatchable load* or a dispatchable *generator* in respect of which *market participant bid* or *offer* has been submitted for the applicable *dispatch hour*, the *IESO* releases the following information to the *registered market participant* for the *facility:*

- The real-time schedule for that *registered facility*,
- The dispatch advisories for that *registered facility* (*MR* Ch. 7, Sec. 7.1.6), and
- The obligation indicator for any registered *facility* that is a *variable generator*.

The *dispatch* advisory will be issued on a reasonable effort basis and missed *dispatch* advisories will not be re-issued.

Within one hour after each *dispatch hour*, for each *registered facility* that is a *dispatchable load* or a dispatchable *generator* in respect of which a valid *bid* or *offer* has been submitted for the applicable *dispatch hour*, the *IESO* releases the *market schedule*[11] for each *dispatch interval* in the *dispatch hour* to the *registered market participant*.

Additionally, the *IESO* shall *publish* on the *IESO* website:

- The standing *offer* prices and quantities for control action sources of *operating reserve* as determined by the *IESO Board* (*MR* Ch. 5, Sec. 4.5.6A.2), and
- The times and quantities of the voltage reductions and reduction in *thirty-minute operating reserve* when these control action sources of *operating reserve* are scheduled to provide *operating reserve* (*MR* Ch. 5, Sec. 4.5.6A.4).

Also, the *IESO Board* may specify the circumstances under which any one or more of the quantities may either be withdrawn or not introduced, and the manner in which any such withdrawal will be effected and the *publishing* thereof (*MR* Ch.5, Sec. 4.5.6A.3).

[11] This obligation is subject to the provisions of *MR* Ch. 7 Sec. 8.4.

5.1.2 Hourly Demand Response (HDR) Resources

The *IESO* releases the *pre-dispatch* schedule for each *registered facility* that is an *HDR* resource as soon as practical[12] (consistent with relevant *reliability standards*).

The *IESO* releases *dispatch instructions,* in the form of an activation notice to the *capacity market participant* (CMP) for each *registered facility* that is an *HDR* resource.

5.1.3 Boundary Entities

As soon as practical and consistent with relevant *reliability standards*, but no later than the start of the *dispatch hour* to which it relates[13], for each *registered facility* that is a *boundary entity* in respect of which the *dispatch instructions* for a given *dispatch hour* provides for the *dispatch* of more than 0 MW, the *IESO* releases the following information to the relevant *market participant*:

- The interchange schedule for that registered facility, as found in the relevant pre-dispatch schedule,
- Any request of that registered facility to submit an offer or bid under a reliability must-run contract and the scheduled use of that registered facility under reliability must-run contracts and contracted ancillary services contracts, and
- The projected market schedule for that registered facility.

5.1.4 All Market Participants

In the five-minute period after the end of each *dispatch interval*, the *IESO* releases to all *market participants* the uniform *market prices* of *energy* and *operating reserves* related to that *dispatch interval*.

Within one hour after the end of the *dispatch hour*, the *IESO* releases to all *market participants* the following information for each *dispatch interval* of that *dispatch hour*:

- Total system load and total system losses,
- Area *operating reserve* requirements,
- For information purposes only, *energy* prices at each set of transmission nodes identified by the *IESO* for this purpose, decomposed as far as practical into an *energy* component, a loss component and a component for all other transmission and system constraints and the prices of each class of *operating reserve* in each reserve area identified by the *IESO* for this purpose,
- Aggregate reliability must-run resources called upon,
- Any area *operating reserve* shortfalls, and
- A list of network and *security* constraints that affected the *real-time schedule*.

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[12] Typically, this will be approximately 2 hours and 30 minutes (but no later than 2 hours) prior to the start of the *dispatch hour* due to the scheduling requirements of *HDR* resources.

[13] Typically, this will be at least 30 minutes prior to the start of the *dispatch hour* due to the requirements to provide e-Tags at least 20 minutes prior to the start of the *dispatch hour*.

The *IESO* also releases the *market schedules* for all *dispatch interval*s in the preceding *dispatch hour* to the *registered market participant*, for each *registered facility*.

In the event of a load *curtailment*, the *IESO* will release to all *market participants* an estimate of aggregate load *curtailed* as soon as practicable following the return to a *normal operating state*.

5.2 Publication of Real-Time Dispatch Information

Within one hour after the end of each *dispatch hour*, the *IESO publishes* information regarding the system results and events that occurred during that *dispatch hour*. This information includes:

- Total load met,
- Transmission capacity between the *IESO-controlled grid* and each *intertie zone*,
- Any *outages* of transmission *facilities*,
- Total *operating reserve* scheduled, and total *energy* called from such *operating reserve*, by area,
- The market prices for each dispatch interval, and
- The uniform Hourly Ontario Energy Price (HOEP).

– End of Section –

6. Determining Dispatch Instructions

6.1 Registered Facilities (other than HDR resources and boundary entities)

The *IESO* will seek to ensure that the *dispatch instructions* issued with respect to each *registered facility*, other than a *boundary entity or HDR* resource, closely approximate the most recent *real-time schedule* for that *registered facility* and *dispatch interval* and are within capabilities of the *facility* as registered with the *IESO*. The *IESO* may, however, issue *dispatch instructions* that depart from the *real-time schedule* produced by the DSO if:

- The *security* and *adequacy* of the system would be endangered by implementing the most recent *real-time schedule*,
- The *dispatch algorithm* has failed, or has produced a *real-time schedule* that is clearly and materially in error,
- The *dispatch algorithm* has produced a *real-time schedule* that does not accurately reflect the *minimum run-time* or lockout[14] status of a *facility* due to *dispatch algorithm* limitations,
- Material changes subsequent to determination of the most recent *real-time schedule*, such as failure of an element of a *transmission system* or failure of a *registered facility* to follow *dispatch instructions*, have occurred, or
- The operation of all or part of the *IESO-administered markets* has been suspended[15] (refer to Market Manual 4.5: Market Suspension and Resumption).

Having produced the *real-time schedule*, an under generation condition may prevail. In such circumstances, the *IESO* will declare an *emergency operating state* if observance of *security limits* under a *normal operating state* will require *curtailment* of *non-dispatchable load*. The *IESO* will implement *demand* management and/or load shedding activities[16], as detailed in the Market Manual 7: Systems Operations Overview[17], to resolve the situation.

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[14] The dispatch algorithm does not have the functionality to recognize the operating status of some facilities once they complete dispatch instructions. This is illustrated in, but not limited to, the following examples:

- The dispatch algorithm does not recognize that, once some quick start facilities synchronize, they must remain in service at or above a minimum loading point for a minimum run-time.
- The *dispatch algorithm* does not recognize that, once some *facilities* change their *dispatch* level, they are locked out and cannot change *dispatch* from that level for a specified period of time.

[15] This may occur as a result of one of the preceding bullets.

[16] Implementation of manual load shedding should be preceded by a declaration of an *Emergency Operating State*.

[17] In general, under generation situations should not appear unexpectedly. In most cases, under generation situations should be evident in advance via the Adequacy Report up to 34 days out. These situations may also be identified in an advisory notice – which may include a Maximum Generation Alert, or the outputs of the pre-dispatch run. Control actions to address under generation in these timeframes can include issuance of a

6.2 Hourly Demand Response (HDR) Resources

The *IESO* will seek to ensure that the *dispatch instructions*¸ in the form of an activation notice, issued with respect to each *registered facility* that is an *HDR* resource for each *dispatch hour* reflect the *pre-dispatch schedule*[18] used for scheduling that *dispatch hour*. The *IESO* may, however, issue *dispatch instructions* that depart from the *pre-dispatch schedule* if:

- The *security* and *adequacy* of the system (internally or externally) would be endangered by implementing the *pre-dispatch schedule,*
- The *dispatch algorithm* has failed, or has produced a *pre-dispatch schedule* that is clearly and materially in error,
- Material changes subsequent to determination of the *pre-dispatch schedule*, such as failure of an element of a *transmission system* or failure of a *registered facility* to follow *dispatch instructions*, have occurred, or
- The operation of all or part of the *IESO-administered markets* has been suspended. Refer to Market Manual 4.5 for more details on this situation.

6.3 Boundary Entities

The *IESO* will seek to ensure that the *dispatch instructions* issued with respect to each *registered facility* that is a *boundary entity* for each *dispatch hour* reflect the *pre-dispatch schedule* used for scheduling that *dispatch hour*. The *IESO* may, however, issue *dispatch instructions* that depart from the *pre-dispatch schedule* if:

- The *security* and *adequacy* of the system (internally or externally) would be endangered by implementing the *pre-dispatch schedule,*
- The *dispatch algorithm* has failed, or has produced a *pre-dispatch schedule* that is clearly and materially in error,
- The *dispatch algorithm* has produced a *real-time schedule* that does not accurately reflect the *minimum run-time* or lockout[19] status of a *facility* due to *dispatch algorithm* limitations,
- Material changes subsequent to determination of the *pre-dispatch schedule*, such as failure of an element of a *transmission system* or failure of a *registered facility* to follow *dispatch instructions*, have occurred,
- In the event of a shortfall in *energy* or *operating reserve*, the output of a *resource* associated with a capacity export is insufficient to support the full export,
- The operation of all or part of the *IESO-administered markets* has been suspended. (Refer to Market Manual 4.5 for more details on this situation.),

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System Advisory for under generation, soliciting *offers* for generation and rejecting, revoking, or recalling *outages*.

[18] For *HDR* resources, the pre-dispatch run occurring three hours in advance of the *dispatch hour* will be used for scheduling demand response during the availability window of the *dispatch day*. A resource will be scheduled for one and up to four consecutive hours when the *pre-dispatch schedule* is less than the resource's total *bid* quantity.

[19] As defined in section 6.1.

- A violation of the net *interchange schedule* limit has occurred,
- Quebec has issued a reliability declaration pursuant to the Amended & Restated IESO-Hydro Quebec Capacity Sharing Agreement, but the *dispatch algorithm* has failed to produce a *pre-dispatch schedule* in accordance with the obligations under the agreement (see Section 6.4), or
- An external jurisdiction has issued a capacity call, but the *dispatch algorithm* has failed to produce a *pre-dispatch schedule* in accordance with the capacity export obligations (see Section 6.7).

In addition, e-Tags and/or *interchange schedules* for *boundary entities* may be required to be changed following *IESO* confirmation of e-Tags and *interchange schedule* with adjacent *control areas* for (e.g., as a result of a failure to successfully navigate the adjacent market). The sequence of this confirmation is as follows:

- The *IESO* validates e-Tags and confirms the *interchange schedules* with the appropriate c*ontrol areas*, prior to five minutes to the start of the *dispatch hour*.

  Note: The *IESO* removes interchange *bids* or *offers* from the schedule where e-Tags are missing, late, invalid, and incorrect and/or c*ontrol area* confirmation fails, unless such interchange *bids* or *offers* are required for *reliability* reasons. Refer to Market Manual 4.2: Submission of Dispatch Data in the Real-Time Energy and Operating Reserve Markets**,** Section 2.5.

- The *IESO* confirms the *interchange schedule(s)* MW quantities with the appropriate c*ontrol areas and* quantities are modified prior to the start of the ramp, as necessary, to ensure viable *interchange schedule(s)*. In the event of an *interchange scheduling* disagreement between *control areas*, the lesser quantity shall prevail. Failure to agree to the lesser quantity will result in the *interchange scheduling being reduced to 0 MW*, and
- The *IESO* notifies *market participants* of revised *interchange schedule(s)* MW quantities where quantities have been revised in discussion with other c*ontrol areas*.

6.4 Intertie Scheduling Protocols

6.4.1 IESO/NYISO Protocol: NY90

In an effort to ensure fair and efficient use of the *IESO*/NYISO *interties*, the *IESO* and the NYISO have agreed to follow a specific *interchange scheduling* protocol for the exchange of *interchange scheduling* information (*MR* Ch. 7 Sec. 1.4.1). On July 29, 2002, the *IESO* and the New York Independent System Operator (NYISO) adopted a scheduling protocol to effectively coordinate *interchange scheduling* between the two jurisdictions. This *interchange scheduling* protocol establishes a timeline that defines when certain *interchange scheduling* checkout activities occur, both within and between the two organizations. Figure 6-1 illustrates this timeline.

The *IESO* will be marking New York *interchange schedules* with either the "**NY90**", “**MrNh**”, “**TLRe**” or "**OTH**" code within the *IESO* systems to reflect schedule check-out activities within the NYISO (see *IESO*-NYISO scheduling protocol below). This approach will result in more accurate and reliable pre-dispatch schedules.

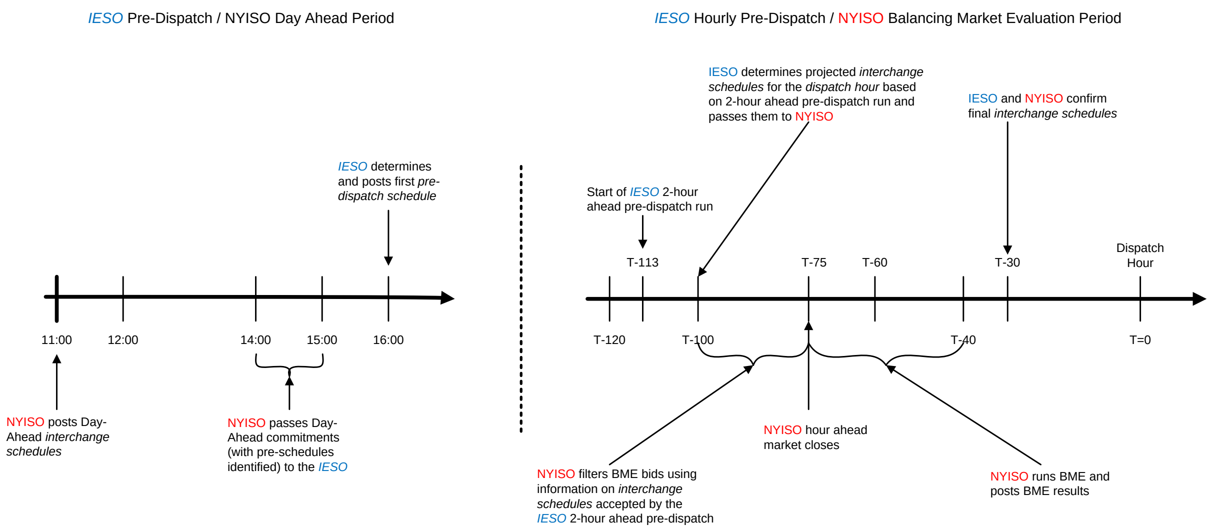

Figure 6-1: IESO - NYISO Scheduling Protocol

Pre-Dispatch Period (*IESO*) and Day-Ahead (NYISO)

11:00 hours (EST) to 12:00 hours	The NYISO posts the Day-Ahead Market schedule
14:00 hours to 15:00 hours	NYISO calls and performs a cursory check on eligible marketers (importers/exporters).
16:00 EST	The *IESO* posts initial *pre-dispatch schedule* for the next 32 hours.

Hourly Pre-Dispatch Period (*IESO*) / RTC (NYISO)

T-100 minutes	The *IESO* determines projected *interchange schedules* for the *dispatch hour* based on the 2-hour ahead pre-dispatch run, applies the **NY90/Max** code to projected *interchange schedules* and communicates the information to the NYISO.
T-100 minutes to T-75 minutes	The NYISO filters the hour ahead Real Time Commitment (RTC) *interchange schedule bids* that affect the *IESO*/NYISO *interties* to include only those *interchange schedules* with *offers*/*bids* accepted by the *IESO's* 2-hour ahead pre-dispatch run.
T-75 minutes to T-40 minutes	The NYISO runs the RTC, automatically adjusting e-Tags accordingly based on the RTC results then notifies the *IESO* of those *interchange schedules* that have failed (in whole or part)[20] to navigate the NYISO market and posts the NYISO Hour-Ahead schedule

[20] The NYISO identifies to the *IESO* those *interchange schedules* not scheduled and partially scheduled by RTC. Those *interchange schedules* scheduled in part by RTC will be scheduled accordingly. Those *interchange schedules* not scheduled will be removed by the *IESO* prior to the *dispatch hour.* In either case the *interchange schedules* will be failed and no CMSC payments will apply.

Hourly Pre-Dispatch Period (*IESO*) / RTC (NYISO)

T-30 minutes	The *IESO* confirms final *interchange schedules* with the NYISO, making final adjustments to *interchange schedules* accordingly and notifies the *market participant* of the changes by automated e-mail. The NYISO posts RTC results
T-100 minutes to T-75 minutes	Where required for *reliability* reasons, the *IESO* may, in economic merit, include *interchange schedules* from the NYISO 2-hour ahead RTC evaluation that failed the *IESO* 2-hour ahead pre-dispatch run, in the short list for evaluation in the final RTC evaluation, or If necessary, in economic merit, constrain on resources irrespective of the *IESO*-NYISO scheduling protocol.

Revisions and/or additions to *dispatch data* within the two hours prior to the *dispatch hour* are restricted. The *IESO* may accept revisions and/or additions for internal *reliability* reasons. Additionally, at the request of the NYISO, the *IESO* may allow revisions and/or additions during this timeframe if the changes facilitate a solution to NYISO *reliability* concerns.[21] *IESO* / NYISO *interchange schedule* implementation is consistent with the *NERC* transaction ramping default of 10-minutes with the ramp straddling the top of the *dispatch hour*.

6.4.2 Curtailed and Failed Interchange Schedules

An *interchange schedule* that has been curtailed during the *dispatch hour* for *reliability* reasons may be reinstated within that *dispatch hour* if the *reliability* condition causing the curtailment is resolved, and the curtailed *interchange schedule(s)* is scheduled in the next *dispatch hour*.

At T-100 minutes, the projected *interchange schedules* for the *dispatch hour* based on the *IESO's* 2-hour ahead pre-dispatch run are considered as at their maximum available for the *dispatch hour* and are "capped" at that value in the constrained schedule using the code **NY90/Max**[22]. This "short list" is forwarded to NYISO for RTC evaluation. CMSC will apply as per the normal scheduling process, provided the "capped" *interchange schedule(s)* clears the NYISO RTC @ T-75 minutes.

Where required for *reliability* reasons, the *IESO* may, include in the short list for evaluation in the final NYISO RTC evaluation, *interchange schedules* from the NYISO 2-hour ahead RTC evaluation that are the next most economically *interchange schedule(s)*, which failed the *IESO* 2-hour ahead pre-dispatch run. The **NY90/Max** code is **not** used for such *interchange schedules* in the pre-dispatch period when the addition to the short list includes a complete *offer* (either the full quantity of the new *interchange schedule* or an existing *interchange schedule* MW is increased to the full quantity offered). However, CMSC or IOG will be applied as appropriate if the *interchange schedule* is dispatched. The **NY90/Max** code is used if the addition to the short list results in a selection of a partial *interchange schedule offer.*

[21] This would not include calls for capacity exports

[22] The schedule is re-evaluated in the 1-hour ahead pre-dispatch run, with the market schedule able to increase or decrease, but the constrained schedule only able to decrease.

At-T-30 minutes, *interchange schedules* that failed the NYISO RTC (all or in part) will be failed by the *IESO* using the code **OTH/Fix,** unless failed as a result of external transmission limitation, in which case the **TLRe** code will be applied. No CMSC payments will apply.

6.4.3 IESO/MISO Protocol: MISO Protocol

In an effort to facilitate the release of MISO transmission and ramp the IESO has a unique scheduling protocol for all MISO transactions. At T-90, all e-Tags for transactions on the Michigan, Manitoba or Minnesota interfaces will be reduced to their 2 hour out pre-dispatch schedule. Subsequently, all transactions whose schedule increases from 2 hours out to 1 hour out will be re-loaded to reflect their 1 hour out pre-dispatch schedule.

6.4.4 IESO/Hydro-Quebec: Capacity Agreements

The IESO and Hydro-Quebec have capacity agreements. Energy scheduled to satisfy the terms of the agreements will be on the PQ.OUTAOUAIS *boundary entity*. Delivery of firm energy under the agreements is measured as the net schedule on PQ.OUTAOUAIS regardless of the *market participant* responsible for the scheduled transaction (i.e., a Hydro Quebec energy transaction does not have to be scheduled for the sending entity to be meeting its energy obligation, if other transactions deliver an equivalent amount of energy).

Submission of *dispatch data* for transactions associated with the agreements shall adhere to the existing timelines and requirements specified in *Market Manual* 4.2, Section 2.5. The determination of *real-time schedules*, *market schedules*, *market prices*, and *dispatch instructions* for these transactions shall be in accordance with this *market manual*, and as described below.

Winter Period (December 1 to March 31)

To call on Ontario capacity, Hydro Quebec TransÉnergie (HQT) shall issue a reliability declaration to the IESO, and Hydro Quebec Energy Marketing (HQEM) shall submit an associated energy export bid (HQEM export). An advisory notice shall be issued notifying market participants. This HQEM export will be scheduled by the *dispatch algorithm* using normal market mechanisms.

To satisfy the terms of the capacity agreements, the *IESO* may take control actions in the pre-dispatch timeframe to increase the net schedule on PQ.OUTAOUAIS to the MW *bid* quantity of the HQEM export if:

- The HQEM export *bid* price is the *maximum market clearing price (MMCP)*
- The net schedule on PQ.OUTAOUAIS is less than the MW *bid* quantity of the HQEM export, and
- There is sufficient transmission capacity on the interface.

To satisfy the terms of the capacity agreements, the IESO may take control actions in real-time to ensure delivery of energy exports associated with the capacity agreements that are scheduled in pre-dispatch.

These control actions will be made in accordance with Market Manual 7.1: IESO-Controlled Grid Operating Procedures, Appendix B.2: Emergency Operating State Control Actions. Constrained-on exports on PQ.OUTAOUAIS shall be applied on a reasonable effort economic basis using the TLRe code (see Table 1-1).

Summer Period (June 1 to September 30)

To call on Quebec capacity, the IESO shall issue a reliability declaration[23] to HQT and issue an advisory notice to market participants. Following this, HQEM will submit an associated import *offer* (HQEM import). As in the winter period, this HQEM import will be scheduled by the *dispatch algorithm* using normal market mechanisms.

Consistent with Market Manual 7.1, Appendix B.1, the IESO may constrain on import transactions on a reasonable effort economic basis in advance of or during an emergency operating state. This may include import transactions on PQ.OUTAOUAIS associated with the capacity agreements, with no preferential treatment given to the HQEM import. Manual constraints will be applied using either the TRLi or ADQh code for IESO adequacy (see Table 6-1).

6.5 Pre-Emptive Curtailments

If the *IESO* determines with reasonable certainty that specific transactions, or a certain volume of transactions, will not be successfully scheduled or will need to be curtailed in real-time due to an internal issue, the *IESO* may remove the affected transactions from the constrained schedule only (using the TLRi code) for future hours.

If the *IESO* determines with reasonable certainty through input from the appropriate scheduling entity that transactions will not be successfully scheduled due to external reliability (security or adequacy), or due to a consistent *market participant* failure (economics or tagging), the *IESO* may remove the anticipated affected transactions from the *IESO* scheduling processes, for future hours and code appropriately.

If an external Reliability Coordinator initiates the *NERC* TLR procedure that has resulted, or is anticipated to result, in transaction failures and it is determined, through input from the appropriate issuing entity, that the TLR will continue for some time into the future, the *IESO* may pre-emptively remove (or reduce to the expected level of delivery) transactions from the applicable pre-dispatch constrained and unconstrained sequences (using the TLRe code). On a reasonable effort basis, the *IESO* will attempt to remove/reduce the transactions as per the IDC process (first by transmission priority bucket, then on a reasonable effort economic basis within the transmission bucket). To prevent an increased schedule to the remaining transactions, the IESO may constrain these transactions to their pre-dispatch value with a TLRe code.

Market participants can visit the *NERC* website at www.nerc.com to confirm whether Transmission Loading Relief Procedures have been implemented.

If pre-emptive curtailments are expected to last for multiple hours, an advisory notice shall be issued notifying *market participants* that this practice is occurring. Another advisory notice shall be issued when the pre-emptive curtailments have ended.

In all cases, pre-emptive curtailments will be made to the same transactions that are expected to be curtailed in real-time on a reasonable effort basis (e.g., economics, transmission priority, etc.).

[23] In accordance with Market Manual 7.1: IESO-Controlled Grid Operating Procedures, Appendix B.1 Actions in Advance of and During the IESO Controlled Grid Emergency Operating State.

6.6 Transaction Coding

6.6.1 Principles of Coding

When altering the *pre-dispatch schedule* issued with respect to each *registered facility* that is a *boundary entity*, the *IESO* will abide by the following coding principles:

Principle 1

The *IESO* will only intervene to alter *pre-dispatch schedules* for a given dispatch hour if:

- In the IESO's opinion, as a result of changing conditions, the *real-time schedules* will not have sufficient resources available to maintain the reliable operation of the *IESO-controlled grid*, or
- Consistent with interconnection agreements and industry standards, the *IESO* is requested to do so by another control area or reliability coordinator, or
- The *market participant* has not met all requirements.

Principle 2

To the extent possible, *IESO* manual changes shall be consistent with the changes that would have occurred if the hour ahead pre-dispatch sequences had recognized the reliability concern.

Principle 3

To the extent practicable, the *IESO* shall limit manual intervention to an amount equal to the difference between the change in conditions and the real-time capability of available internal resources to address that change.

Principle 4

To the extent practicable, the *IESO* shall use the economic merit order of intertie transactions as the basis for determining which transactions to manually adjust.

Principle 5

IESO manual intervention shall impact the same *real-time/pre-dispatch schedule* (constrained or unconstrained) that would have had insufficient resources as a result of the changing conditions, as noted in principle 1.

Principle 6

The *market participant* whose transaction is affected by the *IESO* manual intervention shall be eligible for the same market compensation and be subject to the same risks as if the transaction was scheduled in the hour ahead *pre-dispatch schedule*.

Table 6-1: Application of Interchange Schedule Codes

Transaction Failures		Summary of Codes & Resulting Treatment					
Failure Reasons	**Further Description**	**Code Entered**	**CMSC[24] Treatment**	**DA IFC Exempt (Import)**	**RT IFC Exempt (Import)**	**RT EFC Exempt (Export)**	**DA-IOG Component #2 Treatment**
e-Tagging errors	e-Tagging errors	OTH	No	No	No	No	No
External Jurisdiction Economic Selection Failure (whole or partial)	External Jurisdiction Economic Selection Failure (whole or partial)	OTH	No	No	No	No	No
PJM Ramping Capacity (where ramp reservations required)	Market participant failure to acquire ramping capability.	OTH	No	No	No	No	No
ISO Market Participant Scheduling Errors	Scheduling errors[25]	OTH	No	No	No	No	No
Linked wheels (within participant control)	Curtailment of linked wheels within participant control	OTH	No	No	No	No	No
e-Tag held by IDC	e-Tag held by IDC following the first hour of the TLR process	OTH	No	No	No	No	No
Transaction on a commercially unavailable intertie	Market participant submits a bid or offer based on a commercially unavailable intertie[26]	OTH	No	No	No	No	No
External ISO Curtailments	External ISO Curtailments for TLR (including pre-emptive curtailments)	TLRe	No	Yes	Yes	Yes	No
External ISO Curtailments	Other Security Curtailments	TLRe	No	Yes	Yes	Yes	No
External ISO Curtailments	External ISO Adequacy Cuts	TLRe	No	Yes	Yes	Yes	No
NYISO Ramping Capacity	For NYISO Net Interchange Scheduling Limit (NISL) binding	TLRe	No	Yes	Yes	Yes	No
Linked wheels (outside participant control)	Curtailment of linked wheels outside participant control	TLRe	No	Yes	Yes	Yes	No

[24] CMSC eligibility may be impacted by the scenarios defined in Market Manual 5.5: Physical Markets Settlement Statements, section 1.6.27: Limiting Constrained-off CMSC to Interties.

[25] Failures that are within the market participant's control (e.g., acquiring transmission, market scheduling).

[26] The *IESO* will issue an advisory notice in real-time when an intertie has been declared commercially unavailable. For any subsequent *bids* or *offers* received against that intertie, the transaction will be curtailed to 0 MW and the *market participant* will be subject to a failure charge.

Transaction Failures		Summary of Codes & Resulting Treatment					
Failure Reasons	**Further Description**	**Code Entered**	**CMSC[24] Treatment**	**DA IFC Exempt (Import)**	**RT IFC Exempt (Import)**	**RT EFC Exempt (Export)**	**DA-IOG Component #2 Treatment**
Intertie Limit Violation (when caused by an external curtailment or failure)	IESO or external curtailment to respect an intertie limit violation when the violation is caused for a reason where the failure code is tagged as OTH, TLRe or MrNh	TLRe	No	Yes	Yes	Yes	No
Constrain-on export transaction to Quebec	Constrain-on export transaction to Quebec to meet capacity agreement obligation	TLRe	No	N/A	N/A	Yes	N/A
Capacity export reduced for a transmission limitation	Capacity export reduced for a transmission limitation	TLRe	No	N/A	N/A	Yes	N/A
Capacity export reduced due to backing resource status	Backing generator is derated to an amount less that the scheduled quantity and the IESO is in an energy or operating reserve shortfall	TLRe	No	N/A	N/A	Yes	N/A
IESO Curtailments (Manual)	IESO Curtailments for TLR	TLRi	Yes or No based on DSO schedules	Yes	Yes	Yes	Yes
IESO Curtailments (Manual)	Other Security Curtailments	TLRi	Yes or No based on DSO schedules	Yes	Yes	Yes	Yes
Intertie Limit Reduction (total or partial)	IESO selects and decreases transaction quantity after Hour-Ahead Pre-Dispatch	TLRi	Yes or No based on DSO schedules	Yes	Yes	Yes	Yes
IESO Ramping Capacity (Manual management of Ramp)	For IESO managing transactions to prevent violation of Net Interchange Scheduling Limit (NISL)	TLRi	Yes or No based on DSO schedules	Yes	Yes	Yes	Yes
IESO Curtailments	IESO Adequacy Actions Shortfall beyond next hour (for shifting Energy Limited Resources for future hour shortfall)	TLRi	Yes or No based on DSO schedules	Yes	Yes	Yes	Yes
IESO Curtailments	IESO Adequacy Actions Internal security concerns leading to an adequacy concern.	TLRi	Yes or No based on DSO schedules	Yes	Yes	Yes	Yes

Transaction Failures		**Summary of Codes & Resulting Treatment**					
Failure Reasons	**Further Description**	**Code Entered**	**CMSC[24] Treatment**	**DA IFC Exempt (Import)**	**RT IFC Exempt (Import)**	**RT EFC Exempt (Export)**	**DA-IOG Component #2 Treatment**
IESO Security Curtailment Operating Reserve Activation	Activation of OR provided by import (increase import schedule) Activation of OR provided by export (reduce export schedule)	ORA	Yes or No based on DSO schedules	Yes or No based on RT Offer Price Test*	N/A	Yes	Yes
MISO - Minnesota - Inability to acquire transmission service	Real-Time transaction failures from MISO[29]	MrNh	No	No	Yes	Yes	No
MISO - Michigan - Inability to acquire transmission service	Real-Time transaction failures from MISO[29]	MrNh	No	No	Yes	Yes	No
MISO - Manitoba - Inability to acquire transmission service	Real-Time transaction failures from MISO[29]	MrNh	No	No	Yes	Yes	No
MISO Ramping Capacity	Market participant inability to acquire ramping capability in real time[27]	MrNh	No	No	Yes	Yes	No
NYISO Curtailments	Cuts by NYISO under HAM protocol due to TLR (NYISO Real-Time transactions, Not NYISO Day-Ahead transactions but could be IESO Day-Ahead Imports)[28]	MrNh	No	No	Yes	Yes	No
IESO Curtailments	IESO Adequacy (Surplus or Deficiency) Actions not caused by internal security. (Dispatching on or off of Imports or Exports after the final hour-ahead pre-dispatch)	ADQh	No	Yes or No based on RT Offer Price Test*	Yes	Yes	Yes
NYISO - IESO Scheduling Protocol	90 Minute Checkout	NY90	Yes or No based on DSO schedules	Yes or No based on RT Offer Price Test*	N/A	N/A	Yes
IESO Curtailments (Auto - Automatic	Other Security Curtailments Constrained Off event	AUTO or NY90	Yes or No based on DSO schedules	Yes or No based on RT Offer Price Test*	N/A	N/A	Yes

[27] This is communicated via the e-Tag and not a phone call to the IESO Control Room.

Transaction Failures		Summary of Codes & Resulting Treatment					
Failure Reasons	**Further Description**	**Code Entered**	**CMSC[24] Treatment**	**DA IFC Exempt (Import)**	**RT IFC Exempt (Import)**	**RT EFC Exempt (Export)**	**DA-IOG Component #2 Treatment**
treatment by the DSO algorithm)	(Constrained off with full or partial market schedule quantities)						
IESO Economic Selection (Auto - Automatic treatment by the DSO algorithm)	Constrained Off event (Constrained off with full or partial market schedule quantities)	AUTO or NY90	Yes or No based on DSO schedules	Yes or No based on RT Offer Price Test*	N/A	N/A	Yes
Intertie Limit Reduction	Between Pre-Dispatch of Record and Hour-Ahead Pre-Dispatch Import Schedules may be reduced by an Intertie Limit Reduction which may impact Day-Ahead Import Schedules	AUTO or NY90	Yes or No based on DSO schedules	Yes or No based on RT Offer Price Test*	N/A	N/A	Yes
IESO Ramping Capacity (DSO Managing Ramp)	For DSO managing transactions to prevent violation of Net Interchange Scheduling Limit (NISL)	AUTO or NY90	Yes or No based on DSO schedules	Yes or No based on RT Offer Price Test*	N/A	N/A	Yes

*** RT Offer Price Test:** If DA Import Scheduled quantity is offered in RT at -MMCP then DA-IFC Exempt.

6.6.2 Methodology for Failure Code Application

TLRi or ADQh when curtailing Exports for Adequacy[28]

When exports are curtailed for adequacy there are two states:

(i) an adequacy concern that is caused by an internal security limitation resulting in resources being bottled and not being available for dispatch. When we observe an adequacy concern due to bottled resources in real-time, our Control Room staff will apply the TLRi code to an amount of curtailed export transactions equal to the quantity of bottled MWs in the current system configuration. The TLRi code does not adjust the market schedule, and

(ii) a global adequacy issue resulting from insufficient offers in the market. When we observe a global adequacy issue in real-time, our Control Room staff will apply the ADQh code. The ADQh code causes the market schedule to be adjusted to match the dispatch schedule.

When we have applied the TLRi code, we will perform an after-the-fact analysis to verify that the correct code was applied. Specifically, we will examine the market schedule for those intervals where we curtailed exports in the dispatch schedule. If the market schedule did not result in a shortage for energy or operating reserve, this indicates that there was no global adequacy issue and

[28] The TLRi code may result in CMSC payments while the ADQh will not

that TLRi was the correct code to apply. If the market schedule did result in a shortage for energy or operating reserve, we will change the code from TLRi to ADQh. The effects of any events that occur following the time that the exports are curtailed, which result in a shortage in the market schedule, will not be considered in the analysis of the original TLRi application.

When we have applied the ADQh code, we will perform an after-the-fact analysis to verify that the correct code was applied. To do this, we will rerun the unconstrained sequence with the amount of curtailed export MWs now included and assess the resulting market schedules. In order to rerun the sequence, we must retrieve a saved copy of the *pre-dispatch* run or a save case. In such an instance,

- If the curtailment was made prior to the *dispatch* hour, the *pre-dispatch* run prior to the curtailment will be retrieved to be used as the save case. This save case will be adjusted with the most up-to-date data known at the time of the curtailment. For example: all import and export transactions will be fixed as per the *pre-dispatch* results while any generation losses, import curtailments, etc. will be reflected by adjusting the save case, or
- If the curtailment was made in the dispatch hour, the real time run of the interval in which the curtailment took place will be retrieved to be used as the save case. This save case will be adjusted with the most up-to-date data known at the time of the curtailment.

If the resultant market schedule does not indicate a shortage for energy or operating reserve, the code will be changed to TLRi, as appropriate. If the resultant market schedule indicates a shortage of energy or operating reserve, the *IESO* will apply TLRi to the export transactions equal to the amount of export MWs that could be supported by the market schedule without shortages, and will apply ADQh to the remainder.

Any changes in coding that affect the market schedule will be reviewed under the administered pricing guidelines.

External curtailment that causes an Intertie Limit Violation

In the case where an external entity curtails a transaction or a transaction fails due to participant behaviour, the IESO removes the transaction from the schedule and codes the transaction with TLRe, MrNh or OTH. If the curtailment of this transaction causes the intertie limit to be violated, the IESO will take immediate action to relieve the violation. Because this violation is on the intertie, the violation cannot be solved by internal generation. On all interties, with the exception of Quebec, we are unable to constrain on another transaction and therefore must curtail a transaction.

This further transaction will be coded using TLRe based on the coding principles established at market opening.

If the *pre-dispatch sequence* had known about the external problem before the hour-ahead pre-dispatch run, the bid or offer for the externally curtailed transaction would have been removed and the second transaction would not have been scheduled in either schedule due to the scheduling limits.

Market participants can visit the *NERC* website at www.nerc.com to confirm whether Transmission Loading Relief Procedures have been implemented.

6.7 Capacity Export Scheduling and Curtailment

This section contains information on how capacity exports[29] are maintained or *curtailed,* assuming that the export is a *called capacity export* as required by the external *control area.*

6.7.1 Capacity Export Delivery

In accordance with the applicable *capacity export agreements*, when Ontario has adequate supply, a capacity export is deliverable to the external *control area* as long as the *called capacity export bid* is economic.[30]

In the event of an adequacy shortfall in *energy* or *operating reserve*, the Capacity Resource must be included in the *pre-dispatch schedule* and be online injecting energy in real-time to at least the amount of the *called capacity export*.[31] If this is not the case, refer to Section 6.7.2: Curtailment Provisions.

In the event the *called capacity export* is scheduled pro-rata due to other economic exports on the intertie (*MMCP*), and the *IESO* is subsequently required to curtail exports for global *adequacy*, the *IESO* will ensure the delivery of the called amount to the external *control area,* provided that the Capacity Resource(s) is injecting sufficient *energy* to cover the called amount. In this circumstance, the intertie schedule would be based on pro-rata economic curtailment of all transactions (including capacity exports) up to the called amount.

6.7.2 Curtailment Provisions

In accordance with applicable *capacity export agreements*, the IESO can curtail a *called capacity export*:

- To correct or prevent a violation of voltage, stability, or thermal transmission limits/criteria,
- To prevent a threat to the safety of any person, damage to equipment, the environment, or the violation of any *applicable law*,
- If the Capacity Resource is reduced in the *pre-dispatch schedule* or real-time schedule for reasons which may include:
    - Constraints for voltage, stability, or thermal transmission limitations
    - Constraints for ensuring safety of any person
    - Constraints preventing the damage of equipment or the environment
    - Constraints for preventing the violation of any *applicable law*

[29] Capitalized terms in this section are defined in Market Manual 13: Capacity Export Requests, Appendix A: Glossary of Capacity Export Terms.

Further information on capacity exports is available in Market Manual 4.2, Section 2.6.

[30] Capacity exports are subject to normal economic scheduling. Therefore a capacity export can be scheduled to a value less than its *bid* quantity in the event that an intertie is congested and there are other economic offers (e.g., pro-rata scheduling).

[31] There can be multiple Capacity Resources responding to a capacity call.

- If the external *control area* or *IESO* markets have been suspended, or there is a market tool failure which precludes intertie scheduling and/or inter-ISO coordination, or
- If the Capacity Resource is contracted to the *IESO* to provide Black Start service and is required for Ontario grid restoration.

In the event of a shortfall in *energy* or *operating reserve*, a Capacity Resource must be included in the *pre-dispatch schedule,* and be online injecting energy in real-time to at least the amount of the Capacity Resource's called amount. If this is not the case (e.g., the resource submits an *outage* or derate), the *IESO* will curtail the transaction to the amount of the *pre-dispatch schedule* or the lower of the real-time schedule or real-time injection amount.

A *called capacity export* will not be curtailed by the *IESO* out of economic merit:

- As a result of, or to avoid, a global capacity shortfall resulting in voltage reductions and/or load shedding, or
- To compensate for generator losses other than that of the Capacity Resource.

– End of Section –

7. Issuing Dispatch Instructions

7.1 Registered Facilities (other than HDR resources and boundary entities)

The *IESO* issues *dispatch instructions* for each *registered facility,* except for *boundary entities, HDR* resources or *variable generators,* prior to each *dispatch interval*. The IESO issues *dispatch instructions* to each *variable generator* only for the *dispatch intervals* that have mandatory obligation indicators.[32] The *dispatch instruction* for that *dispatch interval* indicates the following:

- The target *energy* level to be achieved (in MW) by the *facility* at the end of the *dispatch interval* at a rate, in the case of a *dispatchable load*, equal to the rate provided by the *market participan*t as *dispatch data*, and, in the case of a *generation facility,* equal to the most limiting of:
    - The last *dispatch instruction* and offered ramp rate, or
    - Actual MW output and the *generation facility's* effective maximum ramp rate.[33]
- The amount of each class of *operating reserve* that is to be in a condition to respond to a *dispatch* instruction calling for additional *energy* production (as described below).

Dispatch instructions may also identify the amount of reactive support and *regulation* range to be provided under *ancillary service* contracts during the *dispatch interval*[34].

The *IESO* issues *release notifications* to each *variable generator* for the first *dispatch interval* when the mandatory obligation indicator for its *variable generation* no longer exists.

The *dispatch instructions* for any *registered facility* will be consistent with the current operating status of that *registered facility*, any operational constraints described in the most recent *dispatch data* submitted by the *registered market participant* for that *registered facility*, and with the *market entry* data maintained by the *IESO*.

The *IESO* will only issue *dispatch instructions* for a *registered facility*, other than a *boundary entity*, for a given *dispatch interval* when there is a change in the quantity to be scheduled from that

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[32]An obligation indicator is a piece of text information that accompanies *dispatch instructions* and *release notifications* sent to *variable generation* through the *IESO* automated dispatch systems. The value of the obligation indicator is either "mandatory," denoting a *dispatch instruction* that must be followed, or "release," denoting a *release notification*.

[33] The effective maximum ramp rate will be determined based on the lower of the r*egistered* maximum ramp rate, provided by the *market participants* and contained in the participant registration data, or the maximum *offer* ramp rate x the ramp rate multiplier. Initially the value of the ramp rate multiplier will be established at a value of 1.2 for all resources.

[34] Where the *IESO* activates *ancillary service* contracts for reactive support and *regulation* range, such contracts will be typically activated for a number of consecutive *dispatch* intervals as part of a single *dispatch* instruction.

registered facility for the *dispatch interval* relative to the last *dispatch* instruction issued to the *registered facility* (and confirmed by the *registered market participant*) provided,

  - The new *dispatch instructions* for provision of *energy* change from the previous *dispatch instruction* issued is greater than the lesser of 2% of the maximum *offer/bid* capability and 10 MW except:

- To ensure *energy* resources are correctly dispatched to its high operating limit, or its low operating limit, when the *dispatch instructions* change falls within the filter thresholds,
- For provision of *energy* reduction change when the previous *dispatch instructions* is higher than its current maximum *offer*, when the *dispatch instructions* change falls within the filter thresholds, and
- For interval 1 and 7 of each *dispatch hour* when filtering is turned off to ensure small recurring increments or decrements of *energy* that have been legitimately offered by *market participants* are issued *dispatch instructions* on the hour and the half hour, when the change falls within the filter thresholds.

Note: The filter prevents *dispatch instructions* for small changes in scheduled quantities to be issued, except as noted above. The *IESO* may issue *dispatch instructions* within the *dispatch interval*, instructing any *registered facility* with a valid *energy bid* or *offer*, to increase or decrease *energy* production or consumption, consistent with its submitted *bids* or *offers*. Except for a *dispatch instruction* issued to a *market participant* with a *dispatchable load bid* at MMCP, *market participants* must acknowledge the submitted *dispatch instructions* or *release notifications* for each *dispatch interval* within 60 seconds of receipt of the instruction by confirming its intention to comply (or not comply) with the instruction.

If a *response* to the *dispatch* instruction or *release notification* is not received within 60 seconds, the *registered market participant* has an additional 30 seconds to call and have the *IESO* manually accept or reject the *dispatch* instruction or *release notification* on its behalf. Confirming that a *registered facility* will not comply with a *dispatch* instruction, or the failure to acknowledge the *dispatch instruction* or *release notification* will trigger the compliance process described in Section 7.5.

A *dispatchable load* in its "**normal**" *energy* withdrawal pattern with a varying load, which includes a brief period when it may not be following the *dispatch instruction*, as permitted by its exemption, is still required to acknowledge the submitted *dispatch instructions* for each *dispatch interval*. A *dispatchable load* is not however, required to reject the *dispatch instruction*[35] if **not** in its "**normal**" *energy* withdrawal pattern, but is required to:

- Notify[36] the *IESO* of its inability to follow the *dispatch instruction*,
- Notify[36] the *IESO* to request approval to change the *dispatch data* and/or to resume *energy* withdrawals, and
- If the dispatch instruction relates to operating reserve, notify[36] the IESO:

[35] In some circumstances automated *dispatch instruction* may not be available due to the actions of the **Resource Dispatch Filter** tool.

[36] Notification is by telephone, unless otherwise approved by the *IESO*.

- When the deviation from dispatch is expected to be greater than 10 minutes and the *dispatch instruction* is for 10 minute *operating reserve*, or
- When the deviation from dispatch is expected to be greater than 30 minutes and the *dispatch instruction* is for 30 minute *operating reserve*.

Where a *contingency event* is occurring or has occurred, the *IESO* may temporarily cease issuing *dispatch instructions* in accordance with this procedure[37]. If the *IESO* fails to issue *dispatch instructions* to any *registered market participant* with respect to a *registered facility*, that *registered market participant* should use as its default *dispatch instructions* the most recent *dispatch instruction*s issued by the *IESO* in respect of that *registered facility*.

The *IESO* records and time-stamps all *dispatch instructions* and store these records for at least seven years.

Table 7-1: Procedural Steps for Dispatch Instructions for Registered Facilities (other than HDR resources and boundary entities)

Step	Completed by…	Action
1	*IESO*	The *IESO* executes a number of internal processes using different software tools and manual processes to schedule resources to supply *energy* and *operating reserve* to meet requirements.
2	*IESO*	The *IESO* issues *dispatch instructions* to the *registered market participant* for each of its *registered facilities*, where there is a change in the quantity to be scheduled from the *registered facility* relative to the last *dispatch* instruction issued to the *registered facility*. The *IESO* will also issue *dispatch instructions* for each *market participant* that is also a *variable generator* when there is a change in the obligation indicator to a mandatory *dispatch instruction* or a *release notification* relative to the last *dispatch instruction* issued to the *variable generator.* The *IESO* will seek to ensure that the *dispatch instructions* issued with respect to each *registered facility* for each *dispatch interval* closely approximate the most recent *real-time schedule* for that *registered facility* and *dispatch interval*. The *IESO* may, however, issue *dispatch instructions* that depart from the *real-time schedule* where: • The *security* and *adequacy* of the system would be endangered by implementing the most recent *real-time schedule*, • The *dispatch* algorithm has failed, or has produced a *real-time schedule* that is clearly and materially in error, • The *dispatch algorithm* has produced a *real-time schedule* that does not accurately reflect the *minimum run-time* or lockout[38] status of a *facility* due to *dispatch algorithm* limitations,

[37] Typically, this will be as a result of a *market suspension* (refer to *Market Manual* 4.5*)*. However, short-term contingencies, such as a temporary systems failure may result in the temporary cessation of automated *dispatch* instructions without suspending the market. In such case, the *IESO* will manually *dispatch* the *market participant* resources.

[38] As defined in section 6.1.

Step	Completed by…	Action
		• Material changes subsequent to determination of the most recent *real-time schedule*, such as failure of an element of a *transmission system* or failure of a *registered facility* to follow *dispatch instructions*, have occurred, or • The operation of all or part of the *IESO-administered markets* has been suspended (refer to Market Manual 4.5 for more information). The *IESO* records and time-stamps all *dispatch instructions* that are submitted to *market participants*.
3	***Market Participant***	The *market participant* **receives the *dispatch instruction*** from the *IESO* along with a dispatch advisor report and acknowledges the *dispatch* instruction by **confirming to the *IESO* that the *registered facility* will accept or reject** the *dispatch* instruction.
4	*IESO*	The *IESO* confirms whether the *market participant* has accepted or rejected the *dispatch instruction*. If a *response* to the *dispatch instruction* is not received within 60 seconds, the *registered market participant* has an additional 30 seconds to call and have the *IESO* manually accept or reject the *dispatch instruction* on its behalf[39]. The *IESO* may also contact the *market participant* by phone and, in accordance with the instructions of the *market participant*, manually accept or reject the *dispatch instruction* on behalf and on the instruction of the *market participant*. Alternatively, if the *registered market participant* does not accept or reject the *dispatch instruction*, nor does it request the *IESO* to manually accept or reject the *dispatch instruction* on its behalf, the instruction will be deemed to have been rejected by the *registered market participant*. For *dispatch instructions* that are rejected or for which no *response* has been received: • The *registered market participant* is required to maintain its *facility* loading at the level of the last accepted *dispatch instruction*, and • These instances are deemed non-compliant and will trigger the compliance process.

[39] Two items of note regarding *IESO* manual acceptance/rejection of *dispatch instructions* on behalf and on the instruction of *market participants*:

- Ninety seconds after the *dispatch instruction* has been issued, the *dispatch* messaging tools locks out the *IESO* from completing manual actions. Therefore, *Market Participants* must call the *IESO* before the 90-second timer times-out and provide sufficient time for the *IESO* to complete this activity. The *IESO* will manually accept or reject *dispatch instructions* on behalf and on the instruction of *Market Participants* on a reasonable effort basis. The *IESO* may be unable to complete manual acceptance/ rejection for reasons such as delays in contacting the *IESO*, the length of time it takes the *IESO* to locate a specific *dispatch instruction* in the *dispatch* messaging tools, or because of *IESO* workload. Consequently, the *IESO* does not guarantee that it can manually accept or reject any or all *dispatch instructions* on behalf and on the instruction of *Market Participants*.
- If the *IESO* is not able to manually accept a *dispatch instruction* on behalf and on the instruction of a *market participant*, the *market participant* is required to maintain its *facility* loading at the level of the last accepted *dispatch instructions*.

Step	Completed by…	Action
5	***Market Participant***	A *market participant* that expects its *registered facility* to operate in a manner that, for any reason, differs materially from the *IESO*'s *dispatch instructions* shall so **notify the *IESO*** as soon as possible.
6	*IESO*	If a *market participant* for a *registered facility*: • Confirms that it is rejecting a *dispatch instruction*, or • Does not acknowledge the *dispatch instruction*, or • Notifies the *IESO* that the *facility* will be (or is) operating in a manner that differs materially from the *dispatch* instructions, The *IESO* will assess the resource shortfall. The *IESO* may address the resource shortfall by determining that: • New *dispatch instructions* are required (this could include activation of *operating reserve*), or • An *emergency operating state* must be declared.
7	*IESO*	When insufficient resources are available via normal market mechanisms to address a resource shortfall, the *IESO* will declare an *Emergency Operating State*[40].
8	***Market Participant***	*Market participants* **access the *IESO* public website** to view the most recent advisory notice. The advisory notice contains a System *Emergency* Advisory indicating that an *Emergency Operating State* is expected.
9	*IESO*	During commissioning of a *generation unit*, the *IESO* may be required to carry additional reserve because of the increased likelihood of unit failure. The *IESO* may contact any *facility* conducting commissioning tests and requests that these tests halt. In some instances, stopping a commissioning test may lead to a shutdown of a generating unit. In these cases, judgment is used where the *energy* provided by the commissioning unit is more valuable than the advantage received by reducing the reserve requirement. Note that commissioning units are self-schedulers and price-takers. Discontinuing commissioning tests here does not mean that the *IESO* must allow short-notice *offers* within the mandatory *bid* submission window.
10	***Market Participant***	*Market participant* **receives and complies with the *IESO* request to discontinue its commissioning test**. The *market participant* also **informs the *IESO* that the commissioning test has been halted**.
11	*IESO*	Implement actions to continue to satisfy 10-minute *operating reserve* requirements. Refer to [*Market Manual* 7.1: IESO-Controlled Grid Operating Policies](), Appendix B: Emergency Operating State Control Actions.

[40] Refer to *Market Manual* 7.1: *IESO*-Controlled Grid Operating Policies, Appendix B for the complete integrated list of *emergency operating state* control actions.

Step	Completed by…	Action
12	*IESO*	The *IESO* issues *NERC Energy Emergency* Alert 2 (EEA-2) indicating that the *IESO control area* has or is about to initiate load management procedures.
13	*IESO*	Implement actions to continue to satisfy 10-minute **synchronized** *operating reserve* requirements. Refer to *Market Manual 7.1*, Appendix B.
14	*IESO*	When insufficient resources are available via normal market mechanisms to address a resource shortfall, the *IESO* will declare an *Emergency Operating State*[41]. To declare an *emergency operating state*, the *IESO* issues System *Emergency* Advisories via an advisory notice. Usually, two advisories are issued: one indicating the potential for an *emergency operating state* (see step 7) and another indicating that an *emergency operating state* has been declared.
15	***Market Participant***	*Market participants* **access the *IESO* public website** to view the most recent advisory notice. The advisory notice contains a System *Emergency* Advisory indicating that an *Emergency Operating State* has been declared.
16	*IESO*	The *IESO* implements *emergency operating state* control actions to continue to satisfy 10-minute synchronized *operating reserve* requirements, as described in *Market Manual* 7.1, Appendix B.
17	*IESO*	Implement actions to meet *regulation* reserve requirements. Refer to *Market Manual* 7.1, Appendix B.
18	***Market Participant*** *(Transmitters* and/or *Distributors)*	*Transmitters* and/or *distributors* receive and accept instructions to reduce voltage at the distribution level either by 3%, or subsequently, by 5%.
19	*IESO*	Implement actions to avoid implementation of *non-dispatchable load curtailment*. Refer to *Market Manual* 7.1, Appendix B.
20	***Market Participant*** *(Generators)*	*Generators* apply for environmental variances in order to supply more *energy* to the at-risk *IESO-controlled grid*.
21	*IESO*	The *IESO* issues *NERC Energy Emergency* Alert 3 (EEA-3) indicating that load interruption is imminent or in process.
22	*IESO*	The *IESO* curtails *non-dispatchable load* through *emergency* or rotational load shedding.

[41] Refer to *Market Manual* 7.1, Appendix B for the complete integrated list of *emergency operating state* control actions.

Step	Completed by…	Action
		Market participants are alerted that load shedding is imminent followed by specific instructions for *emergency* load shedding or controlled rotational load shedding.
23	***Market Participant*** *(Transmitters* and/or *Distributors)*	*Transmitters* and/or *distributors* receive instructions from the *IESO* via telephone to *curtail non-dispatchable load*.

7.2 Hourly Demand Response Resources

The *IESO* issues a standby notice via the standby report to the *capacity market participant* (CMP) to indicate that an *HDR* resource is on standby to provide demand response (refer to Market Manual 9.3: Operation of the Day-Ahead Commitment Process).

The *IESO* may subsequently issue a *dispatch instruction* to the *CMP,* in the form of an activation notice, by publishing an activation report to the *CMP's* private report site. An activation notice is issued when the relevant pre-dispatch schedule is less than the resource's total *bid* quantity for at least one hour during the *dispatch day* availability window based on the three hours ahead pre-dispatch run (PD-3). The resource may be activated for one up to four consecutive hours during the *dispatch day* and the number of activations per resource will be limited to a maximum of once per day. The activation notice is issued approximately 2 hours and 30 minutes in advance (but no later than 2 hours in advance) of the start of the first *dispatch hour* to which it relates. The activation notice specifies the target reductions in energy to be withdrawn (in MW) by the *HDR* resource for each *dispatch hour*. The *CMP* is expected to achieve its target by the end of the first five-minute interval of each hour and maintain it for the entire hour.

If an activation notice is not received for the first hour of the availability window, the *CMP* must continue to monitor for the receipt of an activation notice resulting from subsequent runs of *pre-dispatch* until the end of the availability window. However, if the *CMP* has submitted bids for an *HDR* resource outside the availability window and has received an activation notice, the *CMP* is expected to comply with that activation notice.

If a standby report indicates that the *HDR* resource is not required to be on standby, then the *CMP* is not required to provide demand response with that *HDR* resource for that *dispatch day.* The *CMP* must remove the *HDR* resource's *dispatch data* before 09:00 EST. Failure to do so may result in the *HDR* resource receiving an activation notice with the requirement to reduce *energy* withdrawal.

The *dispatch instructions* for any *registered facility* that is an *HDR* resource will be consistent with the current *dispatch data* for that *registered facility.*

7.2.1 Dispatch Instructions for CMPs with HDR Resources

The *IESO* will notify *CMPs* with *HDR* resources that may be required for demand response by issuing a standby notice in the standby report, published to the private *market participant* report site. If required to provide *demand response*, the *IESO* will issue *dispatch instructions* to *HDR* resources in the form of an activation notice approximately 2 hours and 30 minutes in advance but not later than

2 hours[42] ahead of the start of the first *dispatch hour* to which it relates. Activation notices will be published to the confidential *market participant* report site. The *CMP* is not required to formally acknowledge the *dispatch instruction*. It is expected that the *dispatch instructions* will be followed unless the *IESO* has been notified that the *HDR* resource is unable to comply.

Table 7-2: Procedural Steps for Dispatch Instructions for HDR Resources

Step	Completed by…	Action
1	***CMP***	A *CMP* that wants to meet their *capacity obligation* for an *HDR* resource must **submit *demand response energy bids***. Submission of *dispatch data* will follow the requirements identified in *MR* Ch. 7 Sec. 3 and Market Manual 4.2.
2	*IESO*	The *IESO* pre-dispatch sequences schedule *energy* and *operating reserve* (including imports) to satisfy the *non-dispatchable load* + losses prediction provided by the Load Forecast tool and to satisfy economic *bids* from *dispatchable loads* (including load *bids* from *intertie zones*).
3	*IESO*	The *IESO* publishes a standby report to the private *market participant* report site. If the *HDR* resource is on standby to provide *demand response capacity* for the *dispatch day,* the standby report will include a standby notice. A standby notice is issued when one of the following requirements are satisfied: 1. The HDR resource's day-ahead *schedule of record* or *pre-dispatch schedule* is less than its total bid quantity for at least one hour during the *dispatch day* availability window. 2. The applicable pre-dispatch shadow price for an HDR resource for at least one hour of the availability window $200 or greater. Effective April 30, 2020, the pre-dispatch shadow price threshold will change to $100. 3. The absence of a standby notice in the standby report indicates the HDR resource is not on standby to provide *demand response capacity*.
4	***CMP***	If the standby report indicates that the *HDR* resource is not on standby (absence of standby notice), the ***CMP* must remove *dispatch data* before 09:00 EST**. Failure to do so may result in the *HDR* resource receiving an activation notice.
5	*IESO*	The *IESO* issues *dispatch instructions* to the *CMP* for *HDR* resources: • When the *HDR* resource's *pre-dispatch* schedule is less than the resource's total *bid* quantity for at least one hour during the dispatch day availability window based on the three hours ahead pre-dispatch run (PD-3). The resource may be activated for one to four consecutive hours during the dispatch day and activation per resource will be limited to a maximum of once per day. By issuing an activation notice to individual *market participant* private report site.

[42] IESO will target to issue DR activation notification 2 hours and 30 minutes before the dispatch hour.

Step	Completed by…	Action
6	***CMP***	Upon receipt of the activation notice, **the *CMP* implements the actions required to comply** with the d*ispatch instructions,* by reducing energy withdrawal for each *HDR* resource to meet the d*ispatch instructions* issued by the *IESO.*
7	***CMP***	A *CMP* that expects the associated *HDR* resource to operate in a manner that, for any reason, differs from the *IESO*'s *dispatch instructions* shall **notify the *IESO*** as soon as possible.
8	***CMP***	A *CMP* that expects the associated *HDR* resource to operate in a manner that, for any reason, differs from the *IESO*'s *dispatch instructions* shall **change their *dispatch data*** as soon as possible.

7.3 Boundary Entities

The *dispatch instructions* for any *registered facility* that is a *boundary entity* will be consistent with the current *dispatch data* for that *registered facility* and with any *interconnection* limitations associated with the *registered facility*.

Interchange schedules may be modified within the hour as a result of instructions from an external *control area*, or due to contingencies or other *reliability* concerns in the *IESO control area*. In the instances where the schedule modification originates from sources external to Ontario (e.g., implementation of Transmission Loading Relief, by an external *control area*), the *IESO* will ensure that the schedule modification does not trigger a Congestion Management Settlement Credit (CMSC) payment.

A *registered facility* that is a *boundary entity* shall comply fully with all *dispatch instructions* for *energy* or *operating reserves* upon confirmation of the relevant *interchange schedule* with the appropriate scheduling entity.

The *IESO* expresses *interchange schedule* MW quantities to the nearest one decimal point. However, the e-Tag software, used to obtain e-Tags for import and export transactions, requires persons to express *energy* quantities in whole MW. As a result, *boundary entities* may have to round up or down their *interchange schedule* MW quantities in order to obtain an e-Tag. To ensure that the *energy* quantities expressed by *boundary entities* for the purpose of obtaining their e-Tags correspond to the *real-time schedule*, the *IESO* requires all *boundary entities* to round-up or down the *interchange schedule* MW quantities according to the following rounding rules.

Interchange schedule value	Rounding Rule	Example
X.1 to X.4	Round down	41.3 MW must be rounded down to 41 MW
X.6 to X.9	Round up	20.7 MW must be rounded up to 21 MW
X.5	Call the *IESO* to find out the actual MW quantity to be used to obtain or revise the e-Tag.	For 35.5 MW, call the *IESO* for instructions

The *IESO* records and time-stamps all *dispatch instructions* and stores these records for at least seven years.

7.3.1 Dispatch Instructions for Boundary Entities

Prior to each *dispatch hour*, the *IESO* issues *dispatch instructions* to each *boundary entity*, in the form of *interchange schedules (published to the Market Participant Interface)*, indicating for that *dispatch hour*:

- The *energy* level to be injected, or withdrawn, (in MW) by the *boundary entity* resource from, or to, the specified *intertie zone*,
- The amount of each class of *operating reserve* that is scheduled, and
- The amount of reactive support and regulation that is to be provided under reliability must-run contracts.

The *registered market participant* for each *facility* must submit an e-Tag with a quantity that matches the *IESO dispatch instruction* – the *IESO* will use the e-Tag submission as confirmation of the interchange *dispatch instruction*. The *IESO* will verify that the e-Tag has been submitted correctly and will confirm *interchange schedules* with adjacent c*ontrol areas*. At any time in the process, the *IESO* may alter *interchange schedules* due to incorrect or missing e-Tags, scheduling differences with adjacent c*ontrol areas*, and *reliability* or other concerns. Following these changes, the *IESO* will inform the *market participant* of the changes and alter the m*arket schedule* to equal the interchange *dispatch instructions* where appropriate. The *market participant* will update their e-Tags and/or *dispatch data* where appropriate.

Table 7-3: Procedural Steps for Boundary Entity Dispatch Instructions

Step	Completed by…	Action
1	***Market Participant***	**Create an e-Tag** for the *interchange schedule* and obtain an e-Tag ID. **Note:** The *market participant* is required to submit the e-Tag by 32 minutes prior to the *dispatch hour* (35 minutes in advance of the *dispatch hour* to support re-allocation for *NERC* Transmission Loading Relief procedures). See step 13.
2	***Market Participant***	**Submit *dispatch data* from *intertie zones*.** *Dispatch data* shall be accompanied by an e-Tag ID. Submission of *dispatch data* will follow the requirements identified in *MR* Ch. 7 Sec. 3 and Market Manual 4.2.
3	***Market Participant***	**Receive schedule for *interchange schedules* for another c*ontrol area* market.** To successfully complete an *interchange schedule*, the *market participant* must also successfully navigate markets in external c*ontrol areas*. If a *market participant* is scheduled in another market for a quantity that is less than the quantity offered or *bid* in the *IESO-administered markets*, the *market participant* must revise the e-Tag. If it is more than 60 minutes in advance of the *dispatch hour*, the *market participant* must revise the *dispatch data* to include the updated e-Tag ID and to lower the *offer*/*bid* quantity to equal the other *control area* schedule. If it is less than 60 minutes in advance of the *dispatch hour* but the *market participant* has submitted *dispatch data* for subsequent hours that use the same e-Tag, the *market participant* must:

Step	Completed by…	Action
		• Revise *dispatch data* for these hours to include the updated e-Tag ID, and • Notify the *IESO* of the potential mismatch between the *dispatch data* quantity available and the amount scheduled by another c*ontrol area*.
4	***Market Participant***	**The e-Tag must be revised if** the *market participant* is scheduled by the *IESO* or by an adjacent c*ontrol area* for a quantity that is different than the e-Tag quantity listed for that *interchange schedule.* Where a *market participant* receives *interchange schedule*s from two or more c*ontrol areas*/markets that differ in quantity for the same *interchange schedule*s, the *market participant* will revise the e-Tag quantity to a value that equals the smallest amount scheduled by the c*ontrol areas*/markets.
5	***Market Participant***	If a *market participant* has revised the e-Tag and acquired a new e-Tag ID, then: • If it is more than 60 minutes in advance of the *dispatch hour*, the *market participant* must **revise the *dispatch data*** to include the updated e-Tag ID and to lower the *offer*/*bid* quantity to equal the other CA schedule, and submit the revised *dispatch data* to the *IESO*, or • If it is less than 60 minutes in advance of the *dispatch hour*, but the e-Tag ID has also been submitted to the *IESO* for interchange *offers*/*bids* for future hours, the *market participant* **must revise the *dispatch data*** to include the updated e-Tag ID for these hours, and submit the revised *dispatch data* to the *IESO*.
6	*IESO*	*Dispatch data* for interchange is validated as all *dispatch data* is validated. *Dispatch data* validation details are covered in a number of documents, including Market Manual 4.2. In addition, for interchange *offers*/*bids* only, the *dispatch data* is checked to ensure that only the valid market scheduling points (MSP) are allowed to be submitted for a chosen constrained scheduling point (CSP).
7	*IESO*	The *IESO pre-dispatch* sequences schedule *energy* and *operating reserve* (including imports) to satisfy the *non-dispatchable load* + losses prediction provided by the Load Forecast tool and to satisfy economic *dispatchable load bids* (including load *bids* from *intertie zones*). The schedules of injections/withdrawals for the next hour are provided as inputs to the real-time sequences.
8	*IESO*	The *IESO* issues *dispatch instructions*, in the form of *interchange schedule*s, to each *registered facility* that is a *boundary entity* for which a *dispatch instruction* is required.
9	***Market Participant***	*Market participants* are expected to **watch for *interchange schedules*** issued by the *IESO* as part of the *pre-dispatch schedule* production process. *Market participants* **identify linked wheeling *interchange schedules*** whose import and/or export component was not scheduled for the next hour and cancel the associated e-Tag.

Step	Completed by…	Action
		Cancellation of the e-Tag is only allowed for linked wheeling *interchange schedules* (that consist of an import that has *offered* between -$50 and –*MMCP* and a corresponding export that has *bid* +*MMCP*). If one leg of the wheel *offered*/*bid* in this manner is scheduled for a reduced quantity, the *market participant* will revise and submit an e-Tag for the wheel with the lowered quantity.
10	*IESO*	The *IESO* will review next hour's *interchange schedule* to determine if changes to interchange *dispatch instructions* are required. For example, *interchange schedules* will be altered if system *reliability* would be endangered by implementing the schedule (*MR* Ch. 7 Sec. 7.2 identifies situations where the *IESO* will issue *dispatch instructions* that deviate from the *published* schedule). When the review of *interchange schedules* for next hour reveals that changes are required, the *IESO* will adjust the schedules in the **Interchange Scheduler** tool. The *IESO* will identify and cancel linked wheeling *interchange schedules* whose import and/or export component was not scheduled or was partially scheduled for the next hour and for which associated e-Tags were submitted. In case one component (import or export) of a linked wheeling *interchange schedules* was partially scheduled, the *IESO* will alter pro rata the schedule for the other component. **Note:** Linked wheeling *interchange schedules* are described in Market Manual 4.2, Section 2.5.4 and consist of an *offer* between -$50 and –*MMCP* for the import and a *bid* at +*MMCP* for the export.
11	*IESO*	The *IESO* contacts *market participants* to inform them only if their *interchange schedules* have been altered relative to the quantities published to the Market Participant Interface at the conclusion of the *pre-dispatch* run to maintain system *reliability*.
12	***Market Participant***	**Receive notice of *interchange schedule* alterations**. The *market participant* is informed that *interchange schedule(*s) have been altered relative to the quantities published to the Market Participant Interface at the conclusion of the pre-dispatch run.
13	***Market Participant***	*Market participant* **submits the e-Tag** that is consistent with the *dispatch data* submitted to the *IESO* (if submitted in advance) or that is consistent with the *interchange schedule* provided by the *IESO* and other c*ontrol areas*/markets for that *interchange schedule*. See step 1.
14	*IESO*	*IESO* tools automatically indicates that the e-Tag has been submitted. The *IESO* will examine the e-Tag to ensure that is has been submitted correctly (e.g. CSP and MSP of the e-Tag and schedule match, quantity and format is correct etc.) and approve the e-Tag. If not, the *IESO* may contact the *market participant* by telephone to correct and re-submit the e-Tag. If the *market participant* has not submitted the e-Tag promptly, the *IESO* may contact the *market participant* and direct them to submit the e-Tag.

Step	Completed by…	Action
15	*IESO*	Upon reviewing the *interchange schedule* for the next hour, the *IESO* will cancel *interchange schedule*s() if: • The e-Tag has not been submitted, • The e-Tag has not been submitted correctly (in those cases where the *IESO* has not elected to contact the *market participant* to correct the e-Tag), • They are part of linked wheeling *interchange schedule*s that did not get scheduled (these linked *interchange schedule*s consist of an *offer* between -$50 and –*MMCP* for the import and a *bid* at +*MMCP* for the export), • A schedule for *operating reserve* will impact upon a TLR'd flowgate (but can't be reduced via re-allocation because the associated *energy interchange schedule* is 0 MW), or • Required to maintain system *reliability*. Cancelled *interchange schedule*s will be removed by the *IESO* from the Interchange Scheduler (IS) tool.
16	*IESO*	When another *control area* has initiated re-allocation of *interchange schedule*s to protect an overloaded flowgate, the *IESO* may receive a list of *interchange schedule*s that must be reduced or curtailed. If the *IESO* receives such a list of *interchange schedule*s, the *IESO* will reduce the *interchange schedule*s quantities accordingly. If the re-allocation reduce or curtail one component (import or export) of a linked wheeling *interchange schedule*s, the *IESO* will reduce proportionally or curtail the *interchange schedule*s for the other component.
17	*IESO*	*IESO* confirms the quantity and e-Tag ID for each *interchange schedule*s with adjacent c*ontrol areas*. For *operating reserve* schedules, the *IESO* confirms quantities on a per-*interchange schedule* basis. If the quantities recorded by the *IESO* and the other c*ontrol area* are different, the interchange quantity for the *interchange schedule*s will be changed to the lower of the two quantities. The *IESO* and/or adjacent c*ontrol areas* may alter *interchange schedule*s if required to maintain system *reliability*.
18	*IESO*	Following confirmation of the *interchange schedule*s with adjacent c*ontrol areas*, the *IESO* will reduce the IS schedule quantities when they must be decreased to match the amounts scheduled by the adjacent c*ontrol area*. If one component (import or export) of a linked wheeling *interchange schedule*s was altered, the *IESO* will alter pro rata the *interchange schedule*s for the other component.
19	*N/A*	Ramps of *energy* between *control areas* are initiated over 10 minutes. *Energy* ramps typically begin at five minutes to the *dispatch hour*.

Step	Completed by…	Action
20	*IESO*	The *IESO* contacts *market participants* to inform them of *interchange schedule*s that have been reduced, curtailed or cancelled relative to the quantities published to the Market Participant Interface at the conclusion of the pre-dispatch run.
21	***Market Participant***	**Receive notice of *interchange schedule* alterations.** The *market participant* is informed that *interchange schedule(*s) have been reduced, curtailed or cancelled relative to the quantities published at the conclusion of the pre-dispatch run.
22	*IESO*	The *IESO* will alter the *market schedule* for reduced/cancelled *interchange schedule*s. When reducing/canceling one component (import or export) of a linked wheeling *interchange schedule*s, the *IESO* will also reduce/cancel the other component. The *market schedule* will be altered so that the *market schedule* quantities equal the *interchange schedule* is quantities provided to the real-time constrained *dispatch* sequences.

7.4 Dispatch of Operating Reserve (OR)

Each *registered facility* to which the *IESO* has sent *dispatch instructions* relating to *operating reserve* must maintain generation (or load reduction) capacity during that *dispatch interval*, consistent with the *dispatch instructions* issued to it. It should be able to increase *energy* production, decrease *energy* withdrawal or be able to schedule, in accordance with the class[43] of *operating reserve* being offered, upon being instructed to do so by the *IESO* as a result of a *contingency event*.

Where a *contingency event* has occurred or is occurring, the *IESO* may issue revised *dispatch instructions* within the *dispatch interval*. The revised *dispatch instructions* will instruct a *registered facility*, other than a *boundary entity*, providing *operating reserve* to begin increasing *energy* production (in the case of a *generator*) or reducing *energy* withdrawal (in the case of a *dispatchable load*) at a rate equal to the *operating reserve* ramp rates provided in the *dispatch data* submission.

A *dispatchable load* must reduce its' consumption, or remain at a reduced consumption level, to provide at least the amount of *operating reserve* requested.

Dispatch instructions issued in respect of an *operating reserve* activation must be accepted to indicate the registered facility will comply with the instruction and that the *market participant* will only alter its dispatch when it receives a new *dispatch instruction*.

Dispatch instructions issued in respect of a *registered facility* that is a *boundary entity* providing *operating reserve* will be such that they ensure that the *energy* associated with each *offer* of *operating reserve* is scheduled by the *IESO* in a manner that:

- Is consistent with all relevant *reliability standards* for activation of *operating reserve*, and

[43] These are 10 minute synchronized, 10 minute non-synchronized, or 30-minute *operating reserve*.

- Is as agreed upon by the entity scheduling the resulting *energy* transfer.

When issuing *dispatch instructions* to *registered facilities* providing *operating reserve*, the *IESO* will call first on the *registered facility* in each area that has offered the lowest price (in $/MWh) for *energy* produced from scheduled *operating reserve*. If such *registered facility* is instructed to produce *energy* but does not do so as rapidly as instructed, or if the *IESO* needs additional *energy* from *operating reserve* in that area, the *IESO* will call upon the *registered facility* offering the next-lowest price for *energy* from *operating reserve*.

If the *IESO* determines that calling upon *registered facilities* in strict order of increasing price of *energy* means that it will be unable to respond in a timely fashion to a *contingency event*, the *IESO* may call upon *registered facilities* out of such strict order. However, the *IESO* will, as far as is practical, call *registered facilities* in a manner that minimizes the price of *energy* called on.

When *operating reserves* are activated as a result of a *NPCC reportable event*, the otherwise applicable 10-minute *operating reserve* requirements will be reduced by a corresponding amount. The *IESO* will subsequently recover to pre-contingency levels of *operating reserve* requirements within 105 minutes of the contingency. (Refer to Market Manual 7.6: Glossary of Standard Operating Terms for the definition of *NPCC reportable event*).

For all events that cause the *IESO* to become deficient, the otherwise applicable 10-minute *operating reserve* requirements will be reduced by a corresponding amount. The *IESO* will subsequently recover to pre-contingency levels of *operating reserve* requirements within 90 minutes of the contingency.

7.5 Manual Procurement of Operating Reserve during forced or planned tools outages

Outages of *IESO-administered markets* software, hardware or communication systems may result in temporary disruptions to market activities, such as electronic scheduling and dispatching. During such disruptions, the *IESO* is required to maintain normal market operations to the greatest extent practicable and, if needed, may employ alternative procedures as described in this section (*MR* Ch. 7, Sec. 1.6.3).

Depending on the duration of the *outage* updated *real-time energy* and *operating reserve* schedules may not be available. Furthermore, if *dispatch instructions* for *energy* are issued during the *outage*, the most recent *operating reserve* schedules may not reflect the actual amount of *operating reserve* available, which may be inadequate to meet the *standard authority* requirements (*MR* Ch. 7, Sec. 1.6.1). Under these conditions, the *IESO* will manually procure additional *operating reserve* by calling upon *ancillary service providers* that have made *offers* to deliver *operating reserve* but, as a result of the *outage*, were not *dispatched* for *operating reserve*.

On a reasonable effort basis, the *IESO* will attempt to procure *operating reserve* in amounts that are proportional with each *market participant*'s share in the total available *operating reserve* capacity.

If, as a result of an *outage* of *IESO-administered markets* software, hardware or communication systems, the *IESO* has called upon a *market participant* to provide *operating reserve*, the *IESO* will:

- Notify market participants if the *dispatch instruction* issued in respect of an *operating reserve* by the Dispatch Scheduling & Optimization tool is invalid,

- Indicate the amount of *operating reserve* from each class that is to be provided by that *market participant*,
- Identify whether the request represents an activation of *operating reserve*,
- Indicate, if possible, the duration of the request. If this is not possible, the request will be valid until the *IESO* states otherwise, and
- Indicate any restrictions as to what areas the *operating reserve* needs to be provided from, leaving the *market participant* to choose what resources will be used to meet the request.

When called upon, the *market participant* will (*MR* Ch. 7, Sec. 1.6.4):

- Ensure that, at all times, the amount of *operating reserve* requested by the *IESO* is available for *dispatch*,
- Assess the status of their resources and inform the *IESO* if *operating reserve* cannot be provided as requested, and
- Immediately report to the *IESO* when their resources *dispatched* for *operating reserve* are reaching the total capacity available for *operating reserve*, within a margin specified by the *IESO*.

Administrative pricing may apply for the manual procurement of *operating reserve* during such market tool failures.

7.6 Compliance with Dispatch Instructions

Every market participant must ensure that each of its registered facilities complies with dispatch instructions issued by the IESO and is subject to all provisions of the *market rules* (*MR* Ch. 7, Sec. 7.5.1). For *variable generation,* compliance with *dispatch instructions* will only apply when the *dispatch instruction* has a mandatory obligation indicator and the *facility* has sufficient fuel (e.g., wind, irradiance) to achieve the *dispatch* target.

Furthermore a *market participant* must notify the *IESO* when it:

- Has been scheduled for 10 minute *operating reserve* and is unable to activate the *operating reserve* within 10 minutes, or
- Has been scheduled for 30 minute *operating reserve* and is unable to activate the *operating reserve* within 30 minutes.

Where a *market participant* expects that, as a result of a *forced outage*, de-rating or any other reason, its *registered facility* will operate in a manner that differs materially from the *IESO's dispatch instructions*, the *market participant* must notify the *IESO* as soon as possible. A difference is material as defined in **Interpretation Bulletin** – "Compliance with Dispatch Instructions Issued to Dispatchable Facilities" (*MR* Ch. 7, Sec. 7.5.2) except for the following:

- In the case of a *registered cogeneration facility* that is either dispatchable or *self-scheduling*, a difference is material if it exceeds:
    - The compliance band as defined in "Compliance with Dispatch Instructions Issued to Dispatchable Facilities" **Interpretation Bulletin**, or

  - The compliance band based on the impact of the production of other forms of useful energy within the facility on *energy* production as determined by the *IESO* during *market entry* (*MR* Ch. 7, Sec. 2.2.6.10), and
- In the case of an *enhanced combined cycle facility* that is either dispatchable or *self-scheduling*, a difference is material if it exceeds:
  - The compliance band as defined in "Compliance with Dispatch Instructions Issued to Dispatchable Facilities" **Interpretation Bulletin**, or
  - The compliance band based on the impact that the recovery of waste heat from an industrial process/processes within the *facility* has on *energy* production as determined by the *IESO* during *market entry* (*MR* Ch. 7, Sec. 2.2.6.10).
- In the case of an *HDR* resource, a difference is material if it exceeds 5 MW of the *demand response capacity* the *DRMP* expects to be able to deliver.

When a *registered facility* operates in a manner that differs materially from *IESO dispatch instructions market participant* actions may include the following:

- Notifying the *IESO* (by telephone) of *forced outages* or de-ratings of its equipment and/or making an *outage* submission using the *outage* submission tools (refer to Market Manual 7.1: IESO-Controlled Grid Operating Procedures and Market Manual 7.3: Outage Management, Section 2.2 for more information),
- Submitting revised *dispatch data* to reflect the current capability of the *registered facility* (refer to Market Manual 4.2, Section 2.4 for more information), and
- Rejecting subsequent *dispatch instructions* that the *registered facility* cannot meet. If the *market participant* knows that its *registered facility* will be unable to comply with a *dispatch instruction* at the time that it receives the instruction, it is preferable that the *market participant* reject the instruction within the 60-second timeframe, rather than accepting the *dispatch instructions* and then failing to respond to the instruction.

Dispatch instructions for *energy* or withdrawal reductions that are flagged by the *IESO* as activation of *operating reserve* are accompanied by an "ORA" flag. A departure from these *dispatch instructions* shall be material if:

- In the case of a *dispatchable generation facility*, the facility fails to be at or above the target, and
- In the case of a *dispatchable load facility*, the facility fails to be at or below the target within the timeframe specified by the operating reserve market, for which the registered facility was scheduled.

In other words, if *a dispatchable generation facility* was *scheduled and dispa*tched for 10 minute synchronized or non-synchronized *operating reserve,* the *facility* would have to be at or above the dispatch target 10 minutes after receipt of the *energy dispatch instruction* flagged for activation of *operating reserve*. In the case of a *dispatchable load facility*, scheduled and dispatched for 10 minute synchronized or non-synchronized *operating reserve,* the *facility* would have to be at or below the dispatch target 10 minutes after receipt of the *dispatch instruction* flagged for activation of *operating reserve*.

Compliance with a *dispatch instruction* by a *registered facility* is not required if such compliance would endanger the safety of any person, damage equipment, or violate any *applicable law* (*MR* Ch.

7, Sec. 7.5.3). A *market participant* that departs from *dispatch instructions* for any such reason must notify the *IESO* as soon as possible and provide the following:

- The reason the *registered facility* is unable to follow the *dispatch instruction* issued,
- The duration the *registered facility* is expected to be unable to follow the *dispatch instruction*, and
- The minimum or maximum MW level the *registered facility* can safely operate at.

Accordingly, the *IESO* will *dispatch* the *registered facility* within the "safe" operating level provided.

If the *market participant* fails to accept or reject a *dispatch instruction* (for example, the message timer times-out before the *market participant* responds to the *dispatch instruction*), the *IESO* will respond as though the *market participant* has rejected the *dispatch instruction*. Correspondingly, the *registered facility* output is to remain at its last accepted *dispatch instruction*. In all cases, the *IESO* prefers that the *market participants* respond to *dispatch instructions* by accepting or rejecting the instructions received.

If failure by a *registered facility*, other than a *boundary entity*, to comply with a *dispatch instruction* endangers *electricity system reliability*, the *IESO* will treat the action through the compliance process and may declare the *registered facility* to be non-conforming. Refer to Market Manual 2.6: Treatment of Compliance Issues for more information on the compliance process.

If a *registered facility*, other than a *boundary entity or HDR* resource*,* produces or withdraws more or less *energy* in a *dispatch interval* than set out in a valid *dispatch instruction* issued by the *IESO*, the *IESO* will, for pricing and *settlement* purposes:

- Treat the difference in *energy* production or withdrawal as a change in *non-dispatchable load* at its location[44], and
- Use any trade-off curves between *energy* and *operating reserves* in the *dispatch data* for that *registered facility* to determine an appropriate adjustment in the quantity of *operating reserve* of each class supplied by the *registered facility*.

The *IESO* will impose financial penalties on a *market participant* associated with a *boundary entity* who fails to schedule *energy* or *operating reserve* with the appropriate scheduling entity according to the applicable *interchange schedule*, other than for bona fide and legitimate reasons as determined by the *IESO.* Bona fide and legitimate reasons include failures caused by actions and circumstances beyond the control of the *market participant* or due to *IESO* or external scheduling entity error or action.

The *IESO* will impose non-performance charges on a *CMP* associated with an *HDR* resource who fails to comply with a *dispatch instruction* in the form of an activation notice other than for bona fide and legitimate reasons as determined by the *IESO,* which include failures caused by actions and circumstances beyond the control of the *CMP*. Bona fide and legitimate reasons include failure of communication infrastructure such that the *DRMP* is unable to modify *HDR bids* or contact the *IESO*.

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[44] The estimated deviations between scheduled quantities and actual quantities will not be considered in determining the *market schedule* until the start of the 7th calendar month following the *market commencement date*

7.7 Generation Units Turnaround Time

At times, market activity may cause fossil *generation units* to be scheduled on for a period of time, then scheduled off for one or more hours and then scheduled back on again. After they have been dispatched off, due to their slower turnaround time, these units are not capable of ramping-up and providing the scheduled output for the first several hours after being dispatch on. When the *IESO* recognizes this potential pattern in the pre-dispatch, it will conduct a *reliability* impact assessment on these units, considering their turnaround time as well as the system conditions and their status at the time.

Based on this assessment, the *IESO* will determine that:

- The *IESO* cannot dispatch these units off because they are critical for maintaining the *reliability* of the *IESO-controlled grid* in the hours in which they would be unavailable and/or their operation would be restricted following their dispatch off, or
- The *IESO* can dispatch these units off because units are not critical for maintaining the *reliability* of the *IESO-controlled grid* in the hours in which they are unavailable following their dispatch off.

If the units are critical for maintaining the *reliability* of the *IESO-controlled grid*, the *IESO* will constrain these units on to their minimum output in the hours they would otherwise be scheduled off, such that they are capable of picking up to the level of their offers in the following hours when they are dispatched on.

If the units are not critical for maintaining the *reliability* of the *IESO-controlled grid*, they will be dispatched off. However, when these units are dispatched back on again, *market participants* must submit revised offers to reflect the actual capabilities of the units and the turnaround time involved. When revised dispatch data is submitted within 2 hours of the dispatch hour, the *IESO Short Notice Change Criteria*[45] apply.

– End of Section –

[45] Refer to Appendix C in Market Manual 4.2: Submission of Dispatch Data in the Real-Time and Operating Reserve Markets

8. Issuing Dispatch Advisories

8.1 Registered Facilities (other than HDR resources and boundary entities)

The *IESO* issues *dispatch* advisories for each *registered facility* that is a *dispatchable load* or *dispatchable generator*, other than a *boundary entity* or *HDR* resource, prior to each *dispatch interval*, indicating for that *dispatch interval*:

- The anticipated *energy* level to be achieved (in MW) by the *facility* at the end of each advisory interval, and
- The anticipated amount of each class of *operating reserve* for each advisory interval.
- The *dispatch* advisories for any *registered facility* will be consistent with the current operating status of that *registered facility*, any operational constraints described in the most recent *dispatch data* submitted by the *registered market participant* for that *registered facility*, and with the *market entry* data maintained by the *IESO*.
- *Market participants* do not have to acknowledge the receipt dispatch advisories. (*MR* Ch. 7 Sec. 7.1.6).

8.2 Boundary Entities and HDR Resources

The *IESO* will not issue *dispatch* advisories to *boundary entities* or *HDR* resources.

8.2.1 Compliance with Dispatch Advisories

There is no obligation for *market participant* to comply with *dispatch* advisories.

– End of Section –

9. Administrative Pricing

The *IESO* is required to, subject to certain prescribed limitations, establish *administrative prices* and corresponding *market schedules*, where applicable, in the following three situations:

(i) Where the real-time *energy market* and the *operating reserve market* have been suspended,

(ii) Where the *IESO* is unable to publish an *energy market price* or *operating reserve market price* due to a failure or *planned outage* of the software, hardware or the communications systems that supports the operation of the *dispatch algorithm*, or

(iii) Where the *IESO* determines in accordance with Board approved guidelines (Appendix A) relating to price error materiality and acceptable causal events that a *published energy market price* or *operating reserve market price* is incorrect due to incorrect inputs which affected the outcome of the *dispatch algorithm*.

This section only applies to the establishment of *administrative prices* and corresponding *market schedules*, where applicable, in regards to the circumstances described above in (ii) and (iii), it does not apply to (i), the establishment of *administrative prices* and corresponding *market schedules* as a result of *market suspension*. For circumstance (i) above refer to Market Manual 4.5: Market Suspension and Resumption.

In circumstances where *administrative prices* are required, the *IESO* shall establish *administrative prices* and corresponding *market schedules* that would, to the extent practical, reflect the *market prices* and corresponding *market schedules* that would have otherwise been produced by the *real-time markets*, but for the event causing *market prices* to be administered (*MR* Ch. 7, Sec. 8.4A.4).

In establishing *administrative prices* for a non-*market suspension* event and corresponding *market schedules*, where applicable, the *IESO* shall set the *administered price* and *market schedule* for a given *dispatch interval* equal to the price and schedule from either (*MR* Ch. 7, Sec. 8.4A.5):

a) The closest preceding dispatch interval that has not been administered, up to a maximum of 24 dispatch intervals, i.e. "copy forward" from "last good" interval,
b) The closest subsequent dispatch interval that has not been administered, up to a maximum of 24 dispatch intervals, i.e. "copy back" from "next good" interval,
c) A combination of the closest preceding and closest subsequent *dispatch intervals* that have not been administered, provided that neither the preceding nor subsequent *dispatch intervals* are selected for more than 24 dispatch intervals, or
d) When the need to *administer prices* extends beyond 48 *dispatch intervals*, the *IESO* will establish *administrative prices* for the remaining *dispatch intervals* of the event causing *market prices* to be administered within the *IESO control area* and the *intertie zones,* using an average *HOEP* for the *energy market* and the hourly average of the *operating reserve* prices for the applicable *dispatch intervals* for the *operating reserve markets.* The hourly average values will be determined from the corresponding hour or hours from each of the 4 most recent *business days* or non-*business days*, as the case may be, excluding those hours from any day in which *administrative pricing* has been established (*MR* Ch. 7, Sec. 8.4.A.6*)*.

The decision on which interval to use ("preceding" or "subsequent" in (a) or (b) above or the combination of (a) and (b) in (c) above) will be based on the *IESO's* judgment as to which price would better meet the guiding principle (i.e. the price that would otherwise have been produced by the market).

Where the *IESO* establishes an *administrative price* for a *dispatch interval* beyond 48 *dispatch intervals*, a *market schedule* is not established and no congestion management *settlement* credit payments made for that *dispatch interval* (*MR* Ch. 7, Sec. 8.4A.7).

The *IESO* will cease to apply *administrative prices* from the commencement of the first *dispatch interval* after:

- The failure to the software, hardware or communications has been rectified, or
- The *planned outage* of the software, hardware or communications has been completed, or
- The incorrect inputs that affected the outcome of the *dispatch algorithm* have been corrected.

The *IESO* will not establish *administrative prices* on the basis of incorrect prices caused by incorrect inputs which affected the outcome of the *dispatch algorithm* if more than 2 *business days* have passed since the *dispatch day* in respect of which the incorrect *energy market price* or *operating reserve market price* was *published*.

To the extent that the *administrative prices* beyond 48 intervals do not adequately compensate a *market participant* for complying with the *IESO's dispatch instructions*, the *IESO* shall provide additional compensation to the *market participant,* subject to materiality limits, as described in *MR* Ch. 7, Sec. 8.4A.9. For the purpose of that section, a request will be considered material and the *market participant* eligible for compensation if the compensation requested is at least:

- $1,000 for a given trade day and registered facility, and
- $200 for a given *trade day* and *registered facility* and the equivalent of $2/MWh.

This compensation shall be calculated as the aggregate of (*MR* Ch. 7, Sec. 8.4A.10*)*:

- The fuel costs or, where applicable, the other costs referred to in *MR* Ch. 7, Sec. 8.4A.11, and the variable operating and maintenance costs incurred by the *market participant* in complying with the *dispatch instructions* issued by the *IESO,* which fuel costs or other costs and variable operating and maintenance costs shall be subject to verification and audit by the *IESO*, and
- Subject to *MR* Ch. 7, Sec. 8.4A.11, an amount equal to 10% of the actual cost as determined above.

Less the amount of the *administrative price* already paid or payable to the *market participant*.

This section does not apply to additional settlement adjustment or compensation issues associated with *administrative prices* established according to *MR* Ch. 7, Sec. 8.4A.5 (i.e., for *market schedules* and prices established by the "copy forward/back" methods). Refer to Market Manual 5.5: Physical Markets Settlement Statements for a description of the associated process where *administrative prices* were applied for 48 intervals or less.

Where the additional compensation referred to above relates to a *generation facility* that is energy limited by design or by bona fide contractual commitments, the *IESO* may accept, in lieu of the actual costs, such assessment of the expected future value or the opportunity costs of the fuel or water consumed:

- During the period while *administrative prices* were in effect, and
- In order to comply with the *dispatch instruction* issued by the *IESO*,

as the *IESO* considers reasonable.

Where such value or costs are submitted in lieu of the actual costs referred to above, the additional 10% amount above the actual costs shall not be payable if, in the *IESO's* opinion, such value or costs include or adequately cover such amount (*MR* Ch. 7, Sec. 8.4A.11). Refer to Market Manual 5.5 for applying for such compensation.

To request additional compensation, the *market participant* must complete and submit the request application IESO_FORM_1398: Additional Compensation During Administrative Pricing.

Any disputes concerning the additional compensation referred to in above shall be resolved using the dispute resolution process set forth in *MR* Ch. 3, Sec. 2.

– End of Section –

10. Compliance Aggregation

The Compliance Aggregation program allows *market participants* to aggregate *generation facilities* (that do not qualify for network model aggregation) for purposes of compliance, in order to share individual dispatch instructions among authorized *generation facilities* when system conditions permit. Only the compliance treatment of "aggregated" resources would change. The DSO and operational tools will continue to work as per the *IESO's* market rules.

To be eligible to participate in the Compliance Aggregation program, the generation facilities must complete the applicable registration process (described in Market Manual 1.2: Market Entry, Maintenance and De-registration). In addition, market participants may wish to opt for the meter disaggregation model. The registration process for the meter disaggregation model is described in Market Manual 3 Part 3.7: Totalization Table Registration.

The compliance band for the *generation facilities* accepted for Compliance Aggregation is defined in "Compliance with Dispatch Instructions Issued to Dispatchable Facilities" Interpretation Bulletin.

Under Compliance Aggregation, the generation facilities will continue to receive separate dispatch instructions and will have to comply with individual resource dispatch instructions, when the *IESO* considers it necessary to maintain reliability of the *IESO*-controlled grid. Some examples requiring individual dispatch instructions may include:

- Load rejection and/or generation rejection arming,
- Outages,
- Configuration changes, and
- Security limit violations.

If reliability concerns exist, the *IESO* will communicate instructions to the *market participant* in the following manner:

- The *IESO* Control Room will contact the market participant and specify if the dispatch is on a Unit Specific Dispatch using terminology similar to: "Compliance Aggregation Name" must return to Unit Specific Dispatch. If available, a time frame for return to operation as a compliance aggregate will be provided.
- The *IESO* Control Room will contact the *market participant* when it is possible to return to Compliance Aggregate operation using terminology similar to: "Compliance Aggregate Name" may return to Compliance Aggregate operation at <specify time>.

While operating as a compliance aggregate, *facilities* are required to:

- Follow the normal dispatch process and submit offers for individual resources to reflect the actual, intended operation,
- Respect all obligations regarding synchronized operating reserve requirements within the compliance aggregate, and
- Maintain sufficient units in the compliance aggregate to have their synchronizing breakers closed to meet the amount of synchronized operating reserve scheduled.

The non-quick start *resources* registered for Compliance Aggregation have the following additional operational requirements in order to operate as a "compliance aggregate" in *real-time*:

- Compliance aggregation may not be used to avoid starting a unit that has been dispatched or to start a unit in place of another that has been dispatched.
- Units within a compliance aggregate are to operate within 50 MW of their individual dispatch instructions unless:
    - Offered ramp up and ramp down rates are the same, or within 1 MW/min for the same MW range, and
    - All offered ramp rates above minimum loading points do not vary by more than 1 MW/min. on each unit in the compliance aggregate.

Operation as a "compliance aggregate" is only permitted where all resources are operating above the *minimum loading point.*

Generation Facilities eligible for compliance aggregation who also provide *regulation* may be subject to additional restrictions.

– End of Section –

Appendix A: Administrative Guidelines

This appendix provides the amendments to guidelines approved by the *IESO Board* on June 10, 2004 for events other than resulting from *market suspension*. The Illustrations have been added to provide clarity.

A.1 Acceptable Causal Events

A.1.1 Attempt to identify dispatch intervals, during which there have been:

- Operational telemetering failures, which have resulted in the loss or corruption of inputs to the *market schedule*,
- *IESO Administered Markets'* software failures, which have resulted in the loss or corruption of inputs to the *market schedule*, or
- *IESO* business process failures, which have resulted in the loss or corruption of inputs to the *market schedule*.

A.1.2 For intervals in which the loss or corruption of inputs has occurred, replace the prices and market schedules for those intervals with:

a. The last good interval's prices and *market schedules* for up to 24 intervals (Figure A-1),
b. The next good interval's prices and *market schedules* for up to 24 intervals (Figure A-2), or
c. A combination of the last good interval's and the next good interval's prices and *market schedules* for up to an aggregate of 48 intervals provided that neither the last good interval's nor the next good interval's prices or *market schedules* shall be used for more than 24 intervals (Figure A-3),

unless the *IESO* is able to reasonably determine that the corrupt price for those intervals is closer to what the prices likely would have been had there been correct inputs, in which case the *IESO* shall deem the prices as correct (and shall therefore not be required to *administer prices*).

When such loss or corruption of inputs continues for more than 48 intervals, the prices will be established using *HOEP* for *energy* prices and the hourly averages for the applicable *operating reserve* prices from the corresponding hour or hours from each of the 4 most recent *business days* or *non-business*, as the case may be, excluding those hours from any day in which *administrative pricing* has been established, unless the *IESO* is able to reasonably determine that the corrupt price for these ensuing intervals is closer to what the prices likely would have been had there been correct inputs, in which case the *IESO* shall deem the prices as correct (and shall therefore not be required to *administer prices*) (Figure A-3).

In determining which of the alternatives to use from section 2, the *IESO* shall be guided by the principle that *administrative prices* and *market schedules* should be established, to the extent practical, to reflect the *market prices* and corresponding *market schedules* that would otherwise have been produced by the real-time markets but for the event causing *market prices* to be administered.

At the April 5, 2002 meeting of the *IESO* Board, *IESO* Management put forward certain screens that would be used for purposes of investigation. *IESO* Management has the discretion to change these screens and to administer prices even if one of these screens has not been triggered.

A.1.3 Copy Forward Illustration:

Assume that as a result of incorrect inputs to the dispatch scheduling & optimization (DSO) algorithm administrative prices are required for 24 intervals starting with *dispatch interval* 1 of HE 16 (see Figure A-1 below).

The *IESO* determines that the last *dispatch interval* for which *energy* and *operating reserve* prices were correctly calculated is interval 12 of HE 15, identified as interval A. The next *dispatch interval* for which *energy* and *operating reserve* prices were correctly calculated is determined to be interval 1 of HE 18.

Assessing the market conditions at the time, the *IESO* determines that the *energy* and *operating reserve* prices calculated for interval A reflect, to the extent practical, the *energy* and *operating reserve* prices that would otherwise have been produced by the market for intervals 1-24. Consequently, under the provisions of *MR* Ch. 7, Sec. 8.4A.5.1, the *IESO* will replace the *energy* and *operating reserve* prices calculated incorrectly by the DSO for intervals 1-24 with the *energy* and *operating reserve* prices calculated for interval A. In doing so, the *IESO* will replace the 4 Ontario prices (*energy*, 10S, 10NS and 30) and all 39 *intertie* prices (*energy*, 10NS, 30 for all 13 *intertie zones*) for intervals 1-24 with the corresponding *energy* and *operating reserve prices* calculated for interval A.

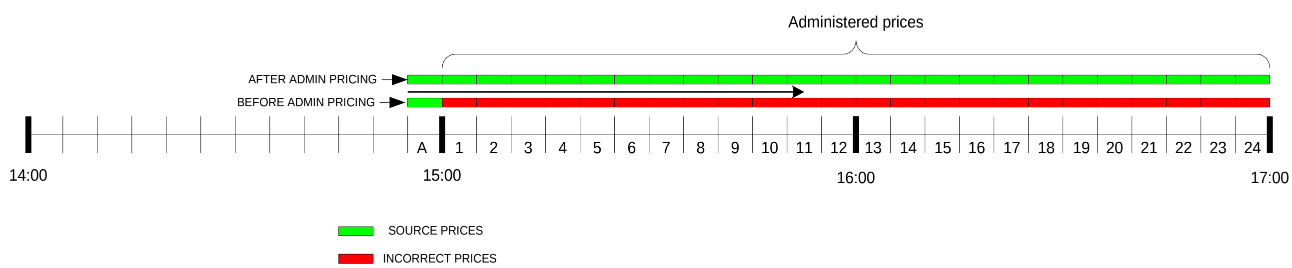


Figure A-1: Copy Forward Scenario

A.1.4 Copy Backward Illustration:

In this example, *administrative prices* are needed for 4 intervals starting with interval 1 of HE 9 (see Figure A-2 below).

The *IESO* determines that the last *dispatch interval* for which *energy* and *operating reserve* prices were correctly calculated is interval 12 of HE 8. The next *dispatch interval* for which *energy* and *operating reserve* prices were correctly calculated is determined to be interval 5 of HE 9, identified as interval B.

Assessing the market conditions at the time, the *IESO* determines that the *energy* and *operating reserve* prices calculated for interval B reflect, to the extent practical, the prices that would otherwise have been produced by the market for intervals 1-4. Consequently, under the provisions of *MR* Ch. 7, Sec. 8.4A.5.2, the *IESO* will replace the *energy* and *operating reserve prices* calculated incorrectly by the DSO for intervals 1-4 with the *energy* and *operating reserve* prices calculated for interval B. In doing so, the *IESO* will replace the 4 Ontario prices (*energy*, 10S, 10NS and 30) and all 39 *intertie* prices (*energy*, 10NS, 30 for all 13 *intertie zones*) for intervals 1-4 with the corresponding *energy* and *operating reserve* prices calculated for interval B.

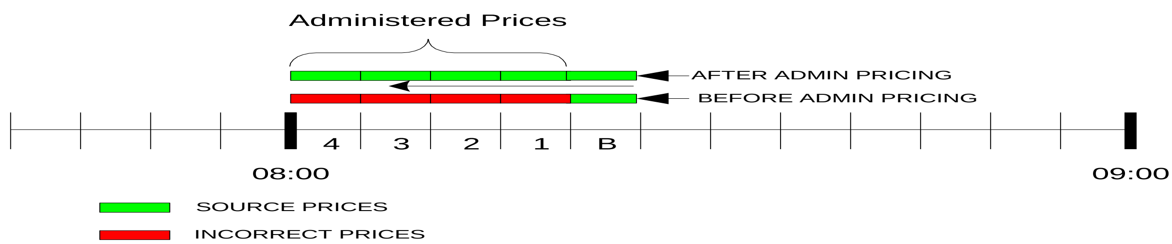


Figure A-2: Copy Backward Scenario

A.1.5 Copy Forward and Backward Illustration

Assume that *administrative prices* are needed for 55 intervals starting with interval 10 of HE 17 (see Figure A-3 below).

The *IESO* determines that the last *dispatch interval* for which *energy* and *operating reserve* prices were correctly calculated is interval 9 of HE 17, identified as interval A. The next *dispatch interval* for which *energy* and *operating reserve* prices were correctly calculated is determined to be interval 5 of HE 22, identified as interval B.

Assessing the market conditions at the time, the *IESO* determines that:

- The *energy* and *operating reserve* prices calculated for interval A reflect, to the extent practical, the price that would otherwise have been produced by the market for intervals A1-A24, and
- The *energy* and *operating reserve* prices calculated for interval B reflect, to the extent practical, the price that would otherwise have been produced by the market for intervals B1-B24.

Consequently, under the provisions of *MR* Ch. 7, Sec. 8.4A.5.3, the *IESO* will replace:

- The *energy* and *operating reserve* prices calculated incorrectly by the DSO for intervals A1-A24 with the energy and *operating reserve* prices calculated for interval A, and
- The *energy* and *operating reserve* prices calculated incorrectly by the DSO for intervals B1-B24 with the *energy* and *operating reserve* prices calculated for interval B.

Since *administrative prices* are required for more than 48 intervals, the *IESO* will, under the provisions of *MR* Ch. 7, Sec. 8.4A.6, use average *HOEP* and average *operating reserve* prices to replace the *energy* and *operating reserve* prices incorrectly calculated by the DSO for intervals 10 to 12 of HE 19 and intervals to 1 to 4 of HE 20.

The average *HOEP* is determined from the corresponding hour from each of the 4 most recent business days or non-business days, as the case may be, excluding those hours from any day in which *administrative pricing* has been established under *MR* Ch. 7, Sec. 8.4A.6. The average *operating reserve* price is determined as the hourly average from the corresponding hour from each of the 4 most recent business days or non-business days, as the case may be, excluding those hours from any day in which *administrative pricing* has been established under *MR* Ch. 7, Sec. 8.4A.6.

The *IESO* will replace the 4 Ontario prices (*energy*, 10S, 10NS and 30) and all 39 *intertie* prices (energy, 10NS, 30 for all 13 *intertie zones*).

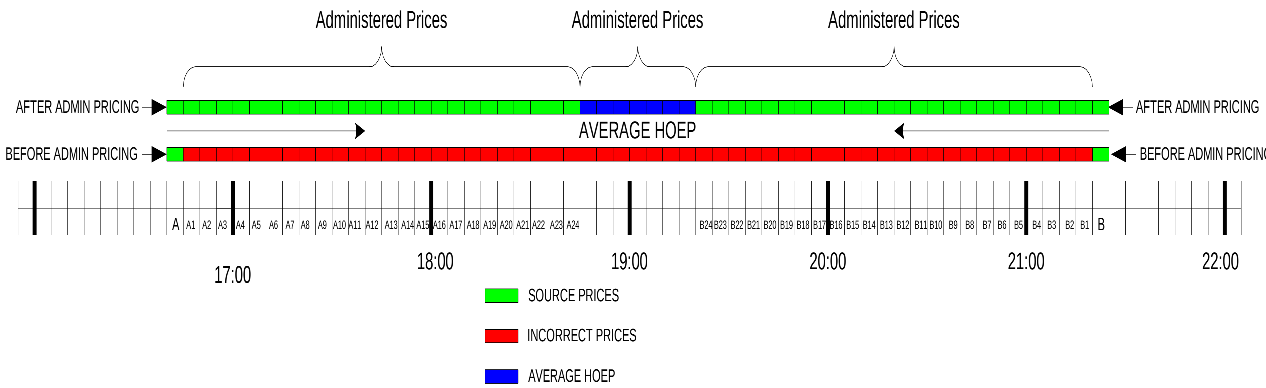


Figure A-3: Copy Forward and Backward Scenario

– End of Section –

References

Document ID	Document Title
MDP_RUL_0002	Market Rules for the Ontario Electricity Market
MDP_PRO_0014	Market Manual 1.1: Participant Authorization, Maintenance and Exit
MDP_PRO_0016	Market Manual 1.2: Facility Registration, Maintenance, and De-registration
MDP_PRO_0022	Market Manual 2.6: Treatment of Compliance Issues
IMP_PRO_0047	Market Manual 3.7: Totalization Table Registration
MDP_PRO_0030	Market Manual 4.5: Market Suspension and Resumption
MDP_PRO_0033	Market Manual 5.5: Physical Markets Settlement Statements
IMO_MAN_0024	Market Manual 6: Participant Technical Reference Manual
MDP_PRO_0040	Market Manual 7.1: IESO-Controlled Grid Operating Procedures
IMP_PRO_0033	Market Manual 7.2: Near Term Assessments and Reports
IMP_PRO_0035	Market Manual 7.3: Outage Management
PRO-357	Market Manual 13.1: Capacity Export Requests

– End of Document –

TAB D

This is Exhibit **"D"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc., Province of Ontario, while a Student-at-Law. Expires April 8, 2022.

Ivey Business School
WESTERN UNIVERSITY · CANADA
Energy Policy and
Management Centre

POLICY BRIEF
JULY 2019

Don't leave me stranded: What to do with Ontario's Global Adjustment?

By Brian Rivard

EXECUTIVE SUMMARY

- This Policy Brief offers an economic perspective to the ongoing policy discussions around the global adjustment. The global adjustment is a monthly fee paid by Ontario consumers to cover the fixed cost to build and maintain generation assets in the province, and to deliver Ontario's conservation programs. It embeds costs incurred to achieve various social policy objectives, including: maintaining supply reliability, promoting environmental and health benefits, and developing green industries and green jobs. The global adjustment is the largest component of the average consumer's electricity cost, representing between 45 to 60 percent of the total electricity bill.

- The current method used to recover the global adjustment from Ontario consumers—the Industrial Conservation Initiative—provides an extreme price incentive for some large consumers to reduce their demand during system peak demand hours. In some cases, it has induced large consumers to invest in storage or behind-the-meter generation to bypass the cost of consuming grid supplied electricity. This bypass can lead to an inefficient use of the province's generation, transmission and distribution assets and increase the risk of the eventual stranding of the province's large grid-related assets.

- This Policy Brief offers a practical approach for decomposing the global adjustment into three separate components: capacity costs, an energy price hedge, and system-wide fixed costs. It proposes that for efficiency and equity reasons, each component should be recovered as a separate charge, and a different cost recovery method should be applied to each component. Doing so, would reduce the risk of hastening investment in new distributed solutions, the stranding of current grid assets, and higher overall costs for Ontario's electricity consumers.

INTRODUCTION

Ontario is evolving its electricity pricing polices in the midst of a changing technological landscape, and the two spheres are path dependent. How the province evolves its pricing policies could materially influence the pace at which consumers adopt new distributed energy technologies as a substitute for receiving traditional grid-related services.

From a policy perspective, the Independent Electricity System Operator (IESO) is working with stakeholders to reform the design of Ontario's competitive wholesale electricity market. The goal of the reform is to "improve the way electricity is priced, scheduled and procured in order to meet Ontario's current and future energy needs reliably, transparently, efficiently and at lowest cost."[1] The Ontario Energy Board (OEB) is seeking to modernize the design of distribution and regulated retail rates in the face of an evolving sector, to promote the efficient and equitable recovery of system costs that are largely fixed and sunk, and to facilitate the rational adoption of new technologies.[2] More recently, the Ontario government held consultations with Ontario businesses to hear first-hand about industrial electricity pricing and programs, and their ideas on how the province's electricity system can make business more competitive.[3]

From a technological perspective, the integrated system as a whole could soon face serious competition from new distributed energy solutions, leading to the gradual decline in the use of the province's grid-related assets. Global technological development is enabling greater choice for consumers on how they use traditional electric grid services. Distributed generation solutions are becoming more cost-competitive with grid-sourced electricity, opening up the possibility that many consumers will turn to these solutions in the future as a way to lower their electricity costs.[4]

The pace of adoption of new distributed technologies will depend on the prices and regulated rates for traditional grid services. Ineffective pricing of grid services could delay consumer investment in these new innovative options when they are efficient and make sense from an environmental standpoint. Alternatively, ineffective pricing of grid services could inefficiently hasten investment in these solutions, causing the premature stranding of grid assets and higher costs for Ontario electricity consumers overall. For this reason, a renewed focus on efficient pricing and rate design of traditional grid services is timely.

One component of the overall electricity cost that deserves particular policy attention is the global adjustment. The global adjustment is a monthly fee paid by Ontario consumers to cover the fixed cost to build and maintain generation assets in the province, and to fund Ontario's conservation programs. The global adjustment is currently the largest component of the average consumer's total electricity bill. It represents roughly 80 percent of the province's generation supply costs and 45 to 60 percent of the cost to provide the fully bundled grid-related service.

Several commentators have raised concern over policy decisions that affected the size and nature of the costs incurred under the global adjustment, and the manner in which these costs are allocated across consumers.[5] Unfortunately, the costs in the global adjustment are essentially sunk and cannot be avoided; there is very little that can be done to redress the decisions that affected the size and nature of the costs. However, there are opportunities to redress decisions on how the costs are allocated to consumers. The current approach, the Industrial Conservation Initiative (ICI), provides an extreme price incentive for large consumers to reduce their demand during system peak demand hours. In some cases, it has induced large consumers to invest in distributed energy solutions such as storage or behind-the-meter generation to avoid paying the global adjustment. However, because the cost in the global adjustment are largely fixed, this results in a shifting of costs to other consumers, which creates an incentive for these consumers to also turn to distributed energy solutions to reduce their costs. Over time, this cycle risks the eventual stranding of the province's large grid-related assets. It would also imply higher costs for Ontario consumers on the whole.

This Policy Brief brings an economic perspective to the ongoing policy discussions around the global adjustment, beginning in the next section with background on the global adjustment and the ICI, followed by an evaluation of how the generation costs in the global adjustment are priced and allocated.

The Policy Brief then offers suggestions on how to improve generation cost pricing in the province to promote more efficient and equitable outcomes. In particular, it offers a practical approach for decomposing the global adjustment into three separate components: capacity costs, an energy price hedge, and system-wide fixed costs, and argues that from an efficiency and equity standpoint, a different cost recovery method should be used for each component. This proposed approach, which is compatible with the general direction of the current pricing policy initiatives, would reduce the risk of hastening investment in distributed solutions, the stranding of existing grid assets and higher overall costs for Ontario's electricity consumers.

BACKGROUND ON THE GLOBAL ADJUSMENT AND INDUSTRIAL CONSERVATION INITIATIVE

Global Adjustment

The global adjustment was established in 2005 as part of a policy transition from a fully competitive market structure to a hybrid market structure that:

- complemented the competitive wholesale market with long-term centralized planning and procurement;
- regulated the prices for certain generation assets;
- introduced a Regulated Pricing Plan (RPP) for low volume residential and small business consumers; and
- created a greater role for government through Ministerial Directive powers.[6]

Ontario Regulation 429/04, instituted the global adjustment as the variance account used to:

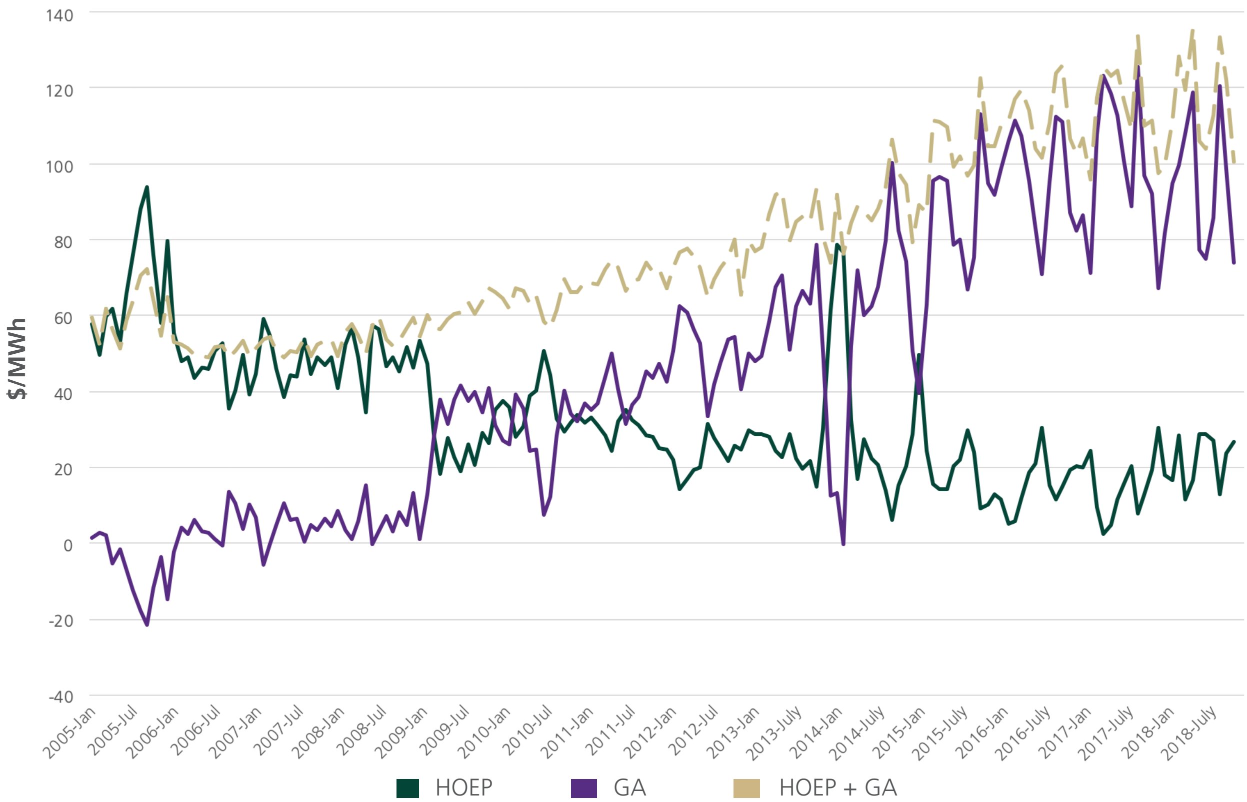
- reconcile differences between payments made to generators at the competitive wholesale market price and payments made through regulation or contract that differ from the wholesale market price; and
- fund the province's conservation and demand management programs.

The new regulation provided the global adjustment be recovered from Ontario consumers based on an individual consumer's share of the total net volume of electricity withdrawn from the grid each month (i.e., a volumetric rate).[7]

Initially, the regulated component of the global adjustment reflected electricity generated by Ontario Power Generation's (OPG) baseload hydroelectric and nuclear assets[8] (also known as "heritage assets"), and the contract component reflected electricity generated by the existing non-utility generator assets under contract to the Ontario Electricity Finance Corporation. OPG's heritage assets received an average regulated rate of 4.5 cents per kilowatt-hour, which was low relative to the prevailing competitive market price. The government expected that regulating the price of OPG's assets would "reduce price volatility and have a stabilizing effect on electricity prices, which will be of great benefit to Ontario's power consumers."[9]

In the first year, the global adjustment typically represented a monthly credit to consumers as market prices were well above the average rate paid to OPG's heritage assets. However, the government gradually directed the OPA (now the IESO)[10] to sign new contracts with generators, initially to ensure a reliable level of generation capacity, and eventually to promote broader government policy objects such as the environmental and health benefits related to the reduction of greenhouse gases, and the economic benefits related to the development of green industries and green jobs.[11] The price or revenue assurances provided under these contracts were generally higher than the competitive market price. As the contract component grew, the global adjustment grew to become a monthly charge to consumers. Figure 1 depicts the growth of the global adjustment relative to the competitive market price, the average monthly Hourly Ontario Energy Price (HOEP), from 2005 to 2018.[12]

Figure 1 | Hourly Ontario Energy Price and Global Adjustment, 2005 to 2018



Source: Author created from data available from the IESO.

Industrial Conservation Initiative

In June 2011, the government introduced amendments to Ontario Regulation 429/04 through the Industrial Conservation Initiative (ICI). The amendments changed the way the global adjustment was allocated to Ontario consumers.[13] The ICI created two classes of consumers for the purpose of allocating the global adjustment. Class A consumers, which were consumers with an average monthly peak demand greater than five megawatts (MW), were charged the global adjustment based on their share of consumption during the five highest demand hours (coincident peak demands) in Ontario during a defined base period from May 1 to April 30 of the previous year. Class B consumers, which included all remaining consumers, continued to be charged the global adjustment volumetrically, but based on the total Class B share of consumption during the five coincident peak demand hours.

The ICI was introduced to address the concerns raised by large volume consumers who believed that they were paying more than their fair share of the fixed costs incurred to maintain and build sufficient generation to meet peak demands. The ICI offered large industrial consumers an incentive to reduce their consumption during critical peak demand hours, which was expected to reduce the need to procure new peaking generation capacity.[14]

The ICI has been amended since 2011 to expanded Class A eligibility. Class A consumers now include consumers with an average monthly peak demand greater than 1 MW, and consumers in certain manufacturing and industrial sectors, including greenhouses with an average monthly demand greater than 500 kilowatts (kW) during the annual base period.

ISSUES WITH THE GLOBAL ADJUSTMENT AND GENERATION COST PRICING

Several commentators have criticised government decisions that affected the size and nature of the costs in the global adjustment. For example, the Office of the Ontario Auditor General (2015) identified several problems with past generation and conservation procurement decisions, including the procurement of more capacity than needed to meet Ontario's peak demands, overpayment for renewable energy, costly gas plant cancellations, ineffective conservation programs, and cost-ineffective conversion of the Thunder Bay coal plant to biomass. The Auditor argues that these decisions resulted in inefficient and unnecessary expenditures that inflated the size of the global adjustment.

Trebilcock (2017) argues that policies such as the Green Energy and Green Economy Act, which were implemented to reduce carbon emissions from the electricity sector and to stimulate job creation in the green energy economy failed to deliver on their objectives in a cost-effective manner. While the policies yielded modest environmental benefits, it had a likely negative effect on employment and dramatically increased the size of the global adjustment and users' electricity costs.

Unfortunately, little can be done to redress the policy decisions that affected the size and nature of the costs incurred within the global adjustment, as these costs are essentially sunk (see Insert 1 for a glossary of economic terms). The IESO is under contractual commitment to pay generators for these costs. To avoid or reduce these costs, the IESO would have to renegotiate the contracts it has with generators. While it is unlikely that generators would accept changes that would make them worse off, there may be an opportunity to push some costs further into the future. Similarly, the OEB has established regulated rate commitments with OPG. The OEB could reduce the size of payments to OPG in future rate hearings by refusing the recovery of some costs or forbearing on regulation all together. Figure 2 depicts the share of global adjustment paid to different generation technologies and their share of total installed capacity for 2017.

Insert 1 | Glossary of Economic Terms

Variable costs: Costs that vary with the quantity of output produced.

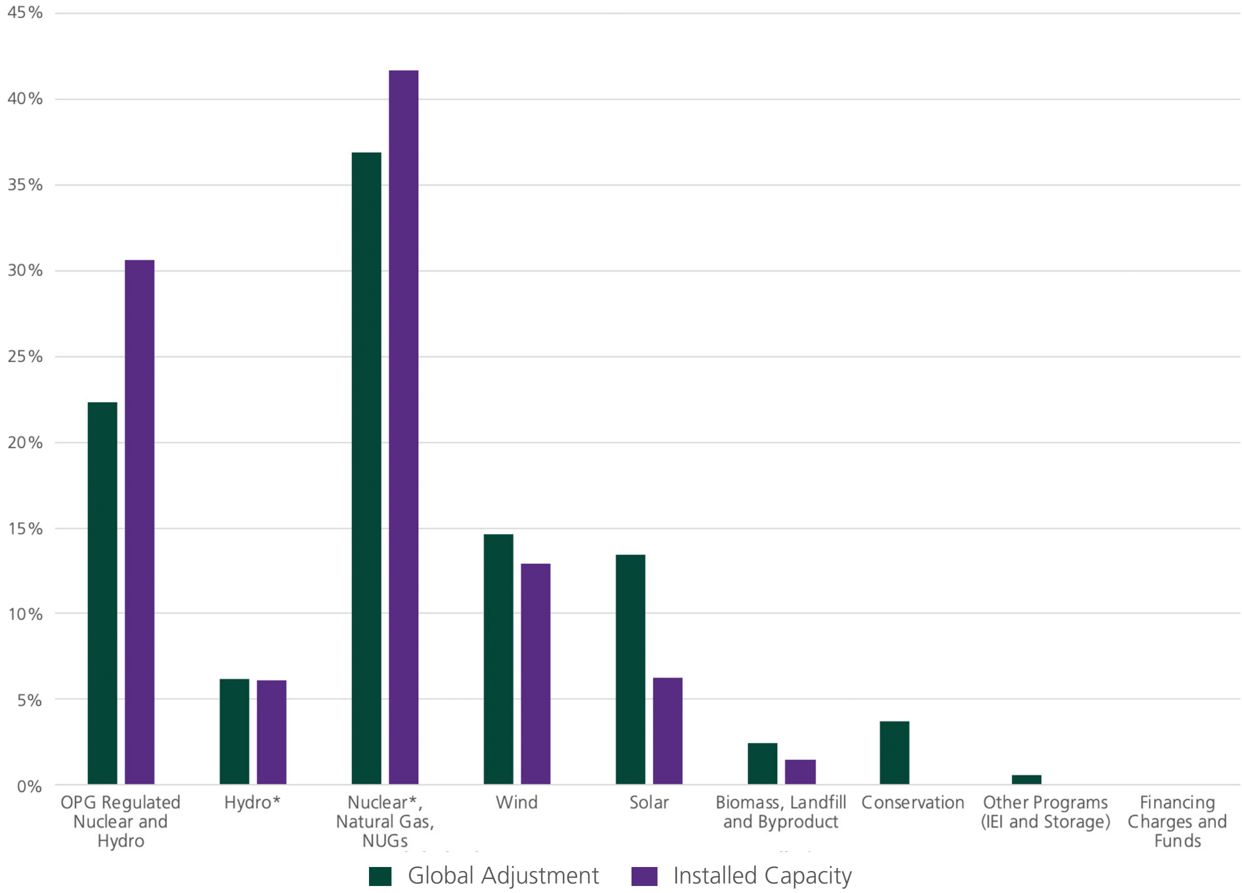
Fixed costs: Costs that do not vary with the quantity of output produced.

Short-term: A period of time in which the optimal decisions of consumers and producers are constrained by the existing stock of assets, (i.e. consumers' energy drawing assets or devices and total generation capacity are fixed).

Sunk cost: A cost already incurred or committed to being paid that cannot be avoided or recovered.

Marginal cost: The additional cost incurred by a firm to increase production by one more unit of output.

Figure 2 | Share of Global Adjustment and Share of Total Capacity by Generation Technologies, 2017



* Non-OPG assets

Source: Author created from data available from the IESO.

A second concern around the global adjustment relates to how the province prices and allocates its generation costs. For example, the OEB's Market Surveillance Panel (MSP) has argued that the current approach leads to an inefficient and inequitable allocation of generation costs.[15] The ICI provides Class A consumers with an extreme incentive to invest in behind-the-meter generation and storage to avoid paying the global adjustment.The cost of these investments are generally higher than the actual avoided cost of using grid supplied electricity, which makes the investments socially efficient. Furthermore, as Class A consumers build on-site generation or storage and reduce overall grid level consumption, the sunk global adjustment costs are shifted to other consumers. This cost shift induces more consumers to find ways to avoid paying the global adjustment, including investing in distributed energy solutions. The MSP warns that this cycle could eventually lead to the premature stranding of large grid assets, and higher costs for Ontario consumers overall.

Unlike the concerns related to the size and nature of costs within the global adjustment, there are opportunities to redress the decision on how the province's generation costs are allocated to consumers to promote more efficient and equitable outcomes. This is the intended contribution of this Policy Brief and the focus of the next section. The remainder of this section sets out economic principles for efficient and equitable pricing and evaluates the current Ontario approach against these principles.

An Economic Perspective on Efficient and Equitable Pricing

In economics, a market is efficient in the short-term if it makes best use of the presently available productive assets. This occurs when the commodity is produced by the cheapest suppliers and it is consumed by all consumers and only those consumers whose willingness to pay to consume is no less than the cost of all inputs used to make it. Long-term efficiency is about making optimal and timely decisions on the investment in new assets and the maintenance or expiry of existing assets. In the long-term, efficiency is achieved when the industry produces at the point where industry long-term average cost is minimized.

Standard microeconomic analysis clearly establishes that economic efficiency is maximized in the short-term when prices equal the marginal cost of production;[16] any departure from marginal cost pricing is likely to reduce the economic value the industry can create.[17] The exception to this rule is when there is a constraint on productive capacity. In this case, price must exceed the marginal cost of the last MW produced in order to ration demand. Efficient pricing with short-term capacity constraints requires the demand side of the market to set the price. The price equals the dollar value of the benefit consumers would get from consuming one more MW of electricity (i.e. the marginal willingness to pay). This price represents the marginal value of adding one MW of new capacity. In the energy economics literature, the portion of the peak price that is above marginal cost is called a *scarcity rent*.[18] Scarcity rents provide producers with an opportunity to cover a portion of their fixed cost. They also provide a signal to potential investors of the relative scarcity of capacity, and the value of either retiring existing capacity or investing in new capacity. Scarcity rents provide incentives for efficient long-term investment decisions. In the long-term, scarcity rents equal the marginal cost of adding new capacity.[19]

There are instances, however, when short-term marginal cost pricing fails to provide producers with sufficient revenue to recover all of their costs, particularly the fixed costs to build and maintain their productive assets. This can be true of industries that require investment in specialized assets with significant fixed costs (i.e. natural monopoly industries). Transmission and distribution services are standard examples of such an industry. Governments generally prefer regulation to competition in these industries, and the challenge for the regulator is to design consumer prices or rates that balance the goals of efficiency and consumer fairness or equity, but allow the regulated firm to recover all of the fixed costs to build and operate the assets, plus earn a fair rate of return on capital (financial viability).

In the regulatory arena, consumer fairness or equity is generally discussed in terms of cost causality (i.e., prices should be fair, in the sense of assigning costs to those who cause them and/or benefit from them being incurred).[20] This concept raises an important distinction between the recovery of fixed costs that are customer-specific versus those that are system-wide.[21] Customer-specific fixed costs vary according to whether the customer receives service from the regulated firm, but not in terms of how much electricity the customer consumes. For example, costs related to account set-up with a distribution company such as meter-related capital costs, minimum service drop costs, and final line transformer expenses are customer-specific. System-wide fixed costs cannot be attributable to a specific customer and are independent of how much electricity is consumed on the system. These can include construction and maintenance cost of a transmission or distribution system or public purpose programs such as conservation and energy efficiency programs. It is both efficient and fair from a cost causality perspective to recover customer-specific fixed costs directly from consumers as a fixed charge. It is the recovery of system-wide fixed costs that involves trade-offs between efficiency and equity. The trade-off generally requires a value judgement on the preferred distribution of wealth.[22]

There is an extensive theoretical and applied literature on approaches for the design of efficient and equitable rates to cover a utility's system-wide fixed costs.[23] Borenstein (2016) examines several approaches and notes that each has pros and cons (See Insert 2 for Bornstein's evaluation). Borenstein concludes that there is no ideal pricing policy, although balancing efficiency and equity suggests using a combination of fixed charges and increased volumetric prices above marginal cost.

Insert 2 | Regulatory Approaches to Utility Fixed Cost Recovery

Volumetric average cost pricing:
A charge per kilowatt hour (kWh) consumed equal to the utility's average total cost. Often seen as fair, since all consumers are treated the same; yet it is inefficient, as it induces too much consumption when the average price is below marginal cost (typically during peak demand periods) and too little consumption when average price is above marginal cost (typically during low demand periods).

Ramsey pricing:
Charging different prices to different consumers based on their elasticity of demand. Efficient in a second-best sense, but generally impractical to implement, as it requires detailed information on individual consumer's demand elasticities. It is sometimes considered "unfair," as low-income consumers typically have the most inelastic demand and pay higher prices.

Fixed charges:
A set amount that does not vary with the volume of electricity used. A volumetric charge for the commodity equal to marginal cost, plus a fixed charge based on willingness and ability to pay, promotes first-best efficiency if there is perfect information on each consumer's willingness to pay. However, in practice, information is imperfect and finding an appropriate proxy measure for willingness and ability to pay has proven challenging, particularly for large industrial and commercial consumers.

Demand charges:
A charge per kWh based on a consumer's peak demand during a defined billing period. There is no efficiency or equity basis for using demand charges to recover system-wide fixed costs as there is no direct relationship between a customer's peak demand levels and these costs.

An Evaluation of Generation Cost Pricing in Ontario

Generation costs include the marginal and variable costs to produce electrical energy and the fixed costs to build and maintain generation capacity. In Ontario, generators recover their variable costs (and part of their fixed costs) in the wholesale market through the competitive market clearing price, which is designed to reflect the system marginal cost at any point in time.[24] Generators are assured their fixed costs are recovered through contracts with the IESO or in the case of OPG, through regulated rates. Payment of these costs are reflected in the global adjustment.

As Figure 1 illustrates, the global adjustment has grown to be 4 to 5 times larger than the market price (i.e., marginal cost), demonstrating that generation cost recovery based on marginal cost pricing alone would result in a revenue shortfall for some if not all generators. Therefore, an alternative regulatory pricing approach, such as those examined by Borenstein (2016), must be considered.[25]

Efficient and equitable fixed cost recovery in Ontario represents a particular challenge because the global adjustment includes both customer-specific fixed costs, system-wide fixed costs and an energy price hedge. Some of the fixed costs in the global adjustment were incurred to ensure a reliable level of generation capacity. Generation capacity costs are essentially a customer-specific cost in that individuals that consume energy in the hours when the IESO projects capacity is most needed for reliability (i.e., system-peak demand periods) contribute to the need for and cost to build and maintain generation capacity. Historically, "dumb" meters did not permit measurement of individual consumer demand during these system peak hours. However, smart meters now provide an accurate hourly measure of the amount any individual consumes, allowing for more direct recovery of customer-specific capacity cost. Other fixed costs in the global adjustment were incurred to promote environmental and health objectives related to the reduction of greenhouse gases, and for economic objectives related to the development of green industries and green jobs. These costs were incurred for the benefit of all Ontarians and they cannot be attributed to any specific consumer (i.e., a system-wide fixed cost). Furthermore, a portion of the payments to OPG's regulated assets reflect the 2005 policy goal of providing consumers price stability, again for the benefit of all Ontario consumers.

Table 1 | Generation Cost Pricing by Consumer Group

Customer Class	Energy Cost	Global Adjustment
Class A	HOEP or MCP* (Marginal Cost Pricing)	Share of 5 Coincident Peaks (Demand Charge)
Class B - RPP	Time-of-Use Prices (Time-Varying, Volumetric Pricing)	
Class B - Non-RPP	HOEP (Marginal Cost Pricing)	Class B GA rate (Volumetric Pricing)
Exports	MCP (Marginal Cost Pricing)	Do not pay

*A small number of large consumers that participate directly in the wholesale market (dispatchable loads) pay the 5-minute market-clearing price (MCP). The HOEP is equal to the arithmetic average of the hourly 5-minute prices.

As Table 1 illustrates, different approaches to generation cost recovery currently apply to different consumer groups. The following provides a brief evaluation of each approach against the principal criteria of efficiency and equity, using Bornstein's assessment as a guide.

In all hours, Class A consumers pay the marginal cost for the electricity that they consume. They are charged a portion of the global adjustment through a demand charge in the five coincident peak demand hours. This pricing approach encourages efficient consumption in the hours that a Class A consumer does not expect to be a coincident peak demand hour since they pay marginal cost. However, because the global adjustment includes both customer-specific fixed capacity costs and system-wide fixed costs, it can induce too little consumption in the expected coincident peak hours if the avoided global adjustment cost is greater than the marginal cost of adding new capacity or consumers' willingness to pay. The MSP recently estimated that a Class A consumer that reduced its demand by 1

MW in all 5 coincident peak demand hours in 2016, would have avoided an annual global adjustment fee of $520,000, which is considerably higher than the marginal cost of adding new generation capacity (the customer-specific cost) and well in excess of estimates of an average consumer's willingness to pay.[26]

Class B consumers are divided into Regulated Price Plan (RPP) consumers (low volume residential and small business consumers) and non-RPP consumers (larger businesses with monthly peak demand of more than 0.5 MW that are not Class A consumers). Non-RPP consumers pay marginal cost plus the Class B monthly global adjustment rate for each MW consumed in the month, which is a volumetric charge.[27] This pricing approach is inefficient in that it encourages too little consumption in all hours; it sets a price above marginal cost in all non-coincident peak hours, and a price above marginal cost plus the long-run marginal cost of new capacity in the coincident peak demand hours (as noted above for Class A consumers). RPP consumers pay time-of-use rates (on-peak, off-peak and mid-peak) set by the OEB, that embed the competitive energy price (HOEP) and the remaining Class B share of the global adjustment (i.e., a time-varying, volumetric pricing).[28] This pricing will induce inefficient consumption in virtually all hours as the time of use rates rarely if ever equal marginal cost or precisely reflect the marginal cost of adding new capacity in the coincident peak hours.

A third group of consumers, exporters, are OEB licensed companies that move electricity from Ontario to another jurisdiction for use by consumers in the other jurisdiction. Exports pay the 5-minute MCP for energy exported out of Ontario. Exporters do not pay the global adjustment. Similar to Class A consumers, this pricing approach encourages efficient consumption in the non-coincident peak hours. The efficiency of the approach in coincident peak hours is more difficult to assess and somewhat controversial for reasons discussed in the next section.

All approaches are questionable from an equity standpoint since they all essentially allocate the system-wide fixed cost in the global adjustment through a demand charge. Class A customers are allocated the system-wide costs directly through a five coincident peak demand charge, and Class B consumers are allocated these costs indirectly by being responsible for the residual of costs based on their aggregate consumption during these hours. As Borenstein notes, there is no relationship between a consumer's peak demands and system-wide fixed costs or the benefits from them being incurred. Hence allocating these costs results in an arbitrary and likely inequitable allocation.

Finally, the MSP argues that the avoided global adjustment fee of $520,000/MW creates an incentive for Class A consumers to invest in on-site generators or storage facilities that are likely more expensive to build and or operate than transmission-connected generation or demand response capacity. As a result, as Class A consumers build on-site generation or storage to reduce grid level consumption and avoid global adjustment, the sunk costs contained in the global adjustment are simply shifted to other consumers, particularly Class B consumers who currently do not have the same ability to avoid these costs. This cost shift induces more consumers to find ways to avoid paying the global adjustment, including investing in distributed energy solutions to avoid consuming from the grid. The MSP raises the concern that this cycle could eventually lead to the premature stranding of generation, transmission, and distribution costs, and higher costs for Ontario consumers overall.[29]

RECOMMENDATIONS FOR MORE EFFICIENT AND EQUITABLE PRICING

As outlined in the previous section, a key challenge for designing efficient and equitable approaches for the pricing of generation costs in Ontario is that the global adjustment embeds customer-specific and system-wide fixed costs and the energy price hedge on OPG's regulated assets. The first step towards improving generation cost pricing in Ontario is to decompose the global adjustment into these three component amounts. The second step is to price each component separately, using an approach that balances the principal criteria of efficiency and equity as outlined above.

Table 2 sets out a practical approach to the first step, decomposing the global adjustment into its three separate components, namely customer-specific capacity costs, the OPG energy price hedge, and system-wide fixed cost. Table 3 offers suggestions for the second step.

Table 2 | Contribution to Global Adjustment (2017)

GA Components	Global Adjustment (Millions)	Installed Capacity (MW)	Unforced Capacity (MW)	Capacity Price ($/MW-y)	Capacity Cost (Millions)	Energy Price Hedge (Millions)	System-Wide Costs (Millions)
OPG Regulated Nuclear and Hydro	$2,649	12,154	10,234	$125,925	$1,289	$1,360	$0
Hydro*	$731	2,433	1,721	$125,925	$217	NA	$514
Nuclear*, Natural Gas, NUGs	$4,375	16,554	15,363	$125,925	$1,935	NA	$2,440
Wind	$1,738	5,124	587	$125,925	$74	NA	$1,664
Solar	$1,594	2,470	826	$125,925	$104	NA	$1,490
Biomass, Landfill and Byproduct	$287	579	514	$125,925	$65	NA	$222
Other Programs (IEI and Storage)	$68	357	297	$125,925	$37	NA	$30
Conservation	$443	0	0	$125,925	NA	NA	$443
Financing Charges and Funds	-$33	0	0	$125,925	NA	NA	-$33
Total	**$11,851**	**39,670**	**29,543**		**$3,720**	**$1,360**	**$6,770**
Resource Reliability Requirement			27,689				
Surplus Capacity			-1,854		-$233		$233
Adjusted Total			**27,689**		**$3,487**	**$1,360**	**$7,004**

Source: Author created using data from the Ontario Planning Outlook (2016) and The Brattle Group (2018).

Table 3 | Generation Cost Pricing by Consumer Group, Current Approach and Proposed Approach

	Current Approach		Proposed Approach			
Customer Class	**Energy Cost**	**Global Adjustment**	**Energy Cost**	**Capacity Costs**	**OPG Energy Price Hedge**	**System-Wide Costs**
Class A	HOEP or MCP* (Marginal Cost Pricing)	Share of 5 Coincident Peaks (Demand Charge)	HOEP or MCP	Demand Charge	Volumetric	Fixed Charge or Taxes
Class B - RPP	Time-of-Use Prices (Time-Varying, Volumetric Pricing)		Time-of-Use	Demand Charge	Volumetric	Fixed Charge or Taxes
Class B - Non-RPP	HOEP (Marginal Cost Pricing)	Class B GA rate (Volumetric Pricing)	HOEP	Demand Charge	Volumetric	Fixed Charge or Taxes
Exports	MCP (Marginal Cost Pricing)	Do not pay	MCP	Demand Charge	Not Applicable	Not Applicable

Source: Author created using data from the Ontario Planning Outlook (2016) and The Brattle Group (2018).

Table 2 offers a retrospective and indicative estimate of the three components in 2017. First, the customer-specific capacity costs are estimated using data on projected 2017 generation capacity and reliability requirements form the IESO's Ontario Planning Outlook (2016) and estimates of the cost of building new generation presented in Brattle Group (2018) and in IESO (2019). The estimates are based on the methodology the IESO is proposing to calculate capacity payments under the Incremental Capacity Auction, one of the initiatives within the broader Market Renewal Initiative.

The IESO is required to maintain a certain level of capacity for reliability. In particular, it is required to maintain a level of capacity in the province so that the likelihood of not being able to supply firm demand due to insufficient capacity is no more than 0.1 days per year.[30] To meet this requirement, the IESO counts on all contracted and regulated generation capacity (i.e., all generation assets need to be available during system peak demand hours to ensure consumer demand is met reliably). The IESO is looking to procure capacity through the Incremental Capacity Auction on an unforced capacity basis. Installed capacity represents the maximum amount of energy that a resource can produce at any point in time, while unforced capacity represents the amount of energy that a resource can be expected to provide, on average, during system peak demand periods, accounting for the possibility of outages or in the case of renewables fuel unavailability. Table 2 presents both the installed and unforced capacity amounts for the different generation technologies and the amount of capacity the IESO estimated it would require in 2017 for reliability.

As part of the Incremental Capacity Auction, the IESO intends to use a capacity demand curve to represent the IESO's willingness to buy capacity by defining the prices that it is willing to pay for varying levels of reliability."[31] Modeling conducted by the Brattle Group (2018) and adopted by IESO (2019) suggest $125,925/MW-y is an indicative estimate for the capacity price of the future auction as this price is consistent with the price that would prevail, on average, in a market that supports entry at the long-run marginal cost of capacity.

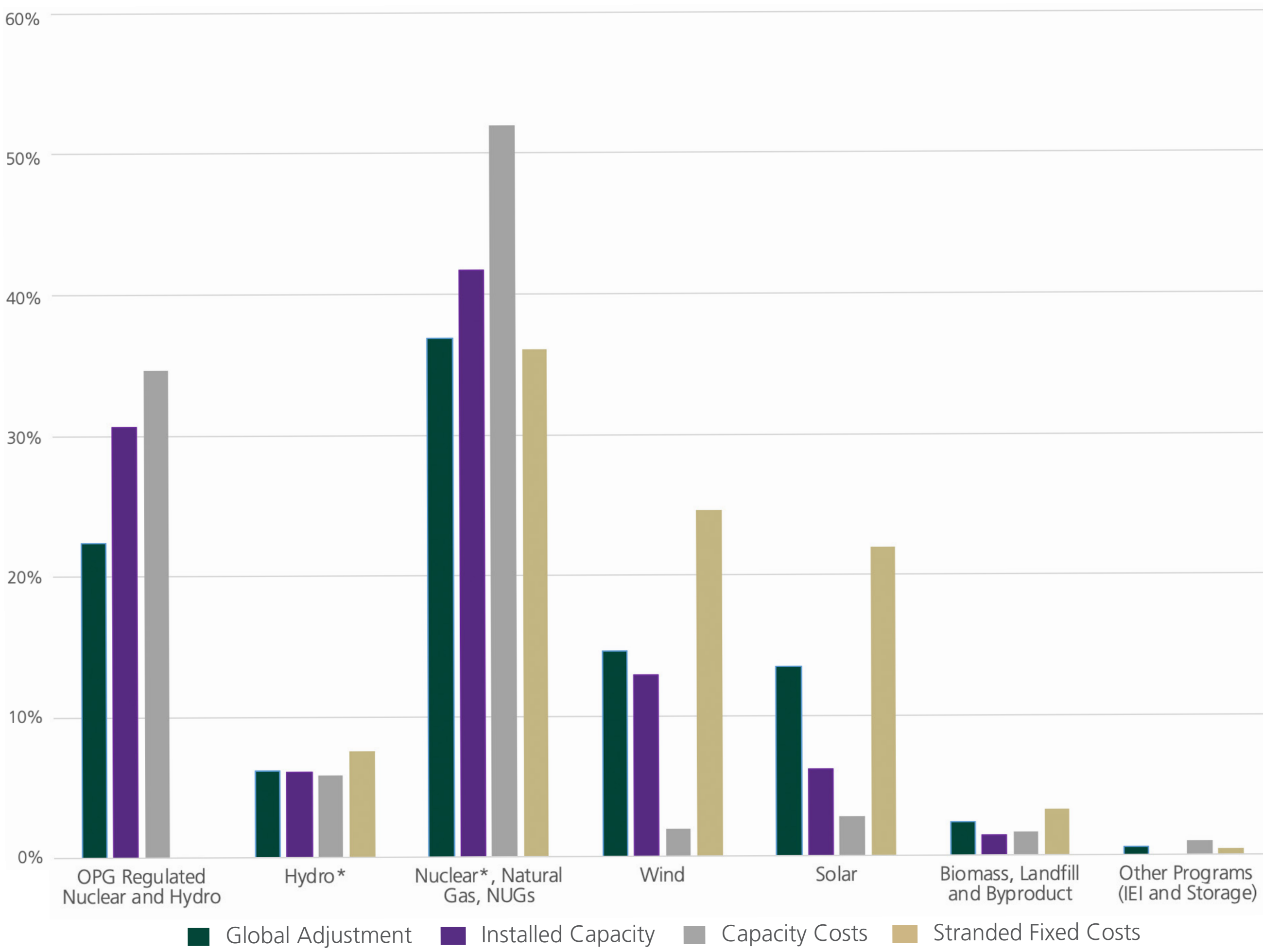
Consistent with how capacity payments would be calculated in the Incremental Capacity Auction, the capacity costs in the global adjustment can be estimated as the product of unforced capacity and the indicative capacity price. Under this approach, the total capacity-related costs embedded in the global adjustment in 2017 represented roughly $3.7 billion. However, the amount of unforced capacity under contract or regulation with the IESO in 2017 was greater than the amount the IESO projected it would need in 2017 to meet its reliability standard when planning in 2016. That is, the province had a surplus of capacity. In a competitive auction, the capacity price would likely have cleared well below the long-run marginal cost of capacity so that the implicit capacity cost for all assets would have been lower than what is estimated in Table 2. For the purpose of the present analysis, the cost of surplus capacity is valued at the long-run marginal cost of capacity, subtracted from the capacity cost component of the global adjustment and added to the system-wide cost component. After subtracting the estimated cost of surplus capacity, the net capacity cost embedded in the global adjustment in 2017 is estimated at $3.5 billion.

Second, the OPG energy price hedge provides Ontario consumers protection against volatile and high energy prices by rebating any revenues that the government-owned generator, OPG earns above what it needs to cover its total fixed and variable costs as defined by its regulated rates.[32] The amount of this price protection can be conceptualized as the difference between what OPG earns for the energy it provides, and what it would earn for its capacity in the competitive capacity auction, less the amount it needs to cover its approved costs. This value is estimated as the difference between what OPG receives from the global adjustment and its indicative capacity value as calculated in Table 2. In 2017, this is estimated as a charge to consumers of roughly $1.4 billion.

The remainder of the global adjustment consists of system-wide fixed costs incurred to achieve different policy objectives, which in 2017 amounted to roughly $7 billion. Arguably these also represent a form of stranded costs. The concept of stranded costs emerged as jurisdictions began deregulating natural monopolies and network industries. Stranded costs are the anticipated shortfall in net revenues on an incumbent's asset under competition that occur as a consequence of changes in regulatory or government policy.[33] As jurisdictions began introducing competition in previously regulated industries, incumbent utilities that had incurred costs prudently under regulation were at considerable risk of recovering the cost of these assets and of earning the regulatory approved return on invested capital. Many jurisdictions assumed the burden of these costs as part of the implicit regulatory contract with the incumbents. The costs were recovered from consumers through a separate competitive transitional charge.

In 1998, the Ontario government faced the issue of stranded costs when it decided to expose the generation services to competition. At the time, Ontario Hydro was carrying long-term debts of $26.2 billion and assets totaling $39.6 billion. The estimated market value of the assets was substantially less than the $39.6 billion. To ensure the financial solvency of the successor companies, the government assumed $19.5 billion of stranded debt and began repaying the debt through a Debt Retirement Charge levied upon Ontario ratepayers. The Debt Retirement Charge was equal to 0.7 cents per kWh of electricity consumed in Ontario. It was retired on March 31, 2018.[34]

Figure 3 | Share of Global Adjustment, Installed Capacity, Capacity Cost and Stranded Fixed Cost, 2017



* Non-OPG assets

Source: Author created from data available from the IESO.

Fast forward to today, when the transition from central planning and procurement to a competitive capacity auction exposes a difference between the competitive energy and capacity value of the contracted assets and the payments guaranteed through contract with the IESO. This difference is a reflection of costs stranded by previous policy decisions. Figure 3 provides a share comparison of the different components by generation technology for 2017, excluding the OPG energy price hedge. System-wide stranded fixed costs accounted for roughly 60 percent of the global adjustment in 2017.

The second step for achieving a more efficient and equitable allocation of generation costs is to price each component of the global adjustment separately using an approach that balances the principal criteria of efficiency and equity as discussed above. Table 3 offers suggested approaches for each consumer group.

First, capacity costs are essentially a consumer-specific fixed cost. Individuals that consume energy in the hours when the IESO projects capacity is most needed for reliability (i.e. system-peak demand periods) contribute to the need for capacity. Furthermore, with smart-meters, we can measure each consumer's consumption in these hours and charge them directly for their share of the cost. A demand charge based on consumption in the system-peak demand hours can approximate the marginal cost of adding new capacity on the system and encourage efficient consumption. A demand charge is also equitable in that it connotes the notion of user pay and cost causality. A coincident peak demand charge such as the one used to recover the global adjustment from Class A consumers represents one option.[35] Another option includes the one considered by the in OEB (2019), which would allocate capacity costs in each hour in a manner that is directly correlated to total Ontario electricity demand (labelled the demand shaped prototype). A third approach is the one prescribed in Alberta Energy (2017), the "weighted energy method," which would allocate capacity costs across several time blocks, with greater weight assigned to time blocks that contribute more to the cost of capacity and lower weights assigned to time blocks that contribute less to the cost of capacity. Ultimately, the efficiency merits of different charge determinants (i.e. coincident peak, demand-shaped pricing, weighted energy) is an empirical question worthy of study but outside of the scope of this policy report.

There is no efficiency or equity basis for dividing consumers into different classes (i.e. Class A and Class B consumers) for the purpose of recovering consumer-specific capacity costs through a demand charge.

Currently, exports do not pay global adjustment and the IESO has indicated it will not recover the annual capacity costs of the Incremental Capacity Auction from exports. This is a standard practice of all jurisdictions. The rationale for this approach is that Ontario does not consider export demand when it establishes its resource adequacy needs (i.e. exports do not benefit from the capacity built for Ontario peak demands). Furthermore, the IESO reasons that "to the contrary, exports provide benefit to the province by exporting excess energy to neighbouring jurisdictions."[36]

However, if capacity costs are a consumer-specific cost to be recovered on a coincident peak demand basis, there is an efficiency and equity argument that exports should pay their share of the capacity costs if they choose to buy Ontario energy in these hours. With a coincident peak demand charge, exports would pay for Ontario's capacity costs, only if they chose to consume in the coincident peak demand hours. This means that in all other hours, including those when there was excess energy, they would pay the marginal energy price, as they do today so that they would still have an incentive to export excess energy. Furthermore, if the export takes on the risk of transferring energy from Ontario to another jurisdiction during an hour in which it reasonably expects to pay part of Ontario's capacity costs, it must be doing so because it thinks the price it will receive in the other jurisdiction will cover the full cost of the transaction. In this sense, the price in the other jurisdiction must be sufficiently high, signaling a severe shortage of generation capacity in the jurisdiction. Consumers in this jurisdiction are willing to pay what it costs to have energy from Ontario transferred to their jurisdiction, including paying the marginal cost of adding capacity in Ontario. The consumers in this jurisdiction benefit from Ontario's investment in capacity and hence pay their share of the use of that capacity.

Second, part of the objective of the government's initial decision to regulate OPG's heritage assets was to provide Ontario consumers protection against volatile and high energy prices. In months with relatively high competitive energy prices, OPG rebates the revenues it earns above prescribed rates to Ontario consumers. In months with relatively low competitive energy prices, OPG recovers shortfalls from their prescribed rates through a charge on Ontario consumers. Initially, the rebate and charge were applied volumetrically on the basis of total monthly Ontario demand.[37] This helped to dampen the effects of the month to month energy price volatility on consumers. The implementation of the ICI distorted this relationship. Recovering the OPG energy price hedge component volumetrically would restore the initial policy purpose of the global adjustment.[38]

Finally, the third component of the global adjustment is a system-wide fixed cost incurred to achieve various government policy objectives. These costs also represent a form of stranded costs. As discussed above, there is no ideal policy for how to recover these costs, although balancing efficiency and equity suggests using a combination of fixed charges and volumetric prices. Ideally, the fixed charges should reflect the willingness and ability of different consumers to pay for grid-related electricity services. The challenge is finding a determinant that provides a reliable measure of willingness and ability to pay. In any event, the choice of a fixed charge would inevitably involve a value assessment on the preferred distribution of wealth in Ontario, an assessment generally best made by government.

As most of these costs were incurred for broader public policy objectives, a strong argument can be made that they should be recovered through the general tax base rather than through electricity rates. In any other sector, a government subsidy paid to a company to invest in clean technologies or to build a factory in Ontario to create new jobs would be recovered from tax payers instead of from consumers through taxes on product prices.

Recovery of the system-wide stranded costs could be accomplished through a separate tax item in the collection of personal income and corporate taxes. The amount of tax paid by an individual or a corporation could depend on an individual's taxable income. For example each tax payer (individual or corporate) could pay a "stranded asset" tax that is proportional to the tax payer's share of total Ontario personal/corporate taxes. Doing it as a separate tax would mean that it would not have to come at the expense of the funding of other social programs. Further, since electricity consumers are already paying for this cost through the global adjustment, it should not have a material impact on their disposable incomes, although it would likely mean that individuals or companies with higher taxable incomes would pay a higher share of the costs than they did previously through an electricity rate.

CONCLUSION

This report offers a practical approach for decomposing the global adjustment costs into three separate components (capacity costs, an OPG energy price hedge, and system-wide system costs), and argues that for efficiency and equity reasons, each component should be recovered as a separate charge using a different cost recovery method for each.

Decomposing the global adjustment into three separate charges at this point in the evolution of Ontario's electricity sector makes sense for at least two reasons. First, it is compatible and consistent with the objectives of current pricing policy initiatives, including the IESO's Market Renewal initiative and the OEB's RPP roadmap and utility enumeration initiatives. Second, it is timely given the changing technological landscape. Technological change is creating greater choice for consumers on how they use the integrated grid. As these solutions become more cost-competitive relative to grid-sourced electricity, there should be a gradual reduction in the use of and need for the traditional grid. This is a positive change on the whole that should take time to transpire, allowing for a gradual and rational transition. However, the current approach to recovering the global adjustment, which embeds fixed and sunk costs that are largely stranded from past policies, provides an extreme price incentive to reduce demand in peak demand hours. This is causing larger consumers to seriously consider distributed energy or behind-the-meter solutions and energy storage solutions.[39] While the extreme price incentive makes these solutions economic for the consumers that adopt them, the solutions are likely still more expensive than the actual avoided system cost of the consumer using grid-supplied electricity. This is not only inefficient, but as the Market Surveillance Panel has noted, it could hasten the transition to a more distributed energy system, causing the premature stranding of grid assets and eventually higher costs for Ontario electricity consumers on the whole. Decomposing the global adjustment and recovering only capacity-related costs during peak demand periods would reduce the potential for inefficient adoption of distributed energy solutions and future electricity costs for Ontario consumers.[40]

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END NOTES

[1]The overall project is termed "Market Renewal," and consists of three separate but related initiatives. For a summary of the Market Renewal program, see http://www.ieso.ca/en/Sector-Participants/Market-Renewal/Overview-of-Market-Renewal .

[2]Information on these consultations can be accessed at https://www.oeb.ca/industry/policy-initiatives-and-consultations/utility-remuneration and at https://www.oeb.ca/industry/policy-initiatives-and-consultations/rpp-roadmap.

[3]The announcement of this initiative can be accessed at https://news.ontario.ca/mndmf/en/2019/03/ford-government-to-launch-consultations-on-industrial-electricity-prices.html.

[4]For a discussion of the trends in distributed energy resources, see Schwartz et al (2017). For an Ontario perspective, see Gregg (2019) and Energy Transformation Network of Ontario (2019).

[5]For example, see Office of the Ontario Auditor General (2015), Trebilcock (2017) and Ontario Energy Board (2018).

[6]The policy reforms were introduced through Bill 100, Electricity Restructuring Act, 2004. The new legislation provided the OEB the responsibility of approving the RPP and created a new agency, the Ontario Power Authority with a mandate to ensure an adequate supply of electricity through long-term planning and procurement contracting. For further background see Hansard Transcripts available at https://www.ola.org/en/legislative-business/bills/parliament-38/session-1/bill-100.

[7]See: O. Reg. 429/04, Adjustments under Section 24.33 under the Electricity Act, 1998 as it came into force on January 1, 2005.

[8]At the same time that the government decided to rate regulate OPG's heritage assets, it imposed a revenue limit of 4.7 cents/kWh on 85 per cent of the output from its remaining assets. The difference between the revenues earned at market prices and the revenue limit were carried on OPG's balance sheet and the government's General Accounts. By 2014, OPG had closed all its coal-fired facilities. Furthermore, the government asked the OEB to regulate OPG's peaking hydroelectric facilities with the differences between the market rates and the regulated rates shifted from the General Accounts to the global adjustment.

[9]See https://news.ontario.ca/archive/en/2005/02/23/Ontario-Government-Introduces-Fair-And-Stable-Prices-For-Electricity-From-Ontari.html, accessed on January 3, 2019. Ontario Regulation 429/04 provided that the global adjustment be named the "Provincial Benefit" on invoices.

[10]On January 1, 2015, the IESO merged with the OPA to create a new organization that combined their respective mandates. The merged entity retained the IESO name.

[11]These were the policy objectives of the Green Energy and Green Economy Act, 2009. For further background see Hansard Transcripts available at https://www.ola.org/en/legislative-business/bills/parliament-39/session-1/bill-150/debates.

[12]The global adjustment changes from month to month for two reasons. First, it increases or decreases as the number of aggregate contracts with the IESO increase or decrease and as the regulated rates paid to OPG increase or decrease. Second, the global adjustment varies with the market revenues earned by contracted and regulated generators. Changes in the market revenues earned is a function of the changes in the HOEP; the higher/lower the average monthly HOEP, the lower/higher the global adjustment.

[13]See http://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTEwNzI0&statusId=MTY2MTgw accessed on January 3, 2019.

[14]Ibid.

[15]See Ontario Energy Board (2018).

[16]See Borenstein (2016). As Borenstein points out, efficiency requires prices equal the marginal social cost of production which includes the cost of any externalities produced such as greenhouse gas emissions. Externalities arise whenever the actions of one economic agent make another economic agent worse or better off, yet the first agent neither bears the costs nor receives the

benefits of doing so. For example, producing electricity using natural gas creates a negative externality – it leads to the emission of greenhouse gases that negatively affect the health of people and the environment. Absent some form of explicit price placed on greenhouse gases, natural gas generators will fail to internalize the cost of the externalities when pricing their output. This means that the price of electricity will be too low, and too much electricity will be consumed from a broader social perspective. It also likely means that there will be over investment in carbon emitting generation relative to non-carbon emitting generation.

[17]The extent to which departures from marginal cost pricing can lead to economic efficiency depends on how responsive consumers are to price changes (i.e., their elasticity of demand). If demand is inelastic (not very responsive to price), all else held constant, departures from marginal cost pricing lead to smaller efficiency losses. Electricity demand is often characterised as being highly inelastic in the short-term, and at the time of consumption, demand is likely perfectly inelastic. Empirical studies have shown evidence of some degree of elasticity in Ontario consumers. For example, see Ontario Energy Board (2018) and Lessem et al (2017).

[18]Borenstein (2000), at page 52.

[19]This paragraph describes the theory of peak-load pricing. The literature on peak-load pricing is voluminous. The interested reader may consult Crew et al (1995), Church and Ware (2000), Borenstein (2000) or Harris (2015).

[20]See Ontario Energy Board (2018) at page 18.

[21]Borenstein (2016) makes this distinction at page 6.

[22]The economic literature offers only limited guidance on the issue of fairness or equity. Horizontal equity implies the like treatment of people who are alike. It corresponds to common notions of fair play and non-discrimination. For example, if two people have the same pre-tax income, they would have equal after-tax incomes. Vertical equity is concerned with how different people are treated differently. This notion of equity is a more contentious. Vertical equity is typically concerned with the "preferred" distribution of wealth in society. What represents the "preferred" distribution of wealth is a normative question that requires a value judgement. For example, it can be argued that those who earn higher pre-tax income should pay higher taxes. Given that vertical equity involves a value judgment, there is no 'economic' answer and most economist defer to government or regulatory agencies to determine the preferred distribution. The task of economists is to determine how to achieve the preferred distribution at least cost or with least loss of efficiency.

[23]See C Harris (2015) for a review of early rate designs.

[24]The market clearing price reflects the social marginal cost to the extent that the Federal government's, Greenhouse Gas Pollution Pricing Act, S.C. 2018, c. 12, s. 186 properly accounts for the social cost of carbon. Under the Act, electricity generators have a direct compliance obligation when their emissions exceed a threshold amount, initially set at 50,000 tonnes, at which point a carbon price applies to the amount above emissions. The federal plan does not affect electricity imported into Ontario from US jurisdictions that continue to use fossil fuel generation, without similar comparable carbon pricing.

[25]The introduction of competition and competitive markets for generation services was expected to incentivize generation investment based only on the marginal energy price; there would be no need for a separate payment to recover the fixed costs of generation assets. However, as jurisdictions across North America gained experience with how "energy-only" markets operated in practice, many called into question the ability of these markets to provide generators with sufficient revenue to cover their fixed costs and to stimulate private invest in generation to the levels required to achieve traditional reliability standards. This has been termed the "missing money" problem – that prices do not rise high enough or often enough to attract required levels of generation capacity investment in an energy-only market. This led some jurisdictions to introduce "capacity markets" which offer generators an additional payment to make capacity available. For further explanation, see Charles River Associates (2017). Ontario choose to offer generators long-term contracts with price or revenue assurances to attract generation investment.

[26]See Ontario Energy Board (2018) at page 16. The Brattle Group (2018) estimates the cost of new entry for a single cycle generation facility at roughly $250,000 per MW per year. Breidenbough (2006) estimates the "value of loss load" for an average consumer at $2,000/MWh to $5,000/MWh US dollars or $3,325/MW to $8,320/MW in current Canadian dollars.

[27]The monthly global adjustment rate ($/MWh) is calculated by dividing the total monthly global adjustment cost not charged to Class A consumers, by the total monthly amount of energy consumed by all Class B consumers.

[28]This is true for RPP consumers that have a smart meter. The small number of RPP consumers that do not have a smart meter pay a set rate for electricity up to a certain level of consumption and a higher rate for all additional electricity consumed (i.e., a tiered price).

[29]The MSP also argues that the ICI methodology is complicated and non-transparent. Class A consumers do not know what the avoided global adjustment costs will be before they consume in a peak demand hour. They must predict in advance whether the hour will be one of the five coincident peak demand hours, their share of demand in the hour, and what the size of the GA will be in the following year. The MSP argues that not knowing the cost of consumption complicates the decision of when to consume; consumers risk reducing consumption during hours that turn out not to be one of the five coincident peak hours which results in losses to the consumers and an efficiency loss more generally.

[30]Independent Electricity System Operator (2019) at page 225. Resource adequacy refers to the ability of an electric system to provide sufficient supply to serve firm demand in aggregate. A resource adequacy standard is an expression of the acceptable frequency or duration of interruptions of power to firm demand caused by insufficiency of supply resources. The Northeast Power Coordinating Counsel's resource adequacy criteria requires that "Each Planning Coordinator or Resource Planner shall probabilistically evaluate Resource Adequacy of its Planning Coordinator Area portion of the bulk power system to demonstrate that the loss of load expectation (LOLE) of disconnecting firm load due to resource deficiencies is, on average, no more than 0.1 days per year.

[31]See Independent Electricity System Operator (2019) at page Ibid, at page 153.

[32]The OEB approved rates in 2017 were roughly $77.96/MWh for the nuclear assets and $41.67/MWh for the hydroelectric assets. See PAYMENT AMOUNTS ORDER EB-2016-0152, ONTARIO POWER GENERATION INC. Application for payment amounts for the period from January 1, 2017 to December 31, 2021.
[33]See Sidak and Spulber (1997) at page 28.

[34]See https://www.fin.gov.on.ca/en/tax/drc/index.html.

[35]All U.S. jurisdictions that operate capacity markets use a coincident peak demand charge. See Alberta Energy (2017) for a comparison of different capacity cost allocation methodologies. The IESO is proposing to recover the annual costs of the Incremental Capacity Auction using a coincident peak demand charge. See IESO (2019) at page 225.

[36]See Independent Electricity System Operator (2019) at page 226.

[37]If the OPG energy hedge amount was recovered volumetrically in 2017, it would have been a charge in all months, and roughly $10/MWh on average. That the hedge was a charge in 2017 might be expected given that the average annual HOEP in 2017 was relatively low at $15.80/MWh compared to the average annual HOEP for the prior 10 year period (2008 to 2017), which was $29.53/MWh.

[38]It has been nearly 15 years since the policy to regulate OPGs rates was introduced. Since this time, considerable change has occurred within the hybrid electricity market. There are now many private generators in the market and OPGs share of output is much smaller. The competitive energy price (HOEP) is generally lower, less volatile, and represents a much smaller component of a typical consumers electricity cost. Furthermore, the introduction of a capacity auction will offer new competitive revenue opportunities for OPG to cover its fixed operating costs that did not exist at the time of the initial policy. These changes may have affected the need to or benefit of regulating OPG's assets. Given the policy evolution, there is arguably merit to having a public consultation to review the current treatment of OPG's assets to asses the costs and benefits of the existing regulatory regime.

[39]For recent evidence of this activity see https://www.greentechmedia.com/articles/read/batteries-benefit-from-ontarios-bizarre-energy-market#gs.g79rmb.

[40]As a postscript, the changes to generation cost pricing proposed in this Policy Brief are likely to lead to a redistribution of wealth across different consumer groups and even within consumer groups. Furthermore, shifting the stranded fixed costs from electricity rates to taxes would require some time to work through the provincial budgeting process. It would be prudent to gradually phase in the changes to avoid possible large shifts in wealth and to allow all customers time to adapt their investment planning decisions and consumption habits. One approach to phasing in the changes could be to separate the capacity costs from the global adjustment in the first phase. The capacity costs could be recovered from all consumers, including exports, using a demand charge such as the current coincident peak charge, the OEB Staff's recommended demand-shaped pricing, or the Alberta weighted energy approach. The remainder of the global adjustment could then be recovered volumetrically. Realizing this phase should help reduce the risk of hastening the investment in distributed energy solutions. In the second phase, the system-wide stranded fixed costs could be gradually shifted from electricity rates to a stranded asset tax. This could be done over a period of two to three budgeting periods.

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TAB E

This is Exhibit **"E"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc., Province of Ontario, while a Student-at-Law. Expires April 8, 2022.

ONTARIO ENERGY BOARD

Market Surveillance Panel

The Industrial Conservation Initiative:

Evaluating its Impact and Potential Alternative Approaches

December 2018

Ontario

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Role of the Market Surveillance Panel

The Market Surveillance Panel (Panel) is a panel of the Ontario Energy Board. Its role is to monitor, investigate and report on activities related to—and behaviour in—the wholesale electricity markets administered by the Independent Electricity System Operator (IESO).

The Panel monitors, evaluates and analyzes activities related to the IESO-administered markets and the conduct of market participants to identify:

- inappropriate or anomalous conduct in the markets, including gaming and the abuse of market power;
- activities of the IESO that may have an impact on market efficiencies or effective competition;
- actual or potential design or other flaws and inefficiencies in the Market Rules and procedures; and
- actual or potential design or other flaws in the overall structure of the IESO-administered markets and assess consistency of that structure with the efficient and fair operation of a competitive market.

Market-related activities and market conduct may also be the subject of a more formal and targeted investigation by the Panel. To that end, the Panel has authority under the Electricity Act, 1998 to compel testimony and the production of information.

The Panel reports on the results of its monitoring and investigations. The Panel does not have the legislative mandate to impose sanctions or other remedies in response to inappropriate conduct or market defects, but it does make recommendations for remedial action as it considers appropriate.

Executive Summary

In 2011, the Government of Ontario introduced a policy known as the Industrial Conservation Initiative (ICI), which changed the way in which Global Adjustment costs are allocated to different classes of consumers.

The stated purpose of the ICI is to provide large consumers with an incentive to reduce consumption at critical peak demand times. The resulting reductions in peak demand were expected to reduce the need to invest in new peaking generation and imports of electricity from coal-reliant jurisdictions. The ICI was also intended to increase the efficiency of price signals, while also recognizing concerns that large volume consumers were paying more than their fair share of costs.

The costs recovered through the Global Adjustment include the costs of contracted and regulated generation, as well as the cost of some conservation programs. The Global Adjustment has grown from $700 million in 2006 (8% of total electricity supply costs) to $11.9 billion in 2017 (more than 80% of total electricity supply costs). As the Global Adjustment has grown, so too has the reduction in peak demand by consumers participating in the ICI. The Panel estimates that ICI participants reduced their consumption by 42% during peak demand conditions in 2016, compared to reductions of 33% and 26% in 2013 and 2011 respectively.

The ICI has the effect of shifting the electricity costs recovered through the Global Adjustment from larger volume consumers to households and small businesses. Because the Global Adjustment now accounts for the lion’s share of electricity supply costs, baseload as well as peaking, how those costs are allocated between large and small consumers has a significant effect on the effective electricity prices that they pay. Since its introduction in 2011, the ICI has shifted nearly $5 billion in electricity costs from larger consumers to smaller ones. In 2017, the ICI shifted $1.2 billion in electricity costs to households and small businesses—nearly four times greater than the amount in 2011. In 2017, the ICI increased the cost of electricity for households and small businesses by 10%.

The Market Surveillance Panel (Panel), in the course of its monitoring of activities related to the IESO-administered market that may affect the efficient and fair operation of that market, regularly reports on effective electricity prices, including the Global Adjustment component of those prices. The Panel has noted on more than one occasion that the ICI affects the effective price paid by different classes of consumers.

In the Panel's view, the ICI as presently structured is a complicated and non-transparent means of recovering costs, with limited efficiency benefits. The magnitude of the incentive to reduce peak demand during a year is inversely related to the Province's need for peak demand reduction the following year. Arguably, the ICI does not allocate costs fairly in the sense of assigning costs to those who cause them and/or benefit from them being incurred.

The Panel recognizes that striking an appropriate balance between potentially competing objectives and interests in cost allocation is a challenge and will remain so. The Panel has prepared this report to contribute in a positive way to any future discussions regarding that balancing exercise, and with a view to promoting consideration of market efficiency and fairness.

The Panel notes by way of postscript that, as it was finalizing this report, the Ontario government announced in its 2018 Ontario Economic Outlook and Fiscal Review that it was launching a public review of electricity pricing for industrial consumers as part of the government's open for business policy.

1. Introduction

The Global Adjustment is the mechanism by which certain electricity supply costs are recovered from electricity ratepayers. Since its introduction in 2005, the Global Adjustment has steadily increased as a percentage of total electricity supply costs, accounting for over 80% ($11.9 billion) in 2017. Given its magnitude, the allocation of Global Adjustment costs amongst consumers has a significant impact on the price consumers pay for electricity.

In January 2011, a new methodology for allocating Global Adjustment costs, called the Industrial Conservation Initiative (ICI), came into effect. Since its introduction, participation in the ICI has shifted nearly $5 billion in Global Adjustment costs from larger consumers to residential consumers and small businesses. In 2017, $1.2 billion in electricity costs were shifted, increasing the cost of electricity for residential consumers and small businesses by 10%.

The Panel recognizes that finding the right balance between competing objectives and interests when allocating costs is challenging. The Panel suggests that the following principal criteria are useful when evaluating methodologies—like the ICI—for allocating fixed costs: efficiency; fairness; simplicity/transparency; and cost recovery. In this report, the Panel assesses the performance of the ICI against those criteria.

2. Background: The Global Adjustment

Generating electricity requires significant investment in infrastructure. The bulk of these investments occur when building and maintaining electricity generators. In the electricity sector, the costs of building and maintaining a generator are referred to as “capacity” costs, which include a reasonable rate of return on those investments. As electricity is consumed on a day-to-day basis, capacity costs are considered “fixed” in that they do not increase or decrease with increasing or decreasing production. The fixed capacity costs associated with generating electricity ultimately need to be recovered from the consumers who benefit from this infrastructure.

In addition to fixed capacity costs, there are incremental (variable or “marginal”) costs associated with generating electricity. Marginal costs are those associated with generating the electricity itself, such as the purchase of natural gas fuel, and increase or decrease with increasing or decreasing production. These costs also need to be recovered from consumers. In Ontario, there is a wholesale electricity market where generators sell electricity at the prevailing market price, which is intended to cover, at a minimum, the marginal costs of generating that electricity. In cases when the market price exceeds the marginal cost of generating the electricity, the excess revenues from the wholesale electricity market help the investor recover the fixed capacity costs associated with building and maintaining its generator.

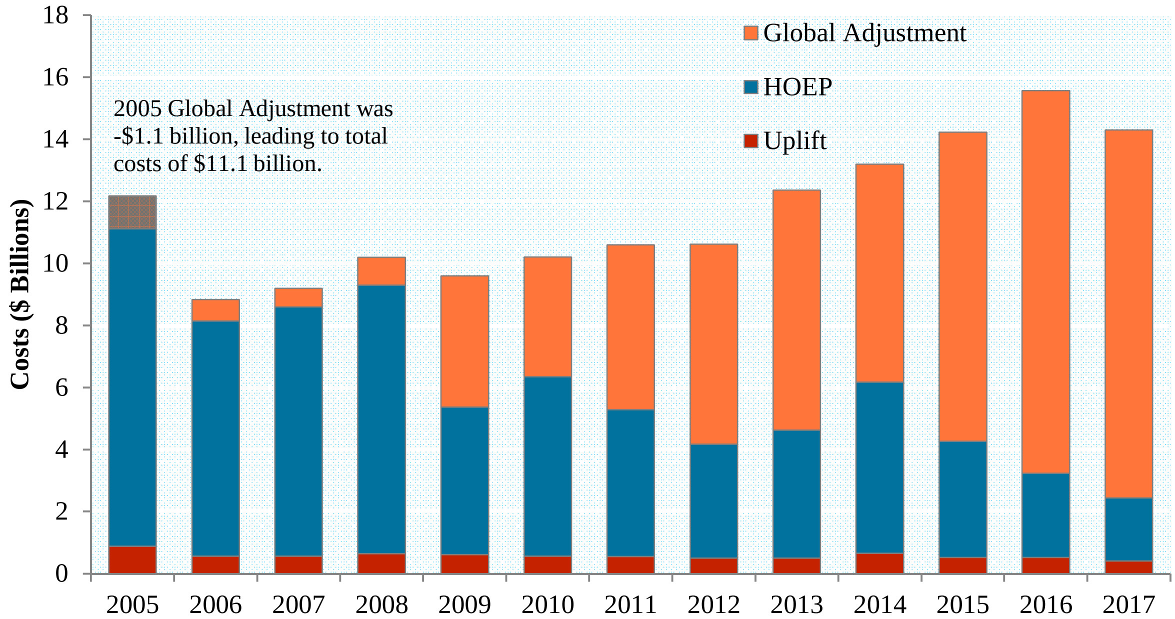
For a number of reasons, revenues from Ontario's wholesale electricity market have been insufficient to cover many generators' fixed capacity costs. In electricity sector parlance, this is referred to as the "missing money" problem. Without long-term financial viability, capacity needed to meet demand may be retired, or may not be built in the first place. Such were the circumstances in the mid-2000s when demand for electricity was growing and Ontario was facing increasingly tight supply conditions.

To address the "missing money" problem and incent investment in new generating capacity, Ontario offered long-term contracts to potential project proponents. While the terms of the contracts differed by generating technology and time of procurement, all contracts were intended to guarantee that investors would recover the fixed capacity costs associated with building and maintaining new generation capacity. This approach proved very successful and significant new generating capacity was built from 2006 onwards. In addition, some of the generation assets owned by Ontario Power Generation Inc. are subject to regulated rates that cover their fixed capacity costs. Generally speaking, when market revenues are insufficient to cover the contracted or regulated amount, supplementary payments need to be made, so a new mechanism was needed to recover these payments from electricity consumers. The Global Adjustment, a charge to Ontario electricity consumers, serves that purpose.

Since its introduction in 2005, the Global Adjustment has made up an increasing portion of the cost of electricity supply charged to consumers. There are many factors driving this trend, including an increasing number of dollars committed to an increasing number of contracted generators. Also a factor is a steady decrease in wholesale electricity market prices, which decreases revenues from the market and necessitates the recovery of a greater portion of fixed capacity costs through the Global Adjustment.

Figure 1 displays how the recovery of electricity supply costs has increasingly shifted from wholesale electricity market charges (the Hourly Ontario Energy Price or "HOEP" and uplift),[1] to the Global Adjustment, which grew from $700 million in 2006 to $11.9 billion in 2017.

Figure 1: Annual Electricity Supply Costs
2005 – 2017
($ Billions)



3. Background: The Industrial Conservation Initiative

Prior to 2011, the Global Adjustment was allocated to all Ontario consumers on a volumetric basis: the costs associated with the Global Adjustment were summed and allocated equally over all megawatt-hours consumed in the Province each month.[2] For example, if the total Global Adjustment was $500 million for a given month, and Ontario consumption was 10 million megawatt-hours, there would be a $50/MWh Global Adjustment charge for all consumers.

In 2011, the Government of Ontario introduced the ICI, a new way of allocating Global Adjustment costs. The change in the allocation of the Global Adjustment was intended to provide large consumers with an incentive to reduce consumption at critical peak demand times. The resulting reductions in peak demand were expected to reduce the need to invest in new

[1] Uplift is charged by the IESO to wholesale market participants in order to recover the costs associated with various wholesale electricity market services and programs, such as the Generation Cost Guarantee program.
[2] Exporters do not pay the Global Adjustment.

peaking generation and imports of electricity from coal-reliant jurisdictions. The ICI was also intended to increase the efficiency of price signals, while also recognizing concerns that large volume consumers were paying more than their fair share of costs.[3]

The Industrial Conservation Initiative: How it Works

The ICI is the mechanism for allocating Global Adjustment costs amongst Ontario consumers. Under the ICI, a consumer's allocation of Global Adjustment costs depends on their consumer class and consumption profile.

New Consumer Classes

The introduction of the ICI divided Ontario consumers into two classes: "Class A" and "Class B". Initially, ***Class A*** was limited to very large consumers with an average monthly peak demand of more than 5 MW (primarily large industrial consumers). Since then, the government has expanded eligibility such that Class A now includes all consumers with an average monthly peak demand of more than 1 MW, as well as consumers in certain manufacturing, industrial and agricultural sectors with an average monthly peak demand of more than 0.5 MW. As a result, the number of Class A consumers has increased from less than 200 in 2011 to over 1,600 in 2018. ***Class B*** comprises all other consumers, including residential consumers and small businesses.

Allocating Global Adjustment Costs

Under the ICI, Class A and Class B consumers are allocated Global Adjustment costs differently. ***Class A*** consumers are charged the Global Adjustment based on their share of consumption during the five peak demand hours in a year.[4] For example, if a Class A consumer was responsible for 1% of Ontario demand during the five peak demand hours in a 12-month period, they would pay 1% of the Global Adjustment in the ensuing 12-month period.[5] By reducing their consumption during peak demand hours, Class A consumers are able to reduce the amount of the

[3] The proposal to amend O. Reg. 429/04 is available at: http://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTEwNzI0&statusId=MTY2MTgw&language=en

[4] Referred to as "coincident peak" demand hours, these five peak demand hours must occur on different days. For example, in 2016 three of the five highest demand hours occurred on August 8th, but only the peak hour during that day (hour ending 18 at 23,100 MW of demand) was treated as one of the five peak demand hours for the purposes of allocating the Global Adjustment under the ICI.

[5] The year-long period during which a consumer's demand during peak demand hours is recorded is the "base period", taking place from May 1 to the following April 30. A consumer's peak demand factor (i.e. percentage of total peak demand) during this base period determines their share of the Global Adjustment for a 12-month "adjustment period" beginning July 1 following the end of the base period.

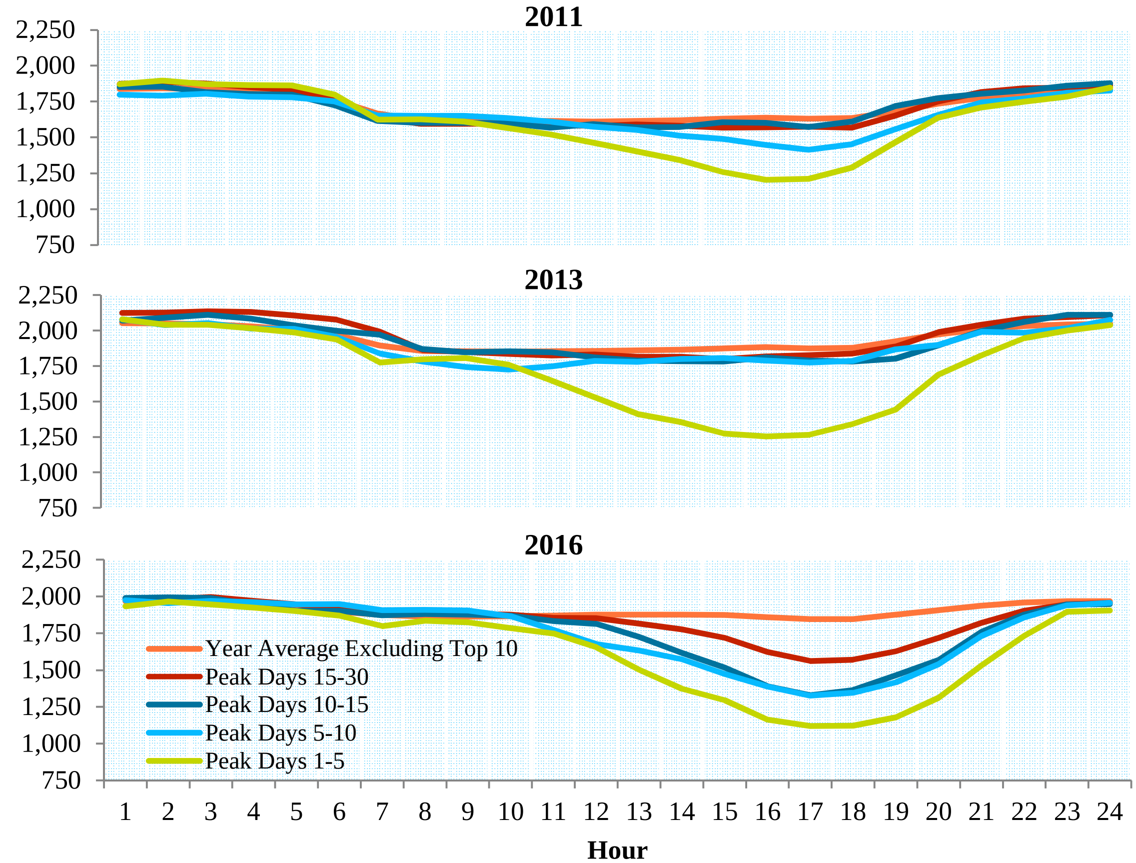
Global Adjustment they pay. Those avoided costs are shifted to ***Class B*** consumers, who pay the remaining Global Adjustment costs on a volumetric basis.

3.1 Impact on Class A Consumption during Peak Demand Hours

The ICI provides Class A consumers with a strong incentive to reduce consumption during peak demand hours. The Panel estimates that by reducing consumption by one megawatt during each of the five peak demand hours in 2016, a Class A consumer would have saved approximately $520,000 in Global Adjustment charges. This incentive has proved effective in reducing Class A consumption during peak demand hours. Figure 2 compares the aggregated consumption profile of all directly-connected Class A consumers[6] on days when peak demand hours occurred in 2011, 2013, and 2016. Reductions in consumption can be measured by comparing consumption during days with a peak demand hour ("Peak Days 1-5" line) to consumption during days without a peak demand hour ("Year Average Excluding Top 10" line).

[6] Directly-connected Class A consumers are those that are connected to the transmission grid. This does not include Class A consumers that are connected at the distribution level. Except where otherwise noted, references to Class A consumers in this report refer to all Class A consumers.

Figure 2: Directly-Connected Class A Response During Peak Demand Days 2011, 2013 and 2016 (MW)



Over the years, consumption reductions have grown as the magnitude of the Global Adjustment, and thus the ICI incentive, have grown. In 2016, on the five days when a peak demand hour occurred, the ICI produced a maximum hourly reduction in directly-connected Class A consumption of 42%, and more moderate reductions during other hours of those days. This compares to a 33% reduction in 2013, and a 26% reduction in 2011.

The Panel cannot precisely determine the total magnitude of peak demand reductions resulting from the ICI as it does not have access to hourly consumption data for Class A consumers that are connected at the distribution level, and not directly connected to the transmission grid.[7] In 2016, 40% of Class A consumers were connected at the distribution level, increasing to 49% in 2017. Based on the assumption that these distribution-connected Class A consumers had the

[7] For more information on data limitations, see the Panel's April 2015 Monitoring Report, pages 105-109, available at: http://www.ontarioenergyboard.ca/oeb/_Documents/MSP/MSP_Report_Nov2013-Apr2014_20150420.pdf

same consumption profile as directly-connected Class A consumers, the Panel estimates that the ICI produced an average peak reduction of 1,200 MW on the five days with peak demand hours in 2016.

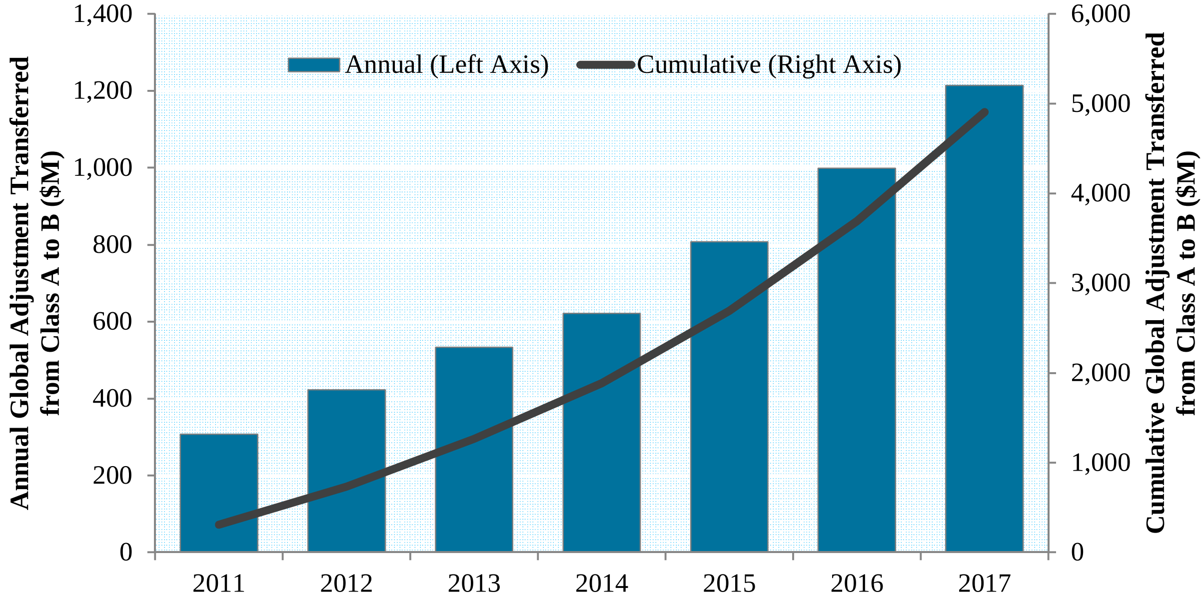
Due to the uncertainty around the days when the year's top five peak demand hours will occur, and given the costly implications of consuming during those hours, Class A consumers reduce consumption in more than just the top five days. This behaviour was prevalent in 2016 (see Figure 2), when there was less certainty around which hours would ultimately make up the five peak demand hours. As a result, directly-connected Class A consumers reduced consumption during a greater number of days (days 6 through 30) compared to years past.[8]

3.2 Impact of the Allocation of the Global Adjustment

As Class A consumers reduce their consumption during peak demand hours and, by extension, the Global Adjustment they pay, the Global Adjustment payable by Class B consumers increases. The resultant shifting of Global Adjustment costs from Class A to Class B consumers has had a significant impact on the effective electricity price paid by both consumer classes. Figure 3 displays the annual Global Adjustment costs shifted from Class A to Class B as a result of participation in the ICI.

[8] In some years, the days containing peak demand hours have been consecutive and easier to predict, resulting in less peak-reducing behaviour outside of those days. In recent years, Ontario has been a summer-peaking jurisdiction, with the peaks typically set during the hottest weekdays in the summer, when air conditioning usage is at its highest. For example, in both 2011 and 2013 the five peak demand hours occurred on consecutive days in the midst of an intense heat wave. Both of these episodes were in mid-July, thus there was little reduction in consumption during the lesser demand days that followed. In the summer of 2016, the 10 highest demand hours occurred over four different weeks from July to September, and this uncertainty induced consumption reductions during hours outside of the days containing the five highest peak demand hours (seen in Figure 2). The expansion of Class A adds further uncertainty around predicting peak demand hours. As more consumers are added to the class, ICI-related demand reductions increase, potentially shifting when the peak demand hours occur. In other words, Class A consumers need to predict the response of other Class A consumers to correctly identify the five peak demand hours.

Figure 3: Global Adjustment Costs Shifted from Class A to Class B Consumers 2011 – 2017 ($ Millions)

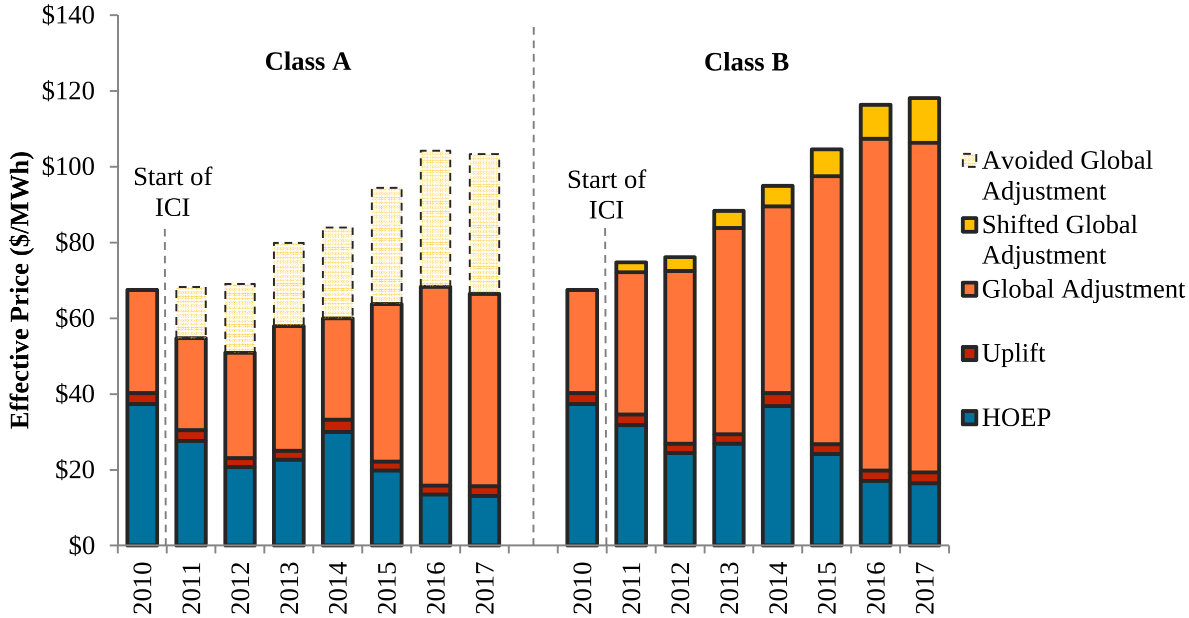


The amount of Global Adjustment costs shifted from Class A to Class B consumers has increased every year since the introduction of the ICI. In 2011, approximately $300 million in Global Adjustment costs were shifted from Class A to Class B consumers as a result of participation in the ICI, representing approximately 3.5% of the total electricity supply costs for Class B consumers that year. In 2017, the costs shifted had increased to $1.2 billion, representing approximately 10% of the total electricity supply costs for Class B consumers. Since 2011, participation in the ICI has shifted a total of $4.91 billion in Global Adjustment costs from Class A to Class B consumers.[9]

Figure 4 displays the average effective electricity price paid by Class A and Class B consumers since 2010, the year prior to the introduction of the ICI. The effective price is broken down by cost component and shows the Global Adjustment costs avoided by Class A consumers and shifted to Class B consumers as a result of Class A participation in the ICI.

[9] As measured from January 2011 to December 2017. Not adjusted for inflation.

Figure 4: Average Effective Electricity Price by Consumer Class
2010 - 2017
($/MWh)



In 2010, the average effective electricity price for both Class A and Class B consumers was $67/MWh. Since then, the average effective price for Class A consumers has decreased to $66/MWh (1.5% decrease), while the average effective price for Class B consumers has increased to $118/MWh (76% increase). In 2017, through participation in the ICI, Class A consumers were able to reduce the average price they pay by $37/MWh. The resultant shift in Global Adjustment costs added approximately $12/MWh to the average price paid by Class B consumers in that same year, representing 24% of the total increase since 2010.[10]

In light of the expansion of the ICI and the increased number of consumers that are eligible for Class A, it is reasonable to expect that the Global Adjustment costs shifted from Class A to Class B consumers will continue to increase.

4. Criteria for Effective Cost Allocation

The Panel recognizes that finding an appropriate balance between competing objectives and interests when allocating costs is challenging. When evaluating the ICI and other methodologies

[10] The per megawatt-hour effective price increase for Class B consumers is smaller than the corresponding decrease for Class A because Class B consumes far more electricity, spreading the cost over more megawatt-hours.

for allocating fixed costs, the Panel suggests that the following should be the principal criteria: efficiency; fairness; simplicity/transparency; and cost recovery.[11] Prices should incent efficient production and consumption decisions in the short-term and efficient investment decisions in the long-term. Prices should be "fair", in the sense of allocating costs to those who cause them and/or benefit from them being incurred. Prices should be simple and transparent, so that consumers can make informed decisions. Finally, prices should be set to wholly recover costs, and should be sustainable in the long-term.

In the following section, the Panel assesses the ICI against these criteria.

5. Assessment of the Industrial Conservation Initiative

5.1 Efficiency

Prices should incent efficient production and consumption decisions in the short-run and efficient investment decisions in the long-run.

Efficiency is concerned with the optimal use of scarce resources in both the short-term and the long-term. In the short-term, this means the least-costly producers of electricity are supplying it to the consumers who value it the most. In the long-term, this means making investments that minimize the average cost of electricity over that period.

Short-Term Efficiency

In a competitive wholesale electricity market, suppliers will offer to sell electricity based on their marginal cost of production, while consumers will bid to buy electricity based on the marginal value they derive from consuming electricity. These offers and bids are aggregated into supply and demand curves respectively, and the market price is set at the intersection of these curves. The result will be a market price equal to the system-wide marginal cost of production. This market price will serve to coordinate the production and consumption of electricity: suppliers of electricity with production costs below the market price will be induced to produce electricity, while consumers who value electricity above the market price will be induced to consume that electricity. This is an efficient outcome.

[11] These principles were articulated in the paper *The Price Isn't Right: Need for Reform in Consumer Electricity Pricing* (2010), available at: https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed//backgrounder_124.pdf . For a recent summary of economic principles and an overview of fixed cost recovery pricing designs see Severin Borenstein's *The Economics of Fixed Cost Recovery by Utilities* (2016), available at: https://ei.haas.berkeley.edu/research/papers/WP272.pdf .

Charging consumers more than the market price of electricity may cause them to forgo consumption, notwithstanding that the value they derive from that electricity exceeds the actual cost of production. This is not an efficient outcome. The volumetric allocation of the Global Adjustment that predated the ICI exhibited deficiencies in this regard. Under that allocation, consumers participating in the wholesale electricity market were charged the market price plus a Global Adjustment charge for every megawatt they consumed. For example, in 2010 the average market price (HOEP) was $37/MWh, while the average volumetric Global Adjustment charge was $27/MWh. Consequently, assuming that market prices reflected the marginal cost of production, consumers were charged $64/MWh (plus uplift) for electricity that cost $37/MWh to produce. Any consumer that valued electricity at more than $37/MWh, but less than $64/MWh, would have been dissuaded from consuming electricity, despite that consumption being efficient.

For a subset of consumers and hours, the ICI represents an efficiency improvement over the volumetric allocation of the Global Adjustment. Class A consumers no longer pay the Global Adjustment based on their consumption in all hours. Instead, their share of the Global Adjustment is now wholly determined by their consumption during the five peak demand hours of the year; their consumption during all other hours has no impact on the Global Adjustment they pay. Consequently, the incremental cost of consumption during all non-peak demand hours is equal to the market price (plus uplift), which serves to maximize short-term efficiency during those hours.

While the ICI resulted in short-term efficiency gains for Class A consumers during non-peak demand hours, it resulted in short-term efficiency losses for Class A consumers during peak demand hours and potential peak demand hours. Whereas a Class A consumer’s allocation of the Global Adjustment was formerly determined by their consumption in all hours, it is now determined based on their consumption in just five hours per year, greatly increasing the cost of consumption during those hours. In 2016, the cost of consuming during a single peak demand hour was approximately $104,000/MWh, more than 6,000 times the average market price of $16/MWh in the same period. In the face of this much higher cost, Class A consumers have foregone from what would otherwise be efficient short-term consumption (see Figure 2).

While shifting costs amongst consumers may not always be viewed as fair, it can be efficient. Consumers value electricity differently; those that place the highest value are willing to bear higher costs before reducing their consumption. To the degree that costs can be shifted from more price-sensitive consumers to less price-sensitive ones, efficiency can be improved. Under the ICI, Class B consumers continue to pay the Global Adjustment on a volumetric basis. As Global Adjustment costs are shifted to Class B consumers, their cost of consumption increases well above the market price. In the face of this higher cost, Class B consumers may also forgo efficient short-term consumption.

When assessing the ICI's overall impact on short-term efficiency, the Panel estimates that the efficiency loss associated with foregone economic consumption by Class A consumers during peak and potential peak demand hours offsets the efficiency gains associated with improving efficiency during non-peak demand hours.[12] An ambiguous or even negative impact on short-term efficiency may ultimately be an acceptable trade-off if it results in increased efficiency in the long term; this is discussed below.

In order to maximize short-term efficiency, the cost of consumption should reflect the short-term marginal cost of production. This should apply to as many consumers and during as many hours as possible.

Long-Term Efficiency

Achieving long-term efficiency means making investments that minimize the average cost of electricity. Doing so means procuring sufficient capacity to meet future demand and reliability needs, but no more, and doing so at the least cost.

Future demand will be affected by expected decreases in peak consumption associated with the ICI. In this respect, the ICI—and the expected peak demand reduction—serve as an alternative to constructing new generating capacity. This can improve long-term efficiency: unlike building a new generator, in theory the ICI does not increase total electricity supply costs, it merely shifts existing costs amongst consumers.

The Panel has not assessed past central-planning activities to determine whether expected demand reductions associated with the ICI alleviated the need to procure additional grid-

[12] See pages 84-91 of the Panel's June 2013 semi-annual Monitoring Report, available at: https://www.oeb.ca/oeb/_Documents/MSP/MSP_Report_May2012-Oct2012_20130621.pdf

connected generating capacity. Assuming that the ICI alleviated the need to procure additional grid-connected generating capacity, it has not necessarily increased long-term efficiency.

The ICI creates an incentive for Class A consumers to invest in new generating or storage capacity located at their facilities. On-site generation offsets consumption from the transmission or distribution grids, allowing Class A consumers to continue their operations during peak demand hours while simultaneously benefiting from the reduction in Global Adjustment charges. Investing in on-site generation has become increasingly economic as the Global Adjustment has increased: building an on-site generator has an annualized cost of approximately $105,000/MW to $135,000/MW, while operating that generator during all five peak demand hours in 2016 would have saved a Class A consumer approximately $520,000/MW in Global Adjustment costs.[13]

Information on exactly how much on-site generation or storage has been built in response to the ICI is not readily available. Nevertheless, there is some evidence that suggests such investments are being made. In 2017 and 2018, three Class A consumers made a combined 33 applications to the Ministry of Environment and Climate Change (as it then was) to build a total of 44 MW of natural gas-fired capacity.[14] One of the express purposes for which this new on-site capacity is being built is "peak shaving", which in turn suggests the purpose is, at least in part, to reduce Global Adjustment costs through participation in the ICI.[15]

The ICI has the potential to change – and appears to be changing – the nature of a portion of generation investments in the province: from large-scale, centrally-procured, grid-connected investments to small-scale, privately-funded, on-site investments. This has the benefit of shifting risk from ratepayers (who pay the costs associated with the IESO's supply contracts) to private investors and increasing the reliability of service for those investing in on-site generation. However, there are potential inefficiencies associated with the decentralization of supply planning.

[13] Estimates of the cost of building on-site generation are based on the construction of a 5 MW gas-fired generator, amortized over 20 years. These estimates are informed by a 2016 study from the U.S. Energy Information Administration and a 2015 study from the U.S. Environmental Protection Agency.
[14] Pending and approved Environmental Compliance Approvals in the province of Ontario are publicly available at: https://www.ebr.gov.on.ca/ERS-WEB-External/
[15] An August 2018 article notes that, "Ontario's Global Adjustment is creating a behind-the-meter energy storage boom," citing the construction of a 10 MW storage system as a recent example. Peter Mahoney, Utility Dive, *Behind-The-Meter Storage is Booming in Ontario,* available at: https://www.utilitydive.com/news/btm-storage-is-booming-in-ontario/530518/

The decision to centrally procure additional grid-connected capacity should be based on whether that capacity is needed to meet system-wide demand. Conversely, a private enterprise’s decision on whether to build an on-site generator is based on their private incentives, not on the supply needs of the system as a whole.

Ontario currently finds itself in surplus supply conditions, yet the incentive to reduce consumption under the ICI has never been stronger. Perversely, the incentive for Class A consumers to reduce peak demand—by investing in on-site generation capacity or otherwise—is strongest when there is ample supply and wholesale market electricity prices are low. As shown in Figure 1, lower market prices result in a higher portion of costs being recovered through the Global Adjustment, providing a stronger incentive for Class A consumers to reduce their consumption during peak demand hours. These conditions may encourage private investment in generating capacity that is not needed to meet system-wide demand. The converse is also true; when supply is tight and market prices are high, the Global Adjustment is smaller and the incentive to reduce peak consumption is lower.

Additionally, investment in small on-site generation capacity may be less efficient than investment in large grid-connected capacity. To the degree capacity was or will be needed, Ontario has a multitude of options available to it, including investments in different generating technologies, demand response, conservation, etc. The IESO also has (or is developing) competitive mechanisms to procure these resources, which uniquely situates it to be able to select the least costly sources of capacity. IESO procurement also benefits from economies of scale, as its investments in large grid-connected capacity may be less costly than many private investments in small on-site capacity on a per megawatt of capacity basis.

Improving long-term efficiency requires a better understanding of how the current allocation of the Global Adjustment is affecting investment in new capacity. To that end, information related to the construction of on-site generation and storage should be gathered. That information can inform decisions about the extent to which the ICI is inducing private investment in unnecessary capacity. If investment is needed, the ICI should not provide a private incentive to build on-site capacity that significantly exceeds the cost of centrally procuring grid-connected capacity, as is the case with the ICI incentive today.

5.2 Fairness

Prices should be fair, in the sense of assigning costs to those who cause them and/or benefit from them being incurred.

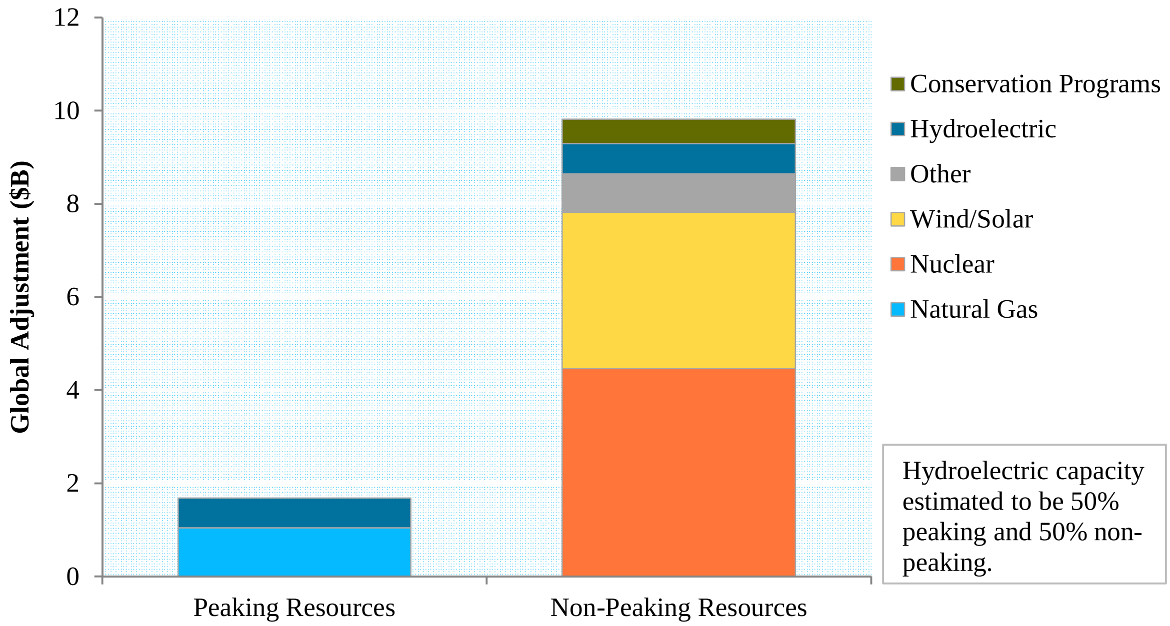
The costs recovered through the Global Adjustment are not limited to the cost of needed generation, nor was all capacity procured on a least-cost basis. Global Adjustment costs include costs related in part to the achievement of environmental and other social policy goals. For instance, the *Green Energy and Green Economy Act, 2009* (Act) offered prospective proponents the opportunity to build new wind and solar generators based on long-term contracts. However, the Act had objectives beyond simply securing needed generating capacity at least cost, including environmental and health objectives related to greenhouse gas reductions and economic objectives related to developing new green industries in the province. In the service of these broader policy goals, the Act procured clean, but more costly, generating capacity in the form of wind and solar resources, in lieu of less clean, but less costly, capacity. Paying a premium to procure clean capacity and recovering those costs through the Global Adjustment means the associated charge covers more than the cost of procuring needed generation at least cost. Incremental costs incurred in support of such broader policy goals are to the benefit of all Ontarians—not just electricity consumers subject to paying the Global Adjustment.

Assuming that costs unrelated to the fixed capacity costs of needed generation are removed from the Global Adjustment, allocating the remaining costs in a fair manner becomes a question of who induces the fixed capacity costs and who benefits from having that capacity available.

One of the considerations in transitioning to the ICI was a concern that large electricity consumers were paying more than their fair share of fixed capacity costs under the volumetric allocation of the Global Adjustment. As the argument goes, large industrial consumers, who typically consume a similar quantity of electricity irrespective of the time of day or weather, do not typically contribute to peaks in demand. Therefore, they should not have to pay the fixed capacity costs of generators that primarily operate during periods of peak demand.

While that fairness argument has some merit, the ICI goes further than necessary. The fixed capacity costs recovered through the Global Adjustment are not limited to those associated with peaking capacity; in fact, the Global Adjustment is mainly composed of the fixed capacity costs of non-peaking generators, as seen in Figure 5.

Figure 5: Components of the Global Adjustment May 2016 – April 2017 ($ Billions)



The Panel estimates that payments to peaking resources make up less than 20% of the costs recovered through the Global Adjustment.[16] The remaining 80% of fixed capacity costs are for non-peaking resources, which Class A consumers use and benefit from during most hours of the year. Despite benefitting from non-peaking resources, the ICI provides Class A consumers with the opportunity to avoid all Global Adjustment costs, which some manage to do. During the five peak demand hours in 2017, five directly-connected Class A consumers consumed no electricity, meaning they pay no Global Adjustment during the following 12-month period. Of the other directly-connected Class A consumers, more than half paid less than 50% of the Global Adjustment they would have paid under a volumetric allocation. This suggests that they too avoided paying for some of the fixed capacity costs of non-peaking generation from which they benefit. Fairness would therefore be enhanced if the cost of peaking generation were to be

[16] Another way to delineate between the fixed capacity costs associated with peaking generation versus non-peaking generation is to consider the utilisation of these resources during peak demand hours. For instance, if a wind resource could reliably generate 25% of its maximum capacity during peak demand hours, 25% of its fixed capacity costs would be considered peaking, while 75% would be considered non-peaking.

allocated based on consumption during peak demand hours, with the cost of non-peaking generation being allocated such that all consumers that benefit from that capacity pay for that capacity.

5.3 Simplicity and Transparency

Prices should be simple and transparent, so that consumers can make informed consumption decisions.

For Class A consumers, determining the cost of consuming electricity during peak and potential peak demand hours is neither simple nor transparent. In order to know the cost of consuming, a Class A consumer must correctly predict whether the hour in question will be a peak demand hour, what percentage of Ontario demand their consumption will represent and the size of the Global Adjustment in the following year, among other things. Figure 1 shows that the Global Adjustment has grown ten-fold in the last decade and has varied by billions of dollars from one year to the next.

Consider the uncertainty around whether or not a given hour will be a peak demand hour, and how the cost of consumption changes under either scenario. The cost of consuming during a non-peak demand hour is equal to the market price for electricity plus uplift, which together averaged approximately $16/MWh in 2016. During a peak demand hour—when a Class A consumer's share of Global Adjustment costs is determined—the cost of consumption is vastly greater. In 2016, the cost of consuming during a single peak demand hour was approximately $104,000/MWh, over 6,000 times the cost of consumption in an average non-peak demand hour.

Not knowing whether the cost of consumption is $16/MWh or $104,000/MWh complicates consumption decisions. The risk of the much higher cost can drive Class A consumers to reduce their consumption during what turn out to be non-peak demand hours (see Figure 2), foregoing efficient consumption. Knowing the cost of consumption in advance of having to make their consumption decision—or being able to predict the cost more easily—can prevent this undesirable outcome.

5.4 Cost Recovery

Prices should be set to wholly recover costs, and should do so sustainably.

The ICI results in the full recovery of Global Adjustment costs. However, as the cost of electricity increases—for Class B consumers, in part as a result of the ICI—consumers are incented to reduce their consumption or withdraw from the grid entirely.[17] As they do so, the average Global Adjustment to be recovered from all remaining consumers increases further, incenting additional consumers to reduce consumption or withdraw, perpetuating the cycle.

Class B consumption has decreased every year since the ICI was introduced, with 2017 consumption down 15.3 TWh (12.9%) relative to 2011. Part of this decline can be attributed to a number of larger Class B consumers converting to Class A consumers as the threshold for participating in the ICI was lowered. Illustrating this, Class A consumption has increased every year, with 2017 consumption up 10.2 TWh (44.7%) relative to 2011. The remaining decline in Class B consumption is in part due to the rising cost of electricity over the years. The decline in Class B consumption increases the price of electricity for remaining Class B consumers. While this dynamic is currently only a minor contributor to increasing Class B electricity costs, its effects could grow as Class B consumption declines.

6. Conclusion and Enhancing Alignment with Cost Allocation Principles

In the Panel's view, the ICI as presently structured is a complicated and non-transparent means of recovering costs, with limited efficiency benefits. Arguably, the ICI does not allocate costs fairly in the sense of assigning costs to those who cause them and/or benefit from them being incurred. In addition, the ICI perversely creates the greatest incentive for peak conservation in years when the supply is ample and marginal cost is lowest and the least incentive in years when supply is tight and marginal cost is high.

The Panel recognizes that trade-offs may be necessary or desirable in relation to the cost allocation criteria discussed in this report; sacrificing fairness in service of long-term efficiency, for example. Nevertheless, the Panel believes that both market efficiency and fairness of the ICI

[17] Withdrawing from the grid entails consuming no electricity from the transmission or distribution grid. For some, particularly large industrial or manufacturing loads, this means relocating business; for others, this means installing on-site generation, such as solar panels. Withdrawing from the grid is becoming increasingly economic as the cost of small-scale generating technology decreases and the price of consuming electricity from the grid increases.

(or an alternative methodology intended to serve much the same purpose) can be enhanced by ensuring that:

- Costs that are not related to the fixed capacity costs of needed generation are removed from the Global Adjustment and recovered by other means.
- Only the cost of peaking generation is recovered based on consumption during peak demand hours; the cost of non-peaking generation should be allocated such that all consumers that benefit from that capacity pay for that capacity.
- Information is gathered in relation to the construction of on-site generation and storage; this can inform decisions about the extent to which the ICI is incenting private investment in unnecessary capacity.
- The ICI does not provide a private incentive to build on-site capacity that significantly exceeds the cost of centrally procuring grid-connected capacity, as is the case with the ICI incentive today.
- The cost of consumption reflects the short-term marginal cost of production; this should apply to as many consumers and during as many hours as possible.

TAB F

This is Exhibit **"F"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

130 FERC ¶ 61,213
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 35

Demand Response Compensation in Organized Wholesale Energy Markets — Docket No. RM10-17-000

PJM Interconnection, L.L.C. — Docket No. EL09-68-000

(March 18, 2010)

AGENCY: Federal Energy Regulatory Commission

ACTION: Notice of Proposed Rulemaking.

SUMMARY: The Federal Energy Regulatory Commission is issuing a Notice of Proposed Rulemaking (NOPR) proposing an approach for compensating demand response resources in order to improve the competitiveness of organized wholesale energy markets and thus ensure just and reasonable wholesale rates. The Commission invites all interested persons to submit comments in response to the regulatory text proposed herein.

DATES: Comments are due 45 days after publication in the Federal Register.

ADDRESSES: You may submit comments, identified by docket number by any of the following methods:

- Agency Web Site: http://ferc.gov. Documents created electronically using word processing software should be filed in native applications or print-to-PDF format and not in a scanned format.

- Mail/Hand Delivery: Commenters unable to file comments electronically must mail or hand deliver an original and 14 copies of their comments to: Federal Energy Regulatory Commission, Secretary of the Commission, 888 First Street, N.E., Washington, DC 20426.

Instructions: For detailed instructions on submitting comments and additional information on the rulemaking process, see the Comment Procedures Section of this document.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION:

130 FERC ¶ 61,213
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Demand Response Compensation in Organized Wholesale Energy Markets — Docket No. RM10-17-000

PJM Interconnection, L.L.C. — Docket No. EL09-68-000

NOTICE OF PROPOSED RULEMAKING

(March 18, 2010)

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NOTICE OF PROPOSED RULEMAKING

(March 18, 2010)

1. The Federal Energy Regulatory Commission (Commission) is proposing to revise its regulations to establish the approach described below as compensation for demand response[1] resources[2] participating in organized energy markets. We propose that Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs)[3] with tariff provisions permitting demand response providers to participate as resources in energy markets by reducing consumption of electricity from their expected

[1] Demand response means a reduction in the consumption of electric energy by customers from their expected consumption in response to an increase in the price of electric energy or to incentive payments designed to induce lower consumption of electric energy. 18 CFR § 35.28 (b)(4).

[2] Demand response resource means a resource capable of providing demand response. 18 CFR § 35.28 (b)(5).

[3] The following RTOs and ISOs have organized wholesale electricity markets: PJM Interconnection, L.L.C. (PJM); New York Independent System Operator, Inc. (NYISO); Midwest Independent Transmission System Operator, Inc. (Midwest ISO); ISO New England, Inc. (ISO-NE); California Independent System Operator Corp. (CAISO); and Southwest Power Pool, Inc. (SPP).

levels in response to price signals be required to pay to demand response providers, in all hours, the market price for energy for such reductions.[4]

I. Background

A. Role of Demand Response in Organized Wholesale Energy Markets

2. The Commission has acted over the last several decades to implement Congressional policy to expand the wholesale energy markets to facilitate entry of new resources and support competitive markets. Most recently, the Commission in Order No. 719 implemented a series of reforms aimed at improving the competitiveness of the organized energy markets, finding that effective wholesale competition protects consumers by, among other things, providing more supply options, encouraging new entry and innovation, and spurring deployment of new technologies.[5] Improving the

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[4] This provision applies only to demand response acting as a resource in organized wholesale energy markets. The provision will not apply to demand response under programs that ISOs and RTOs administer for reliability or emergency conditions, such as, for instance, Midwest ISO's Emergency Demand Response; NYISO's Emergency Demand Response Program; PJM's Emergency Load Response; and ISO-NE's Real-Time 30-Minute Demand Response Program, Real-Time and 2-Hour Demand Response Program, and Real-Time Profiled Response Program. This provision also will not apply to compensation in ancillary services markets, which the Commission has addressed elsewhere. See e.g., Wholesale Competition in Regions with Organized Electric Markets, Order No. 719, 73 Fed. Reg. 64,100 (Oct. 28, 2008), FERC Stats. & Regs. P 31,281 (2008) (Order No. 719 or Final Rule).

[5] See Order No. 719 at P 1; see also Regional Transmission Organizations, Order No. 2000, FERC Stats. & Regs. ¶ 31,089, at P 1 (1999), order on reh'g, Order No. 2000-A, FERC Stats. & Regs. ¶ 31,092 (2000), aff'd sub nom. Pub. Util. Dist. No. 1 of Snohomish County, Washington v. FERC, 272 F.3d 607, 348 U.S. App. D.C. 205

(continued…)

competitiveness of organized wholesale markets, the Commission concluded, is therefore "integral to the Commission fulfilling its statutory mandate to ensure supplies of electric energy at just, reasonable, and not unduly discriminatory or preferential rates."[6]

3. As the Commission recognized in Order No. 719, active participation by customers in organized wholesale energy markets through demand reductions helps to increase competition in those markets.[7] Demand reductions whereby customers reduce electricity consumption from normal usage levels in response to price signals can generally occur in two ways: (1) customers reduce demand by responding to dynamic rates that are based on wholesale prices (sometimes called "price-responsive demand"); and (2) customers can provide demand response that acts as a resource in wholesale markets to balance supply and demand. While a number of states and utilities are pursuing retail-level price-responsive demand initiatives based on dynamic and time-differentiated retail prices and utility investments, these are state initiatives, and, thus, are not the subject of this proceeding.[8] Our focus here is on customers providing - through bids - demand response that acts as a resource in organized wholesale energy markets.

(D.C. Cir. 2001).

[6] Order No. 719 at P 1.

[7] See Order No. 719 at P 48.

[8] Some ISOs and RTOs are engaged in stakeholder discussions concerning the coordination necessary between wholesale markets and retail rate design, and we expect

(continued…)

4. Demand response acting as a resource in organized wholesale energy markets helps to improve the functioning and competitiveness of such markets in several ways. First, demand response can lower prices. When bid directly into the wholesale market, demand response – which results in lower demand – can result in lower clearing prices.[9] For example, a study conducted by PJM, which simulated the effect of demand response on prices, demonstrated that a modest three percent load reduction in the 100 highest peak hours corresponds to a price decline of six to 12 percent.[10] Demand response can also lower prices in the organized wholesale energy markets by reducing the need to dispatch higher-priced generation, or construct new generation, in an effort to satisfy load.[11] Second, demand response can mitigate generator market power.[12] This is

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to address any filings emerging from those discussions in future proceedings.

[9] Wholesale Competition in Regions with Organized Electric Markets, Order No. 719-A, FERC Stats. & Regs. ¶ 31,292 (2009).

[10] ISO-RTO Council Report, Harnessing the Power of Demand How ISOs and RTOs Are Integrating Demand Response into Wholesale Electricity Markets, found at http://www.isorto.org/atf/cf/%7B5B4E85C6-7EAC-40A0-8DC3-003829518EBD%7D/IRC_DR_Report_101607.pdf.

[11] Id. ("Demand response tends to flatten an area's load profile, which in turn may reduce the need to construct and use more costly resources during periods of high demand; the overall effect is to lower the average cost of producing energy."). Similarly, NYISO "has experienced a significant increase in the registration of the [demand response] programs that have effectively reduced the need for additional [generation] capacity resources to the system based on customer pledges to cut energy usage on demand." See NYISO's 2009 Comprehensive Reliability Plan at 3, found at http://www.nyiso.com/public/webdocs/newsroom/planning_reports/CRP__FINAL_5-19-

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because the more demand response is able to reduce demand, the more downward pressure it places on generator bidding strategies by increasing the risk to a supplier that it will not be dispatched if it bids a price that is too high.[13] Third, demand response has the potential to support system reliability and address resource adequacy[14] and resource management challenges surrounding the unexpected loss of generation.[15]

09.pdf.

[12] See Comments of NYISO's Market Monitor filed in Docket No. ER09-1142-000, May 15, 2009 (Demand response "contributes to reliability in the short-term, resource adequacy in the long-term, reduces price volatility and other market costs, and mitigates supplier market power.").

[13] Id.

[14] See ISO-RTO Council Report, Harnessing the Power of Demand How ISOs and RTOs Are Integrating Demand Response into Wholesale Electricity Markets at 4, found at http://www.isorto.org/atf/cf/%7B5B4E85C6-7EAC-40A0-8DC3-003829518EBD%7D/IRC_DR_Report_101607.pdf ("Demand response contributes to maintaining system reliability. Lower electric load when supply is especially tight reduces the likelihood of load shedding. Improvements in reliability mean that many circumstances that otherwise result in forced outages and rolling blackouts are averted, resulting in substantial financial savings . . . ."); Smart Grid Policy, 126 FERC ¶ 61,253, at P 19 and n.23 (2009) ("The Smart Grid concept envisions a power system architecture that permits two-way communication between the grid and essentially all devices that connect to it, ultimately all the way down to large consumer appliances. . . . Once that is achieved, a significant proportion of electric load could become an important resource to the electric system, able to respond automatically to customer-selected price or dispatch signals delivered over the Smart Grid infrastructure without significant degradation of service quality.").

[15] For instance, in ERCOT, on February 26, 2008, through a combination of a sudden drop in power supplied by wind generators, a quicker-than-expected ramping up of demand, and the loss of thermal generation, ERCOT found itself short of reserves.

(continued…)

5. Given its ability to lower electricity prices and ensure reliability, demand response can play a critical role in helping the Commission fulfill its mandate under the Federal Power Act (FPA) to ensure that rates charged for energy are just and reasonable.[16] Accordingly, and consistent with national policy requiring facilitation of demand response,[17] the Commission has acted to remove barriers to participation of demand response resources in organized wholesale electricity markets. For example, in Order No. 890, the Commission modified the pro forma Open Access Transmission Tariff to allow non-generation resources, including demand response resources, to be used in the provision of certain ancillary services where appropriate on a comparable basis to service provided by generation resources.[18] Order No. 890-A further requires transmission

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The system operator called on all demand response resources, and 1200 MW of Load acting as Resource (LaaRs) responded within ten minutes, bringing ERCOT back into balance, from 59.85 Hz back to 60 Hz.

[16] 16 U.S.C. § 824d (2006).

[17] See EPAct 2005, Pub. L. No. 109-58, § 1252(f), 119 Stat. 594, 965 (2005) ("It is the policy of the United States that . . . unnecessary barriers to demand response participation in energy, capacity, and ancillary service markets shall be eliminated.").

[18] Preventing Undue Discrimination and Preference in Transmission Service, Order No. 890, FERC Stats. & Regs. ¶ 31,241 at P 887-88 (2007), order on reh'g, Order No. 890-A, FERC Stats. & Regs. ¶ 31,261 (2007), order on reh'g and clarification, Order No. 890-B, 73 Fed. Reg. 39092 (Jul. 8, 2008), 123 FERC ¶ 61,299 (2008), order on reh'g, Order No. 890-C, 126 FERC ¶ 61,228 (2009), order on clarification, Order No. 890-D, 129 FERC ¶ 61,126 (2009).

providers to develop transmission planning processes that treat all resources, including demand response, on a comparable basis.[19]

6. The Commission built on these reforms in Order No. 719, requiring ISOs and RTOs to, among other things, accept bids from demand response resources in their markets for certain ancillary services on a basis comparable to other resources.[20] The Commission also required each ISO and RTO "to reform or demonstrate the adequacy of its existing market rules to ensure that the market price for energy reflects the value of energy during an operating reserve shortage,"[21] for purposes of encouraging existing generation and demand resources to continue to be relied upon during an operating reserve shortage, and encouraging entry of new generation and demand resources.[22]

B. Current ISO and RTO Demand Response Programs

7. In addition to the foregoing efforts, the Commission has issued orders in recent years approving various types of ISO and RTO demand response programs. As noted above, some of these programs are administered for reliability and emergency conditions. Apart from these programs, wholesale customers and qualifying large retail customers

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[19] Order No. 890-A at P 216.

[20] Order No. 719 at P 47-49.

[21] Id. P 194.

[22] Id. P 247.

may bid demand response directly into the day-ahead and real-time energy markets, certain ancillary service markets and capacity markets.[23] Demand response providers participating as resources in the day-ahead and real-time energy markets are the subject of this proceeding.

8. With particular regard to demand response compensation for this latter category of resources, the Commission previously has allowed a system-by-system approach, whereby each RTO and ISO has developed its own compensation methodologies for demand response resources in its energy market. As a result, the levels of compensation for demand response vary significantly among RTOs and ISOs. PJM pays the Locational Marginal Price (LMP)[24] minus the generation and transmission portions of the retail

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[23] Other demand response programs allow demand response to be used as a capacity resource and as a resource during system emergencies or permit the use of demand response for synchronized reserves and regulation service. See, e.g., PJM Interconnection, L.L.C., 117 FERC ¶ 61,331 (2006); Devon Power LLC, 115 FERC ¶ 61,340, order on reh'g, 117 FERC ¶ 61,133 (2006), appeal pending sub nom., Maine Pub. Utils. Comm'n v. FERC, No. 06-1403 (D.C. Cir. 2007); New York Indep. Sys. Operator., Inc., 95 FERC ¶ 61,136 (2001); NSTAR Services Co. v. New England Power Pool, 95 FERC ¶ 61,250 (2001); New England Power Pool and ISO New England, Inc., 100 FERC ¶ 61,287, order on reh'g, 101 FERC ¶ 61,344 (2002), order on reh'g, 103 FERC ¶ 61,304, order on reh'g, 105 FERC ¶ 61,211 (2003); PJM Interconnection, L.L.C., 99 FERC ¶ 61,227 (2002).

[24] LMP refers to the price calculated by the ISO or RTO at particular locations or electrical nodes within the ISO or RTO footprint and is used as the market price to compensate generators. There are variations in the way ISOs and RTOs calculate LMP; however, each method establishes the marginal value of resources in that market. Nothing in this NOPR is intended to change ISO and RTO methods for calculating LMP.

rate.[25] ISO-NE and NYISO currently pay LMP when prices are above a threshold level, with the levels differing between the RTOs.[26] The Midwest ISO currently has a program that pays LMP for demand response in the real-time energy market when the demand response provider has purchased the amount reduced in the day-ahead market for energy and ancillary services.[27] CAISO pays LMP in its participating load program that allows qualifying resources to provide day-ahead and real-time energy and non-spinning reserves.[28] SPP currently has no demand response program at all.[29] ISOs and RTOs

[25] PJM FERC Electric Tariff, Sixth Revised Sheet No. 388D.01.

[26] For example, under ISO-NE's Real Time Price Response Program, the minimum bid is $100/MWh and a demand response resource is paid the higher of LMP or $100/MWh. See Section III.1.3 of the ISO New England Transmission, Markets and Services Tariff, Section 1 of the Second Restated New England Power Pool Agreement. NYISO implements a day-ahead demand response program by which resources bid into the market at a minimum of $75/MWh and can get paid the LMP. See NYISO Incentivized Day-Ahead Economic Load Curtailment Program, Fifth Revised Tariff Sheet No. 34-34A, 89.

[27] See Charges and Credits for Real-Time Energy and Operating Reserve Market Energy Purchases and Sales Associated with Demand Response Resources. Midwest ISO FERC Electric Tariff, Fourth Revised Volume No. 1, Second Revised Sheet No. 1114.

[28] See section 11.2.1.1 IFM Payments for Supply of Energy, CAISO FERC Electric Tariff.

[29] However, the Commission has directed SPP to report on ways it can incorporate demand response into its imbalance market. Southwest Power Pool, Inc., 114 FERC ¶ 61,289, at P 229 (2006). In its orders addressing SPP's compliance with Order No. 719, the Commission also directed SPP to make a subsequent compliance filing addressing demand response participation in its organized markets.

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have continued to examine the effectiveness of demand response compensation in their respective regions, and, as a result, the issue of proper compensation continues to be the subject of several proceedings.[30]

C. The Need for Reform

9. Despite the benefits of demand response and various efforts by the Commission, ISOs and RTOs to address barriers to and compensation for demand response participation, demand response providers collectively play a small role in wholesale markets. After several years of observing demand response participation in ISO and RTO markets with different, and often evolving, demand response compensation structures, the Commission is concerned that some existing, inadequate compensation structures have hindered the development and use of demand response. The impediment has been addressed at Commission-sponsored technical conferences concerning demand response, where participants have confirmed that customers "must have confidence that appropriate price signals will be sustained by stable competitive pricing structures, before

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Southwest Power Pool, Inc., 129 FERC ¶ 61,163, at P 51 (2009).

[30] See PJM Interconnection, L.L.C., Docket No. EL09-68-000; ISO New England, Inc., Docket No. ER09-1051-000; ISO New England, Inc., Docket No. ER08-830-000; Midwest Indep. Transmission Sys. Operator, Inc., Docket No. ER09-1049-000.

they will make an investment in demand response."[31] Some participants have advised that demand response quite simply will not occur without adequate compensation.[32]

10. Indeed, there are indications that demand response resources react correspondingly to increases or decreases in payment. PJM provides a case study on this point. It first implemented its Economic Load Response Program (Economic Program) providing for demand response compensation in June 2002.[33] Several years later, starting in January 2008, when PJM reduced its compensation for demand response, settled demand reductions began decreasing from previous years.[34] Specifically, PJM's Market Monitor noted that, from 2007 to 2008, following the decrease in compensation, settled demand

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[31] Transcript of Order No. 719 technical conference at 24, statement by James Eber, Director of Demand Response at Commonwealth Edison, found at http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=3994&CalType=%20&CalendarID=116&Date=05/21/2008&View=Listview.

[32] See Statements of Larry Stalica, Vice President, Linde Energy Services, Inc. FERC Technical Conference- Demand Response in Organized Electric Markets, May 21, 2008, found at http://www.ferc.gov/EventCalendar/Files/20080521081612-Stalica,%20Linde%20Energy%20Services.pdf. ("The mere avoidance of electricity prices often provides insufficient value to offset these real costs. Demand response will not occur if customers do not have an economic incentive to reduce consumption.").

[33] See PJM Interconnection, L.L.C., 99 FERC ¶ 61,227 (2002). PJM's Economic Program provided for payment of LMP for all demand response reductions when LMP equaled or exceeded $75/MWh and paid LMP minus the generation and transmission components of the retail rate when LMP was less than $75/MWh.

[34] The tariff provision providing for payment of LMP when LMP equaled or exceeded $75/MWh terminated by its terms on December 31, 2007, and, since then, PJM has paid only LMP minus the generation and transmission components of the retail rate.

reductions decreased by 36.8 percent, from 714,200 MWh to 458,300 MWh, and the decline has continued at least through March 2009.[35] Although the Commission had rejected a request to prevent the compensation decrease from occurring as per the terms of PJM's then-existing tariff, the Commission encouraged PJM and its stakeholders to continue analyzing the effectiveness of PJM's demand response program with the decreased payments for demand response.[36] Based upon our own review, the Commission is now concerned that evidence of demand reductions in PJM, and inadequate demand response participation , now and in the future, may be the result of compensation that is no longer just and reasonable, because, as detailed below, the existing and varying levels of compensation generally fail to reflect the marginal value of demand response resources to ISO and RTO energy markets.

II. Discussion

11. Given the importance of demand response resources to the competitiveness of organized wholesale electricity markets, and based upon our experience to date with demand response in the ISO- and RTO-administered markets, the Commission proposes to address compensation for demand response resources participating in organized wholesale energy markets generically in this proceeding. The Commission proposes to

[35] Monitoring Analytics, Barriers to Demand Side Response in PJM at 22 (July 1, 2009).

[36] PJM Interconnection, L.L.C., 121 FERC ¶ 61,315, at P 29 (2007).

add section 35.18(g)(1)(v) to our regulations to establish a specific compensation approach for demand response resources participating in organized wholesale energy markets (such as the day-ahead and real-time markets administered by the ISOs and RTOs). Under the proposed section, each Commission-approved ISO and RTO that has a tariff provision providing for participation of demand response resources in its energy market must pay demand response resources, in all hours, the market price for energy, i.e., full LMP, for demand reductions made in response to price signals.[37]

12. The Commission proposes to take this action generically to address issues that are common to the RTO and ISO markets in a coordinated manner in a single proceeding. As discussed further below, we believe paying demand response resources the LMP in all hours will compensate those resources in a manner that reflects the marginal value of the resource to each RTO and ISO, comparable to treatment of generation resources. This will improve the competitiveness of the organized wholesale energy markets and, in turn, help to ensure that energy prices in those markets are just and reasonable.

13. As explained above, we have previously accepted a variety of ISO and RTO proposals for compensation for demand response providers, with different levels of

[37] This provision will not apply to programs that ISOs and RTOs administer for reliability or emergency conditions. In those situations, the ISO and RTO tariffs may provide compensation that is not necessarily related solely to energy prices but is designed to prevent involuntary load curtailment.

payment. As we have gained experience with these programs, we are concerned that the current compensation levels appear to have become unjust and unreasonable. Providers may submit price and quantity bids into the organized wholesale energy markets and the market clears at the marginal resource yet they fail to compensate demand response at levels that reflect the marginal value of the resource being used by the RTO or ISO to balance supply and demand. The current wholesale compensation levels may therefore be leading to under-investment in demand response resources, resulting in higher, and unjust and unreasonable, prices in the organized electricity markets. To help ensure that wholesale prices in ISOs and RTOs remain just and reasonable, we are proposing to require each ISO and RTO to pay the LMP to demand response providers participating in the organized wholesale energy markets.

14. It is a well-established practice in the organized wholesale energy markets to rely on LMPs to encourage efficient behavior by market participants. The LMP represents the value of additional supply or reductions in consumption at each node within the RTO or ISO and, thus, reflects the marginal cost of the last unit necessary to efficiently balance supply and demand.[38] The LMP is therefore the primary mechanism for compensating

[38] See ISO New England, Inc., 100 FERC ¶ 61,287, at P 71 (2002) (LMP "provide[s] appropriate price signals indicating the value of additional resources or conservation at each node in the transmission system"); Cleco Power LLC, et al., 103 FERC ¶ 61,272, at P 67 (2003) ("It is widely observed that markets work efficiently when prices reflect marginal costs, i.e., when the market price will be equal to the cost of

(continued…)

generation resources clearing in the organized electricity markets, which the Commission has found encourages "more efficient supply and demand decisions in both the short run and long run."[39]

15. Given that the LMP represents the marginal value of the resource being used by the RTO or ISO to balance supply and demand, it follows that the LMP should be paid to any resource clearing in the RTO's or ISO's energy market. In balancing supply and demand, a one megawatt reduction in demand is equivalent to a one megawatt increase in energy for purposes of meeting load requirements and maintaining a reliable electric system. The ISO or RTO is able to avoid dispatching suppliers with higher bids, be they generation or demand response, by accepting a lower bid to either reduce consumption or increase generation. As Dr. Alfred E. Kahn noted in a recent *PJM* proceeding in Docket No. EL09-68-000, consumers offering to reduce consumption should be induced "to behave as they would if the market mechanisms alone were capable of rewarding them directly for efficient economizing."[40] This is because "the (incremental) costs saved by curtailments in demand clearly will be LMP - including the marginal costs of generation.

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bringing to market the last unit necessary to balance supply and demand.").

[39] See New England Power Pool, 101 FERC ¶ 61,344, at P 35 (2002).

[40] Kahn Affidavit at 4.

So, in the end the LMP inducement is the economically correct one."[41] This appears to be true across all ISOs and RTOs and, therefore, it appears appropriate to compensate both generation and demand response resources participating in the organized wholesale electricity markets at the LMP.

16. Ultimately, the markets themselves will determine the level of generation and demand response resources needed to balance energy and demand. The level of compensation provided to each resource, however, affects its willingness and ability to participate in the market. [42] For example, demand response resources need to make investments in technologies to enable participation in the organized wholesale energy markets, as well as incur costs in changing their operations in order to provide demand response. In those markets paying less than the LMP to demand response resources, such resources have less revenues to support investment in demand response-enabling technology (such as metering equipment, energy usage monitors and process controls) necessary to enable more wholesale market participation by demand response resources. Where compensation for demand response is inadequate, demand response resources will be hesitant to invest in demand response devices. Compared to existing compensation

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[41] Id. at 3.

[42] Generation and demand response resources have the potential to earn other revenues through bilateral arrangements, capacity markets where they exist, and ancillary services.

levels, paying the LMP in all hours should allow more demand response resources to cover their investment costs and increase their ability to participate in the organized wholesale electric markets.

17. Increased levels of demand response participation, in turn, should lead to lower clearing prices in the organized wholesale energy markets. As the Commission explained in accepting PJM's Economic Load Response Program:

> Without a demand response mechanism, [an independent system operator] is forced to work under the assumption that all customers have an inelastic demand for energy and will pay any price for power. There is ample evidence that this is not true. Many customers, given the right tools, can and will manage their demand. . . . A working demand response program puts downward pressure on price, because suppliers have additional incentives to keep bids close to their marginal production costs and high supply bids are more likely to reduce the bidder's energy sales. Appropriate price signals to customers thus helps to mitigate market power as high supply bids are more likely to reduce the bidders' energy sales. Suppliers thus have additional incentive to keep bids close to their marginal production costs.[43]

18. Additionally, increasing the aggregate amount of demand response resources in the organized wholesale energy markets will help to move prices closer to the levels that would result if all demand could respond to the marginal cost of energy. Paying the LMP to those potential demand response resources who are capable of responding – but who

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[43] PJM Interconnection, L.L.C., 99 FERC ¶ 61,227, at 61,939 (2002) (quoting PJM Interconnection, L.L.C., 99 FERC ¶ 61,139, at 61,573 (2002)).

have not been participating as a resource due to inadequate compensation – should bring those additional demand response resources into the organized wholesale energy markets. But again, the markets themselves will determine the appropriate level of demand response, and generation, resources needed by the ISO and RTO to balance energy and demand based on their relative bids into the markets.

19. We recognize that the appropriate level of compensation for demand response resources participating in organized wholesale energy markets has been the subject of debate. In various proceedings, some parties have advocated payment of LMP minus components of the retail rate, on the theory that such an approach permits all consumers to react as if they were paying LMP.[44] Some parties have argued that payment of LMP is appropriate only during the most expensive hours,[45] on the theory that demand response will have the greatest impact during those hours in which the aggregate supply curve is steep (i.e., when supply is less elastic). Given the current barriers to demand response[46]

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[44] Professor William W. Hogan has argued, for instance, that payment of LMP (without an offset for some portion of the retail rate) over-compensates individual demand response providers and might result in more demand response than is efficient. See Attachment to Answer of Electric Power Supply Association, Providing Incentives for Efficient Demand Response, William W. Hogan, October 29, 2009, submitted in Docket No. EL09-68-000.

[45] See PJM's Transmittal Letter at 29 submitted in Docket No. EL09-68-000.

[46] A recent Commission Staff report details several barriers to demand response, including regulatory barriers, such as lack of a direct connection between wholesale and

(continued…)

and the evolving nature of the technology enabling demand response, a perfect solution or payment scheme may not exist. We nonetheless believe that paying LMP in all hours to the demand response resources that can participate in the organized wholesale energy markets is the correct approach at this time, because that payment reflects the marginal effect of each demand response resource in the hour, just as the LMP reflects the marginal effect of generation resources in each hour. LMP is the marginal value of both demand response and generation in any hour, regardless of whether it is morning or evening, daytime or nighttime, weekday or weekend.[47]

20. We, nevertheless, seek comment on the need to compensate demand response acting as a resource in organized wholesale energy markets. Commenters may address

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retail prices, lack of dynamic prices, measurement and verification challenges, lack of real-time information sharing, and ineffective demand response program design; technological barriers, such as lack of advanced metering infrastructure and the high cost of some enabling technologies; and other barriers, such as lack of customer awareness and education. Federal Energy Regulatory Commission Staff, A National Assessment of Demand Response Potential (June 2009), found at http://www.ferc.gov/legal/staff-refports/06-09-demand-response.pdf. In compliance filings submitted by RTOs and ISOs and their market monitors pursuant to Order No. 719, as well as in responsive pleadings, parties have mentioned additional barriers, such as the inability of demand response resources to set LMP, minimum size requirements, and others.

[47] We note that in PJM, 17 percent of load reductions by demand response resources for that year occurred between the non-peak hours of 11 p.m. and 8 a.m. See 2008 State of the Market Report for PJM, Volume 2, Table 2-93 at 103, found at http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2008/2008-som-pjm-volume2.pdf.

whether current compensation for demand response providers acting as a resource in the organized wholesale energy markets is adequately procuring demand response. We further solicit comment on alternative approaches to compensating demand response resources participating in organized wholesale energy markets, and the merit of those approaches in comparison to the one proposed here. In particular, we ask for comment on whether a reduction in consumption is comparable to an increase in electricity production for purposes of balancing supply and demand, and whether, therefore, demand response providers and generators should receive comparable compensation. We further seek comment on whether paying LMP to demand response resources is comparable compensation or is more or less than comparable to compensation paid to generation in the ISO and RTO energy markets. We also request comment on whether payment of LMP should apply to all hours, and, if not, the criteria that should be used for establishing the hours when LMP should apply. Additionally, we seek comment on whether requiring payment of LMP is appropriate across all ISOs and RTOs, or whether variations among ISOs and RTOs justify varying levels of demand response resource compensation. To that end, we further seek comment on whether the Commission should allow regional variations for an ISO or RTO that does not seek to compensate demand response resources participating in the organized wholesale energy market.

21. Organized wholesale energy markets are evolving and, as such, the rules and regulations related to those markets will continue to evolve. This is no less so for

demand response, as the markets, and the types of demand response participating in them, continue to evolve. Therefore, it may be necessary in the future for industry and the Commission to reassess the appropriate method for compensating demand response resources in organized wholesale energy markets.[48] Accordingly, we also seek comment on whether, and under what circumstances, the Commission should conduct periodic reviews of demand response compensation and the criteria that should be used in making such assessments.

22. With specific regard to the proposed regulatory text set forth below, we seek comments on whether terms such as "expected levels," "price signals," and "market prices" are sufficiently defined.

23. Because we are addressing generically in this rulemaking proceeding the same issues raised in the PJM proceeding in Docket No. EL09-68-000, that docket is hereby terminated.[49] The Commission will take administrative notice of the record in the PJM

[48] Indeed, the Commission's proposed action in this proceeding is evidence of our continuing assessment of compensation for demand response resources. In PJM Interconnection, L.L.C., 121 FERC ¶ 61,315 (2007), the Commission rejected a complaint that PJM's existing compensation for demand response (LMP minus the generation and transmission components of the retail rate) was unjust and unreasonable, finding that there was insufficient evidence at the time to make such a finding. As we have acquired more experience with the participation of demand response resources in the organized wholesale energy markets, we are concerned that compensation for demand response in PJM and other RTO and ISO markets may no longer be just and reasonable.

[49] See Michigan Pub. Power Agency v. Midwest Indep. Transmission Sys.

(continued…)

proceeding so that parties in that proceeding need not refile affidavits or other evidence introduced there.

III. Information Collection Statement

24. The Office of Management and Budget (OMB) requires that OMB approve certain information collection and data retention requirements imposed by agency rules.[50] Therefore, the Commission is submitting the proposed modifications to its information collections to OMB for review and approval in accordance with section 3507(d) of the Paperwork Reduction Act of 1995.[51]

25. The Office of Management and Budget's (OMB) regulations require approval of certain information collection requirements imposed by agency rules. Upon approval of a collection(s) of information, OMB will assign an OMB control number and an expiration date. Respondents subject to the filing requirements of a rule will not be penalized for failing to respond to these collections of information unless the collections of information display a valid OMB control number.

26. The Commission is submitting these reporting requirements to OMB for its review and approval under section 3507(d) of the Paperwork Reduction Act. Comments are

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Operator, Inc., 128 FERC ¶ 61,268, at P 29 n.47 (2009) (Commission has discretion to decide when and where it will resolve an issue).

[50] 5 CFR § 1320.11(b) (2009).

[51] 44 U.S.C. § 3507(d) (2006).

solicited on the Commission's need for this information, whether the information will have practical utility, the accuracy of provided burden estimates, ways to enhance the quality, utility, and clarity of the information to be collected, and any suggested methods for minimizing the respondent's burden, including the use of automated information techniques.

Burden Estimate: The Public Reporting burden for the requirements contained in the NOPR is as follows:

Data Collection	Number of Respondents	No. of Responses	Hours Per Response	Total Annual Hours
FERC-516				
Transmission Organizations with Organized Electricity Markets	6	1	6	36

Information Collection Costs: The Commission seeks comments on the costs to comply with these requirements. The Commission has projected the average annualized cost of all respondents to be the following: 36 hours @ $220 per hour = $7,920 for respondents. No capital costs are estimated to be incurred by respondents.

Title: FERC-516 "Electric Rate Schedule Tariff Filings"

Action: Proposed Collections.

OMB Control No: 1902-0096.

Respondents: Business or other for profit, and/or not for profit institutions.

Frequency of Responses: One time to initially comply with the rule, and then on occasion as needed to revise or modify.

27. Necessity of the Information: The information from FERC-516 enables the Commission to exercise its statutory obligation under Sections 205 and 206 of the FPA. FPA section 205 specifies that all rates and charges, and related contracts and service conditions for wholesale sales and transmission of energy in interstate commerce be filed with the Commission and must be "just and reasonable." In addition, FPA section 206 requires the Commission upon complaint or its own motion, to modify existing rates or services that are found to unjust, unreasonable, unduly discriminatory or preferential. The Commission needs sufficient detail to make an informed and reasonable decision concerning the appropriate level of rates, and the appropriateness of non-rate terms and conditions, and to aid customers and other parties who may wish to challenge the rates, terms, and conditions proposed by the utility.

28. This proposed rule, if adopted, would amend the Commission's regulations to obligate ISOs and RTOs to pay the market price for energy to demand response resources for demand reductions within each respective ISO and RTO region. Requiring ISOs and RTOs to pay the market price for energy to demand response resources for demand reductions in response to price signals will potentially reduce the market clearing price of electricity. The Commission has emphasized the importance of demand response as a vehicle for improving the competitiveness of organized wholesale electricity markets and

ensuring supplies of energy at just, reasonable and not unduly discriminatory or preferential rates.[52]

29. Internal review: The Commission has reviewed the requirements pertaining to organized wholesale electric markets and determined the proposed requirements are necessary to its responsibilities under sections 205 and 206 of the FPA.

30. These requirements conform to the Commission's plan for efficient information collection, communication and management within the energy industry. The Commission has assured itself, by means of internal review, that there is specific, objective support for the burden estimates associated with the information requirements.

31. Interested persons may obtain information on the reporting requirements by contacting: Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426 [Attention: Michael Miller, Office of the Executive Director, Phone: (202) 502-8415, fax: (202) 273-0873, e-mail: michael.miller@ferc.gov]. Comments on the requirements of the proposed rule may also be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503 [Attention: Desk Officer for the Federal Energy Regulatory Commission], e-mail: oira_submission@omb.eop.gov.

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[52] Order No. 719 at P 16.

IV. Environmental Analysis

32. The Commission is required to prepare an Environmental Assessment or an Environmental Impact Statement for any action that may have a significant adverse effect on the human environment.[53] The Commission concludes that neither an Environmental Assessment nor an Environmental Impact Statement is required for this NOPR under section 380.4(a)(15) of the Commission's regulations, which provides a categorical exemption for approval of actions under sections 205 and 206 of the FPA relating to the filing of schedules containing all rates and charges for the transmission or sale of electric energy subject to the Commission's jurisdiction, plus the classification, practices, contracts and regulations that affect rates, charges, classifications, and services.[54]

V. Regulatory Flexibility Act Certification

33. The Regulatory Flexibility Act of 1980 (RFA)[55] generally requires a description and analysis of final rules that will have significant economic impact on a substantial

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[53] Order No. 486, Regulations Implementing the National Environmental Policy Act, 52 Fed. Reg. 47,897, FERC Stats. & Regs. Regulations Preambles 1986-1990 ¶ 30,783 (1987).

[54] 18 CFR § 380.4(a)(15) (2009).

[55] 5 U.S.C. § 601-12 (2000).

number of small entities.[56] ISOs and RTOs, not small entities, are impacted directly by this rule.

34. California Independent System Operator Corp. (CAISO) is a non-profit organization comprised of more than 90 electric transmission-owning companies and generators operating in its markets and serving more than 30 million customers.

35. New York Independent System Operator, Inc. (NYISO) is a non-profit organization that oversees wholesale electricity markets serving 19.2 million customers. NYISO manages a 10,775-mile network of high-voltage lines.

36. PJM Interconnection, L.L.C. (PJM) is comprised of more than 450 members including power generators, transmission owners, electricity distributors, power marketers, and large industrial customers, serving 13 states and the District of Columbia.

37. Southwest Power Pool, Inc. (SPP) is comprised of 50 members serving 4.5 million customers in eight states and has 52,301 miles of transmission lines.

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[56] The RFA definition of "small entity" refers to the definition provided in the Small Business Act, which defines a "small business concern" as a business that is independently owned and operated and that is not dominant in its field of operation. See 15 U.S.C. § 601(3) (2000) (citing to section 3 of the Small Business Act, 15 U.S.C. § 632 (2000)). The Small Business Size Standards component of the North American Industry Classification system defines a small utility as one that, including its affiliates, is primarily engaged in the generation, transmission, or distribution of electric energy for sale, and whose total electric output for the preceding fiscal years did not exceed 4 MWh. 13 CFR § 121.202 (Sector 22, Utilities, North American Industry Classification System, NAICS) (2004).

38. Midwest Independent Transmission System Operator, Inc. (Midwest ISO) is a non-profit organization with over 131,000 megawatts of installed generation. Midwest ISO has 93,600 miles of transmission lines and serves 15 states and one Canadian province.

39. ISO New England, Inc. (ISO-NE) is a regional transmission organization serving six states in New England. The system is comprised of more than 8,000 miles of high-voltage transmission lines and several hundred generation facilities, of which more than 350 are under ISO-NE's direct control.

40. The Commission believes this rule will not have a significant economic impact on a substantial number of small entities, and therefore no regulatory flexibility analysis is required.

VI. Comment Procedures

41. The Commission invites interested persons to submit comments on the proposed regulatory text that commenters may wish to discuss. Comments are due 45 days after publication in the Federal Register. Comments must refer to Docket No. RM10-17-000,[57] and must include the commenter's name, the organization they represent, if applicable, and their address in their comments.

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[57] Because this NOPR terminates Docket No. EL09-68-000, comments should not refer to that proceeding.

42. The Commission encourages comments to be filed electronically via the eFiling link on the Commission's web site at http://www.ferc.gov. The Commission accepts most standard word processing formats. Documents created electronically using word processing software should be filed in native applications or print-to-PDF format and not in a scanned format. Commenters filing electronically do not need to make a paper filing.

43. Commenters that are not able to file comments electronically must send an original and 14 copies of their comments to: Federal Energy Regulatory Commission, Secretary of the Commission, 888 First Street, NE, Washington, DC 20426.

44. All comments will be placed in the Commission's public files and may be viewed, printed, or downloaded remotely as described in the Document Availability section below. Commenters on this proposal are not required to serve copies of their comments on other commenters.

VII. Document Availability

45. In addition to publishing the full text of this document in the Federal Register, the Commission provides all interested persons an opportunity to view and/or print the contents of this document via the Internet through FERC's Home Page (http://www.ferc.gov) and in FERC's Public Reference Room during normal business hours (8:30 a.m. to 5:00 p.m. Eastern time) at 888 First Street, NE, Room 2A, Washington, DC 20426.

46. From FERC's Home Page on the Internet, this information is available on eLibrary. The full text of this document is available on eLibrary in PDF and Microsoft Word format for viewing, printing, and/or downloading. To access this document in eLibrary, type the docket number excluding the last three digits of this document in the docket number field.

47. User assistance is available for eLibrary and the FERC's web site during normal business hours from FERC Online Support at (202) 502-6652 (toll free at 1-866-208-3676) or email at ferconlinesupport@ferc.gov, or the Public Reference Room at (202) 502-8371, TTY (202)502-8659. E-mail the Public Reference Room at public.referenceroom@ferc.gov.

List of subjects in 18 CFR Part 35

Electric power rates, Electric utilities, Reporting and recordkeeping requirements.

By direction of the Commission. Commissioner Moeller is concurring in part and dissenting in part with separate statement attached.

(S E A L)

Nathaniel J. Davis, Sr.,
Deputy Secretary.

In consideration of the foregoing, the Commission proposes to amend Chapter I, Title 18 of the Code of Federal Regulations as follows:

PART 35—FILING OF RATE SCHEDULES AND TARIFFS

1. The authority citation for Part 35 continues to read as follows:

Authority: 16 U.S.C. § 791a-825r, 2601-2645; 31 U.S.C. § 9701; 42 U.S.C. § 7101-7352.

2. Amend § 35.28 as follows:

Add a new paragraph (g)(1)(v).

§ 35.28 Non-discriminatory open access transmission tariff.

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(v) Demand response compensation in energy markets. Each Commission-approved independent system operator or regional transmission organization that has a tariff provision permitting demand response resources to participate as a resource in the energy market by reducing consumption of electric energy from their expected levels in response to price signals must pay to those demand response providers, in all hours, the market price for energy for these reductions.

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Demand Response Compensation in Organized Wholesale Energy Markets — Docket No. RM10-17-000

PJM Interconnection, L.L.C. — Docket No. EL09-68-000

(Issued March 18, 2010)

MOELLER, Commissioner, *concurring, in part* and *dissenting, in part*:

As our country's demand for energy increases, the reduction of energy usage through demand response programs will play a critical role in meeting our needs and it is my hope that this nascent industry will thrive and succeed. In the Energy Policy Act of 2005, Congress established a policy to encourage the use of demand response by: (1) facilitating the deployment of technology to enable customers to participate in demand response programs; and (2) eliminating unnecessary barriers to demand response participation.[1] Even before this law was passed, this Commission supported similar policies in the organized electric markets by encouraging the use of price responsive demand during high priced energy periods.[2]

Demand response is playing an increasingly critical role in our nation's energy supply mix. Additional demand response has the potential to produce more efficient market outcomes, contribute to a cleaner environment,[3] result in lower costs to customers, and help to check market power since it provides a countervailing willingness

[1] Energy Policy Act of 2005, Pub. L. No. 109-58 § 1252(f), 119 Stat. 594 (2005).

[2] *PJM Interconnection, L.L.C.*, 99 FERC ¶ 61,227, at 61,943 (2002), *see also* Order No. 719 at P 16 ("Thus, enabling demand-side resources…improves the economic operation of electric power markets by aligning prices more closely with the value customers place on electric power.")

[3] A recent report by the National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, provides estimates of the cost associated with air pollution as the result of energy production.

to reduce demand in the face of high prices.[4] With respect to prices, studies have shown that sometimes a small decrease in demand from demand response resources during peak periods can significantly reduce market prices. In sum, the benefits that demand response resources can bring to the energy markets are proven and significant.

The initial success of demand response has resulted in a steady maturation of the demand response industry. However, as the industry continues to mature, we must ensure that our policies are properly tailored to guide the development of demand response in a manner that will result in economically-efficient outcomes. Moving too quickly to reach a desired result can result in unintended consequences – and I believe that today's decision to propose a standard payment could have unintentional effects on both demand response participation and the efficient operation of the organized markets over the longer term.

In today's notice of proposed rulemaking (NOPR), the majority concludes that the Commission should require a standard payment to compensate demand response resources. Specifically, the majority's proposed outcome would be that these resources are paid the market price (*i.e.*, the locational marginal price or "LMP") for energy reductions in all 8,760 hours of the year. This determination is followed by questions such as whether other compensation designs could also work; questions that I believe would have been more appropriately asked *prior* to establishing this NOPR.[5] For that reason, I believe that a preliminary issuance (such as a Notice of Inquiry) should have been established to collect and analyze the evidence in advance of initiating a formal rulemaking proceeding.

While the majority claims that it is "concerned that compensation for demand response in PJM and other RTO and ISO markets may no longer be just and reasonable", the NOPR lacks a thorough discussion of the evidence that they relied upon to substantiate their concerns.[6] The NOPR also lacks a sufficient explanation of the

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[4] *California Indep. Sys. Operator Corp.*, 116 FERC ¶ 61,274, at P 689.

[5] To the extent that this NOPR asks questions to determine whether the proposed rule is just and reasonable, I concur.

[6] NOPR at n. 48. In support of the conclusion that compensation may no longer be just and reasonable, the preamble provides an example involving PJM's Economic Load Response Program and the drop of settled demand reductions experienced after the subsidy payments expired per the terms of PJM's tariff. NOPR at P 10. While the cited level of reduction is a fact, the PJM market monitor stated that "[w]hile the removal of

(continued…)

"experience" that FERC has recently gained that would otherwise support the conclusion that the organized electric markets "fail to compensate demand response at levels that reflect the marginal value of the resource being used by the RTO or ISO to balance supply and demand."[7]

To the contrary, the record in Docket No. EL09-68-000 shows wide disagreement in the industry regarding the issue of demand response compensation. In that proceeding, state utility commissions[8], the grid operator, industry economists, and the market participants all reached various conclusions regarding the question of how to compensate demand response resources in PJM.[9] In light of such rigorous debate, I am not sure if the

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the incentive program, effective November 2007, may have reduced participation, the exact role of the elimination of the incentive program is not known because there were changes to other key factors which directly impact participation." *Citing* Monitoring Analytics, *Barriers to Demand Side Response* in PJM, at 22 (July 1, 2009). More recently, the PJM market monitor recognized that between 2008 and 2009, "[t]here were many factors contributing to the lower levels of participation and lower revenues in the Economic Program, including lower price levels in 2009, lower load levels, and improved measurement and verification." Notably, while payments from the Economic Program have fallen substantially since 2007, capacity revenue for demand response has increased significantly (rising 114% to $303 million from 2008 to 2009.) *Citing* Monitoring Analytics, *State of the Market Report for PJM*, at 111 (March 11, 2010).

[7] NOPR at P 13.

[8] Compare the position of the Indiana Utility Regulatory Commission (*i.e.*, LMP less the generation portion of retail rates (LMP-G) is an accepted indication of cost-effectiveness) with the position taken by the New Jersey Board of Public Utilities and the District of Columbia Public Service Commission (*i.e.*, compensation for demand response should be based solely on LMP). Comments filed in Docket No. EL09-68-000.

[9] While there appears to be no disagreement that the correct price signal for all customers is the LMP, the debate centers on whether demand response resources should be *paid* the LMP *or* should realize the *value* of LMP if they choose to reduce demand. Additionally, at certain times, the LMP can become negative, meaning that generators must pay into the market to the extent they generate power. Should demand response resources likewise be required to pay into the market during negative LMP events, or should they be exempt?

Commission has a sustainable rationale to support a finding that the proposed rule is just and reasonable and that the existing compensation methods (that have been approved by this Commission) are no longer just and reasonable.

In fact, only recently did the Commission issue an order that not only sustained the manner by which PJM compensates demand response resources but also encouraged PJM and its stakeholders to identify and analyze issues to improve their demand response program.[10] Subsequently, PJM filed a detailed report explaining that while the stakeholder process did not yield a consensus position, the PJM Board moved forward and developed a compromise solution that was designed to strengthen its demand response markets.[11] In lieu of evaluating the merits of the proposal approved by PJM's Board, the NOPR terminates the PJM docket and directs PJM and its stakeholders to focus on whether demand response resources should be paid the market price – a question that has undoubtedly been analyzed, addressed and debated at numerous stakeholder meetings.

Since today's NOPR does not sufficiently explain the need for a uniform compensation approach, I am troubled by the decision to terminate PJM's individual proceeding. If approved, PJM's efforts toward developing a compromise solution for its market would have likely resulted in additional demand response participation and its associated benefits. However, with this NOPR's issuance, PJM and the other RTOs must now refrain from making changes to its demand response compensation rules pending the outcome of the rulemaking proceeding. The NOPR may also discourage some emerging organized markets from continuing to evolve toward the LMP model, as well as discourage some non-organized regions from seriously considering moving toward a market structure.

Ultimately, I want demand response to thrive and succeed in *all* the energy markets.[12] However, there are only so many policy decisions and rulemakings that this

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[10] *PJM Industrial Customer Coalition v. PJM Interconnection, L.L.C.*, 121 FERC ¶ 61,315, at P 29 (2007) (Wellinghoff and Kelly, Comm'rs, dissenting).

[11] PJM did note that the concept of paying LMP-G received considerable support and "conservatively could be said to have garnered at least a three-quarters majority approval." *See* PJM Supplemental Report in Docket No. EL09-68-000 at 24-25.

[12] My concern here goes to highlight the differences between regions with competitive wholesale markets and those that consist of largely bilateral market structures. By imposing a uniform compensation requirement, this proposed rulemaking

(continued…)

Commission can make to encourage its development. As mentioned in the preamble, the primary barrier to increased demand response is the disconnect between retail and wholesale prices and the remedy resides at the retail level where there is a lack of dynamic pricing. The approach embraced in the NOPR may also lead to a situation where residential ratepayers could be subsidizing other classes of service while unable to participate themselves in demand response programs. Absent attention to these issues, it will be difficult for any proposal to place generation and demand response on a precisely level playing field.

Until then, this Commission must review what options it has available without resorting to policies that would adversely enable the short-term development of demand response at the expense of its longer-term success. In closing, I believe that demand response programs have great potential to enhance the organized energy markets and I look forward to their continued development. I am concerned, however, that a one-size-fits-all approach could result in uneconomic outcomes that ultimately set back the future development of demand response.

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Philip D. Moeller
Commissioner

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could further exacerbate bifurcated approach toward national policy: entities in a competitive wholesale market must comply with increasingly burdensome requirements while entities operating in bilateral markets are often free from requirements that otherwise advance national policy goals.

TAB G

This is Exhibit **"G"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

California ISO
Shaping a Renewed Future

Demand Response
Net Benefits Test

Lin Xu, Ph.D.

Market Analysis and Development,

California Independent System Operator

June 29, 2011

Demand Response Net Benefits Test

1. INTRODUCTION

This paper covers the ISO's proposal to fulfill FERC order 745 regarding demand response compensation in the organized wholesale energy market. FERC order 745 requires:

- Demand response (DR) resources will be compensated at full LMP if the LMP is above a threshold price as will be determined by the Net Benefits Test.
- The Net Benefits Test will be performed monthly (by the 15th day) to establish the static monthly threshold price to be used in the next trade month.
- The threshold price is determined by the point where the net benefits of dispatching DR exceeds the marginal cost of DR.
- The net benefit of dispatching DR is estimated based on a representative aggregated supply curve for the trade month.

Per FERC order 745, the representative aggregated supply curve is created in the following way:

- Pick a representative curve of the trade month using previous year's curve.
- Adjust for resource availability.
- Adjust for fuel prices.
- Smooth the curve using numerical methods.

The theory behind the Net Benefits Test is illustrated in Figure 1. In Figure 1, an aggregated supply curve is drawn on the p-q plane, with p representing price and q representing supply quantity. As a convention, consider the aggregated supply curve as price function of supply quantity. A load curve is also drawn on the same p-q plane, which intersects the supply curve at the market clearing equilibrium. Demand response adds elasticity to load. Dispatching demand response will reduce the market clearing price.

- Dispatching an incremental amount (dq) of demand response will reduce the system marginal price (dp) according to the supply curve.
- The benefit to non-DR load for dispatching demand response is q*dp.
- The cost of dispatching demand response is p*dq.
- The net benefit is non-negative if q*dp >= p*dq, or dp/dq >= p/q.
- If there exists a point on the supply curve (p0, q0) with q0 > 0, p0 > 0 and q*dp = p*dq, or equivalently [dp/dq(@q0)] /[p0/q0] = 1 (where @q0 means being evaluated at q0), such that the net benefit is non-negative for all p > p0, then p0 is called the threshold price.
- Demand response should be dispatched only when the clearing price is above the threshold price.

The threshold point condition, q*dp = p*dq, or equivalently (dp/dq) / (p/q) = 1, is a first order necessary condition. It cannot distinguish positive net benefits and negative net benefits for p greater than the threshold price. In the appendix, two theorems are proved to provide second order necessary condition and second order locally sufficient condition for the threshold point. The meaning of theorem 1 (second order necessary condition) is that in order for a point (q0, p0) that satisfies the first order necessary condition to have net non-negative benefits for p>p0, the supply curve must be convex at q0. The meaning of Theorem 2 (second order locally sufficient condition) is that if the supply curve has elasticity equal to one and is strictly convex at a point, then incremental price from this point will result in positive net benefits.

The two theorems further characterize the true threshold point locally beyond the first order necessary condition of elasticity equal to one. When there exists multiple candidate points satisfying the first order necessary condition (elasticity equal to one), the theorems will help find the correct threshold point.

The main body of the ISO's proposal will cover three major aspects:

- How to construct the representative supply curve?
- How to smooth the representative curve?
- How to find the threshold point on the representative curve?

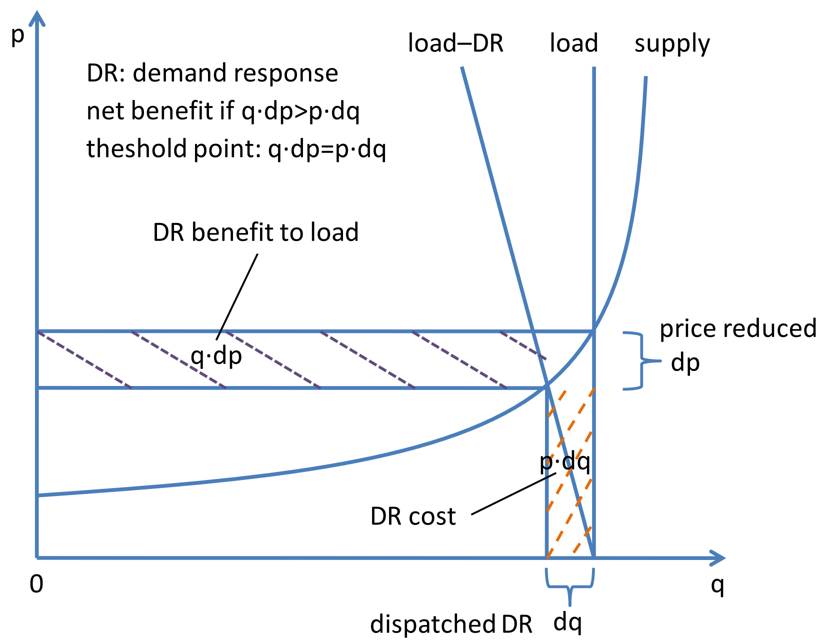

FIGURE 1: DEMAND RESPONSE COST AND BENEFIT

2. CAISO NET BENEFITS TEST DETAILS

2.1 CONSTRUCTING THE REPRESENTITIVE SUPPLY CURVE

The first and most important step of the Net Benefits Test is to construct a representative aggregated supply curve for the trade month, say July 2011. The ISO would publish the Net Benefits Test results by Jun 15th 2011 for July 2011. The construction of the representative supply curves will be based on historical market offers from July 2010, which will be referred to as the reference month. The reference month aggregated supply curve will be called the reference supply curves.

The ISO will construct two reference curves, one for on-peak hours and the other for off-peak hours according to North American Electric Reliability Corporation's (NERC) definition of on-peak and off-peak.[1] The reference supply curves will be constructed based on real-time predispatch (RTPD) mitigated bids from all generation resources including tie-generators, both committed and uncommitted. Import and export bids are excluded.

The reference supply curve must also be adjusted for resource availability. The resource availability can be captured by averaging the hourly reference supply curves over the entire reference month (for every price level, the supply quantities will be averaged). For example, there are 416 on-peak hours and 328 off-peak hours (for a total of 744 hours) in July 2010. The 416 on-peak hourly supply curves are averaged and used to construct the average on-peak reference supply curve, and the 328 off-peak hourly supply curves are averaged and used to construct the average off-peak reference supply curve. The on-peak and off-peak reference supply curves are illustrated in Figure 2.

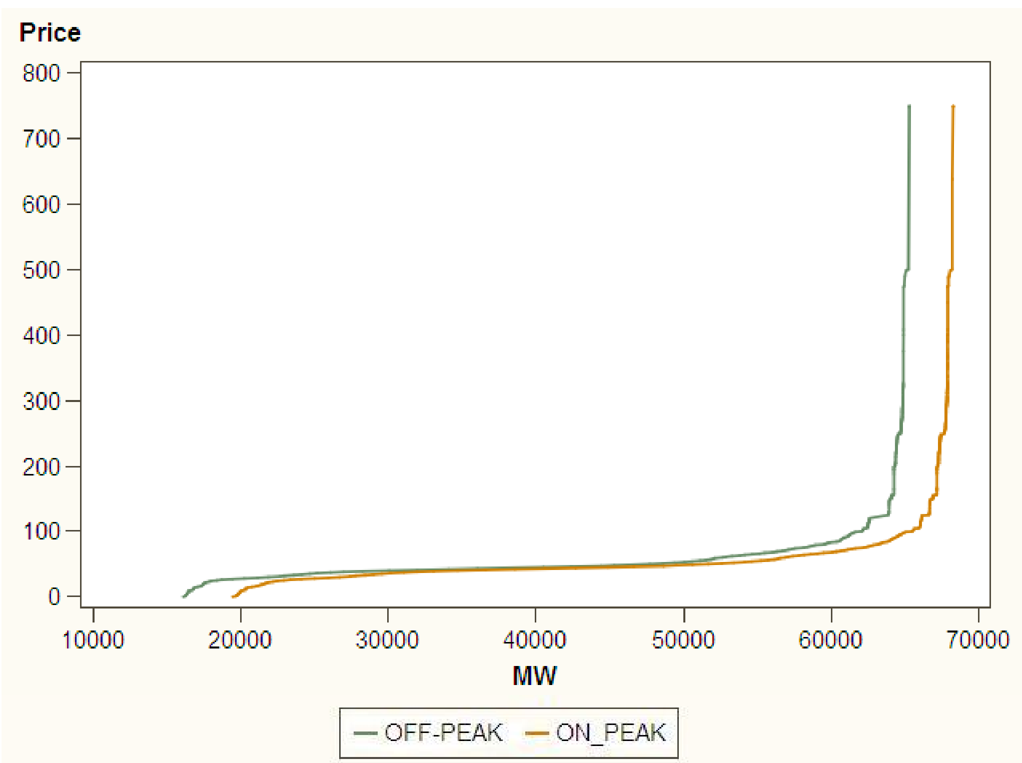

FIGURE 2: A SAMPLE SUPPLY CURVE FROM JULY 2010

[1] NERC, http://www.nerc.com/docs/oc/rs/Additional_Off-peak_Days.doc

FERC order 745 requires the reference supply curve be adjusted for fuel price differences between the reference month and the trade month. Gas fired units account for approximately 60% of the installed capacity in the ISO, while oil units and coal units each account for 1%. Because the oil and coal percentages are so small relative to gas, the ISO will only adjust for gas price differences in the Net Benefits Test. The ISO intends to use the simple average of the following two indices to calculate the California gas price:[2]

- PG&E Citygate, and
- Southern California Border

The supply curve will be scaled by a scaling factor, which is defined as the forward gas price for the trade month divided by the historical average gas price for the reference month. More specifically, for every supply quantity, the corresponding bid price will be scaled by the scaling factor. For example, if the forward monthly average gas price is $4.73 for July 2011,[3] and the historical monthly average gas price was $4.25 for July 2010, then the gas scalar = 4.73/4.25 = 1.11.

Scaling the supply curve factors in both the fuel cost difference for gas fired units and the opportunity cost differences for generators of other fuel types. Even though the whole supply curve is scaled, only the portion that is close to the threshold price is relevant for calculation of the threshold. With typical threshold prices around $45 to $60, the supply bids in this range are mainly from gas fired units or generators of other fuel types whose bids incorporate opportunity costs. Therefore, it is appropriate to scale the system wide supply curve without needing to drill down to the unit specific level.

In summary, for each trade month, the ISO will have an on-peak representative supply curve and an off-peak representative supply curve, which accounts for resource availability and fuel price differences between the reference month and the trade month.

2.2 CURVE SMOOTHING

FERC order 745 requires the supply curve be smoothed using numerical methods. The curve will be smoothed to twice differentiable so that theorem 1 and theorem 2 can be used to characterize the threshold point.

The smoothing method proposed by the ISO is an exponential function curve fitting expressed as

$p = \exp(a*q^3+b*q^2+c*q+d)$,[4]

[2] The ISO is working on acquiring reliable data source for these two gas price indices. However, if the data source is unavailable, the ISO will use the Henry Hub price index instead.

[3] The $4.73 forward gas price is only intended to demonstrate how to calculate the gas scalar, and may not be the actual monthly average forward gas price.

[4] Midwest ISO adopts similar function form, https://www.midwestiso.org/Library/Repository/Meeting%20Material/Stakeholder/DRWG/2011/20110509/20110509%20DRWG%20Item%2003b%20Net%20Benefit%20Test%20for%20Demand%20Response%20Compensation.pdf

where *a*, *b*, *c*, and *d* are coefficients to be determined by a regression on observations of supply quantities and prices.

The regression can be carried out by taking the natural logarithm of the price:

ln(p) = *a**q^3+*b**q^2+*c**q+*d*.

This converts the regression from non-linear to linear.

One technique to achieve a better fit is to apply a price window to the representative supply curves such that the threshold price is inside the price window. In this way, observations that are far away from the threshold, which are irrelevant for the Net Benefits Test, will not affect the regression. In other words, a properly chosen price window allows the regression to focus on observations that are close to the threshold in order to more accurately estimate the threshold price point. On the other hand, the price window should not be too small. If the threshold is too small, it is possible that the threshold price resides outside this price window. If this happens, the price window must be adjusted, and the regression process repeated until the threshold price is well situated inside the price window. Choosing a window from $25 to $100 produces good results from the historical data. Sample smoothed supply curves for July 2011 are illustrated in Figure 3 and Figure 4. In this example, the parameters of the smoothed curves are listed in

Table 1.

Coefficients	Off-peak	On-peak
a (*10^(−9))	0.00004274	0.0000465
b (*10^(−6))	-0.0049986	-0.0059874
c (*10^(−3))	0.20570776	0.2678375
d	0.96260595	-0.2399994

TABLE 1: SAMPLE JULY 2011 REGRESSION RESULTS

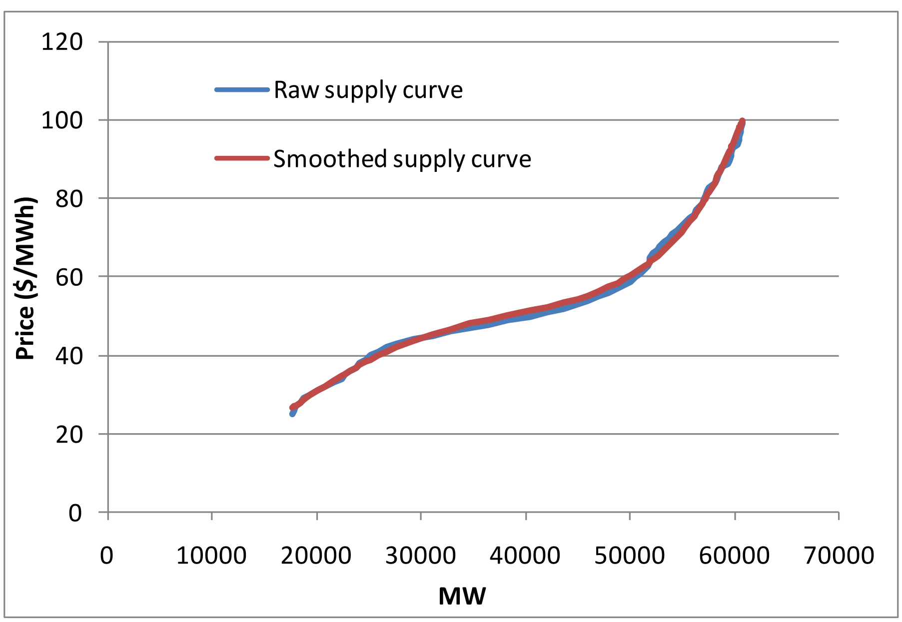

FIGURE 3: SMOOTHED OFF-PEAK SUPPLY CURVE FOR JULY 2011 WITH PRICE WINDOW [25, 100]

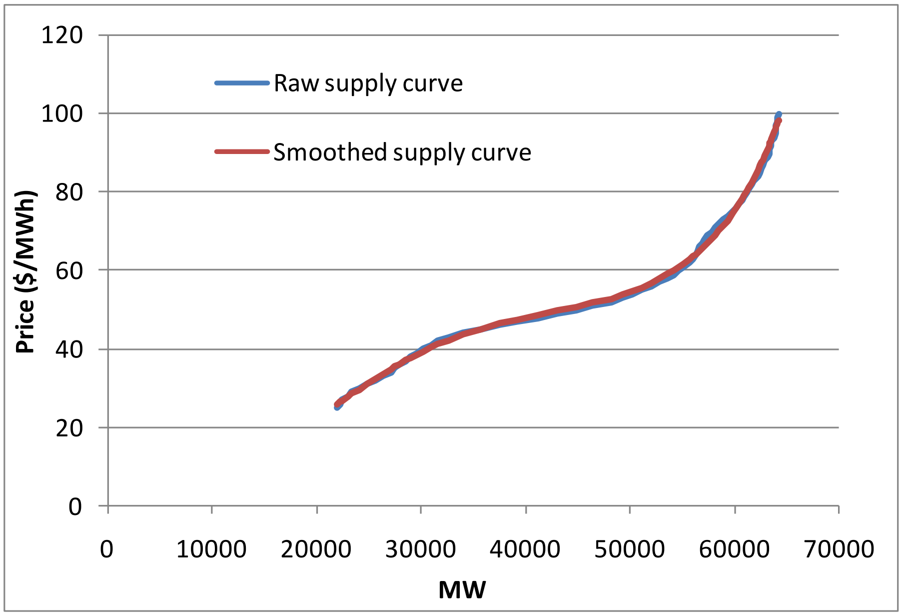

FIGURE 4: SMOOTHED ON-PEAK SUPPLY CURVE FOR JULY 2011 WITH PRICE WINDOW [25, 100]

2.3 FINDING THE THRESHOLD PRICE

Given the supply curve in the form of p = exp(*a**q^3+*b**q^2+*c**q+*d*), the threshold price is first calculated using the first order necessary condition (the elasticity equal to one) as follows:

(dp/dq) /(p/q) = 1, or

(3**a**q^2+2**b**q+*c*)* exp(*a**q^3+*b**q^2+*c**q+*d*) / [exp(*a**q^3+*b**q^2+*c**q+*d*) / q] = 1, or

3**a**q^3+2**b**q^2+*c**q =1.

Solve this cubic equation, and denote the root by q0.

This is a cubic equation, so there are three roots. If there is one real root, and two complex roots, then the real root should be used to calculate the threshold price. If there are three real roots, then:

- The one produces a price outside the price window should be discarded.
- The one, at which the supply curve is concave, should be discarded by theorem 1.

In the July 2011 on-peak example, the three roots are 4646.7, 30329.4, and 50864.8, and the corresponding prices are $2.41, $39.37, and $55.26. The price $2.41 is outside the price window, so it should be discarded. At the price $39.37, the supply curve is concave, so it should also be discarded. The price of $55.26 is the only point that satisfies theorem 1. In addition, because the supply curve is strictly convex at the price of $55.26, it is a true threshold price locally per theorem 2. Similarly, the true threshold price for July 2011 off-peak hours is $57.00.

3. RESULTS

Preliminary results based on actual historical market bids without gas price adjustment typically produce threshold prices of $45 to $60.

APPENDIX

Theorem 1 [second order necessary condition]: Assuming the supply curve is monotonically increasing and twice differentiable, if there exists a point (q0, p0) on the supply curve with q0 > 0 and p0 > 0 that satisfies the first order necessary condition (the supply curve has elasticity equal to one at q0), and for all p > p0, dp/dq >= p/q, then the supply curve is convex at q0, i.e.

$d^2p/dq^2(@q0) >= 0$.

Proof:

Suppose (q0, p0) is a point satisfies the first order necessary condition, [dp/dq(@q0)] / (p0/q0) = 1, and for all p > p0, dp/dq >= p/q.

By first order Taylor expansion, dp/dq = dp/dq(@q0) + [d^2p/dq^2(@q0)] * (q-q0).

By first order Taylor expansion, p/q = p0/q0 + [(dp/dq*q – p) / q^2](@q0) * (q-q0) = p0/q0.

Then, dp/dq >= p/q implies dp/dq(@q0) + [d^2p/dq^2(@q0)] * (q-q0) >= p0/q0, or

[d^2p/dq^2(@q0)] * (q-q0) >= 0.

Because the supply function is monotonically increasing, p > p0 implies q > p0. Therefore,

d^2p/dq^2(@q0)>=0.

Theorem 2 [second order locally sufficient condition]: Assuming the supply curve is monotonically increasing and twice differentiable, if the following conditions hold at a point (q0, p0) with q0 > 0 and p0 > 0 on the supply curve:

2A) the supply curve has elasticity equal to one at q0, i.e. [dp/dq(@q0)] / (p0/q0) = 1, and

2B) the supply curve is convex at q0, i.e. d^2p/dq^2(@q0) > 0,

then for all p > p0 in the vicinity of p0, dp/dq > p/q.

Proof:

Similar as the proof of Theorem 1,

d^2p/dq^2(@q0) > 0 implies [d^2p/dq^2(@q0)] * (q-q0) > 0 for all p > p0 in the vicinity of p0.

Because [dp/dq(@q0)] / (p0/q0) = 1, dp/dq(@q0) = p0/q0.

Therefore, dp/dq(@q0) + [d^2p/dq^2(@q0)] * (q-q0) > p0/q0.

By first order Taylor expansion of dp/dq and p/q, dp/dq > p/q for all q > q0 in the vicinity of q0.

Because the supply curve is monotonically increasing, dp/dq > p/q for all p > p0 in the vicinity of p0.

TAB H

This is Exhibit **"H"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

Date	Hour	HOEP ($/MWh)	NDL (MWh)	DL (MWh)	Contracted or Regulated	Non Contract (MWh)	Imports (MWh)	Exports (MWh)
January 1, 2018	1	51.29	16188	186	18528	19	376	-2394
January 1, 2018	2	43.59	15774	162	18216	20	242	-2402
January 1, 2018	3	93.6	15594	154	18347	19	92	-2599
January 1, 2018	4	54.78	15304	138	18109	19	587	-3008
January 1, 2018	5	14.35	15197	171	17929	19	265	-2630
January 1, 2018	6	18.6	15290	131	18175	20	341	-2961
January 1, 2018	7	21.72	15460	201	19134	19	114	-3434
January 1, 2018	8	40.89	15657	205	19420	19	114	-3645
January 1, 2018	9	20.75	15849	193	19246	19	264	-3452
January 1, 2018	10	74.57	16205	203	19701	17	189	-3498
January 1, 2018	11	4.65	16430	215	19452	19	344	-3040
January 1, 2018	12	9.45	16580	218	19336	18	463	-3010
January 1, 2018	13	13.65	16662	227	19556	18	214	-2820
January 1, 2018	14	14.37	16608	197	19387	18	331	-2875
January 1, 2018	15	26.73	16780	182	19436	18	346	-2761
January 1, 2018	16	42.12	17101	202	20283	18	355	-3288
January 1, 2018	17	42.28	17753	208	21613	18	189	-3686
January 1, 2018	18	44.84	18913	216	22849	18	330	-3870
January 1, 2018	19	42.22	18763	229	22454	19	642	-3742
January 1, 2018	20	41.06	18487	235	22311	19	583	-3951
January 1, 2018	21	43.76	18157	257	22112	19	396	-3869
January 1, 2018	22	48.38	17756	279	21166	19	644	-3688
January 1, 2018	23	42.58	16925	269	19566	19	855	-3073
January 1, 2018	24	38.14	16120	237	19302	19	312	-3099
January 2, 2018	1	31.12	15629	189	19218	19	147	-3416
January 2, 2018	2	10.76	15263	175	18141	19	212	-2748
January 2, 2018	3	14.34	14996	236	18160	19	224	-3084
January 2, 2018	4	0.29	14979	223	17804	19	335	-2873
January 2, 2018	5	1.43	14996	202	18305	19	282	-3255
January 2, 2018	6	14.36	15490	230	18983	19	372	-3547
January 2, 2018	7	19.1	16577	206	20199	19	229	-3579
January 2, 2018	8	34.9	17751	124	21583	19	379	-4021
January 2, 2018	9	43.72	18324	105	22015	19	376	-4115
January 2, 2018	10	46.03	18744	94	22262	21	433	-3901
January 2, 2018	11	49.4	18917	179	22433	19	909	-4283
January 2, 2018	12	66.6	19012	111	22298	19	599	-3801
January 2, 2018	13	42.14	18817	120	21938	20	545	-3520
January 2, 2018	14	40.35	18678	135	21553	18	382	-3094
January 2, 2018	15	34.36	18490	204	21436	18	515	-3173
January 2, 2018	16	29.98	18564	232	21637	18	444	-3161
January 2, 2018	17	42.86	19138	198	22559	20	415	-3633
January 2, 2018	18	42.33	19962	88	23452	17	635	-3863
January 2, 2018	19	40.37	19796	121	23304	19	705	-4119
January 2, 2018	20	42.44	19589	142	22867	21	942	-3978
January 2, 2018	21	42.29	19255	190	23082	19	278	-3817
January 2, 2018	22	41.64	18585	214	21492	19	427	-3088
January 2, 2018	23	8.01	17582	256	19972	20	276	-2399
January 2, 2018	24	29.72	16609	260	19511	20	131	-2767

January 3, 2018	1	2.31	15807	274	18460	19	635	-2805
January 3, 2018	2	19.43	15435	262	18366	18	501	-3076
January 3, 2018	3	0	15251	264	18185	18	428	-2970
January 3, 2018	4	0	15206	277	18095	18	219	-2781
January 3, 2018	5	0	15252	251	18395	18	349	-3155
January 3, 2018	6	0	15731	265	18504	18	820	-3344
January 3, 2018	7	32.26	16749	263	19427	18	1148	-3535
January 3, 2018	8	66.58	17870	219	20753	18	872	-3610
January 3, 2018	9	79.95	18344	219	21337	18	714	-3585
January 3, 2018	10	88.93	18589	209	21725	18	639	-3555
January 3, 2018	11	84.83	18600	235	21293	18	1317	-3720
January 3, 2018	12	86.87	18577	221	21286	18	949	-3495
January 3, 2018	13	88.33	18537	227	21245	19	1110	-3642
January 3, 2018	14	64.63	18573	234	21022	20	1423	-3647
January 3, 2018	15	40.84	18581	241	20948	19	1661	-3778
January 3, 2018	16	56.34	18708	238	21639	19	1100	-3722
January 3, 2018	17	82.3	19218	206	22366	18	1253	-4265
January 3, 2018	18	89.3	20081	173	23059	17	1290	-4157
January 3, 2018	19	88.01	19905	184	22672	19	1314	-3955
January 3, 2018	20	81.94	19757	175	21794	19	1843	-3636
January 3, 2018	21	83.84	19488	187	21447	19	1824	-3586
January 3, 2018	22	84.16	18783	173	20711	18	1928	-3699
January 3, 2018	23	76.34	17794	171	19886	18	1601	-3447
January 3, 2018	24	46.04	16607	265	18424	19	1514	-2942
January 4, 2018	1	15.77	15792	261	17461	20	1301	-2484
January 4, 2018	2	4.94	15328	250	17179	19	1310	-2735
January 4, 2018	3	6.47	15056	238	17349	20	816	-2687
January 4, 2018	4	0.75	14981	231	17492	19	497	-2717
January 4, 2018	5	0	15099	232	17673	19	551	-2824
January 4, 2018	6	0.42	15670	230	18565	20	481	-3205
January 4, 2018	7	23.91	16739	235	19665	22	923	-3588
January 4, 2018	8	64.7	17963	181	20620	22	1342	-3796
January 4, 2018	9	67.25	18510	161	21115	22	1290	-3841
January 4, 2018	10	66.97	18606	135	20943	19	1407	-3657
January 4, 2018	11	61.74	18527	114	20760	26	1638	-3735
January 4, 2018	12	58.55	18432	191	20320	26	2067	-3754
January 4, 2018	13	51.98	18309	207	20077	22	2267	-3778
January 4, 2018	14	13.35	18274	172	20233	20	1989	-3675
January 4, 2018	15	13.33	18215	208	20193	21	1619	-3411
January 4, 2018	16	13.35	18421	193	20318	20	1983	-3674
January 4, 2018	17	21.1	18926	122	20528	21	2267	-3759
January 4, 2018	18	54.4	19843	78	21680	21	2267	-3987
January 4, 2018	19	56.01	19987	85	21543	21	2267	-3733
January 4, 2018	20	58.91	19961	72	21782	21	1998	-3749
January 4, 2018	21	58.82	19839	105	21421	20	2105	-3591
January 4, 2018	22	60.96	19417	228	21043	20	2167	-3486
January 4, 2018	23	73.71	18579	317	20907	19	1019	-3021
January 4, 2018	24	106.23	17563	303	20262	17	317	-2735
January 5, 2018	1	18.5	16802	278	18817	21	816	-2328
January 5, 2018	2	13.33	16410	271	17795	22	1584	-2457

January 5, 2018	3	13.36	16218	304	17668	21	1626	-2605
January 5, 2018	4	13.34	16128	312	17785	21	1496	-2709
January 5, 2018	5	13.45	16258	268	18373	21	843	-2522
January 5, 2018	6	9.69	16769	275	18747	21	1317	-2866
January 5, 2018	7	68.23	17792	302	19844	20	1248	-3014
January 5, 2018	8	77.02	19025	202	20651	19	1563	-3019
January 5, 2018	9	79.79	19437	259	21024	18	1798	-3186
January 5, 2018	10	77.02	19466	220	21082	18	1898	-3232
January 5, 2018	11	81.64	19440	250	21333	20	1873	-3550
January 5, 2018	12	80.73	19455	253	21387	20	1748	-3358
January 5, 2018	13	70.35	19265	230	21296	21	1438	-3193
January 5, 2018	14	67.87	19188	183	21139	20	1652	-3350
January 5, 2018	15	68.42	19177	128	21087	20	1686	-3396
January 5, 2018	16	75.97	19304	137	21887	18	770	-3159
January 5, 2018	17	77.9	19786	95	22762	20	251	-3069
January 5, 2018	18	105.23	20569	66	23527	21	453	-3281
January 5, 2018	19	112.51	20485	50	23762	21	368	-3535
January 5, 2018	20	95.42	20346	111	23094	21	537	-3165
January 5, 2018	21	128.05	20214	89	23229	21	570	-3563
January 5, 2018	22	77.94	19558	191	22522	22	838	-3624
January 5, 2018	23	69.07	18772	237	21059	27	1238	-3246
January 5, 2018	24	67.57	17827	243	20213	41	1303	-3345
January 6, 2018	1	42.71	16947	287	19316	40	1207	-3198
January 6, 2018	2	12.21	16515	284	18580	40	1473	-3075
January 6, 2018	3	13.32	16260	273	18529	40	1136	-3069
January 6, 2018	4	13.36	16129	284	19095	40	558	-3092
January 6, 2018	5	21.76	16180	287	19268	40	461	-3168
January 6, 2018	6	13.35	16412	260	19504	40	425	-3208
January 6, 2018	7	47.6	16953	257	19843	40	462	-3131
January 6, 2018	8	54.38	17773	125	20881	40	240	-3337
January 6, 2018	9	65.51	18376	124	21713	40	64	-3296
January 6, 2018	10	60.85	18738	199	22020	40	64	-3190
January 6, 2018	11	59.86	18850	175	22072	40	71	-3157
January 6, 2018	12	76.16	19057	192	22509	40	64	-3589
January 6, 2018	13	64.84	18708	224	22199	40	183	-3528
January 6, 2018	14	60.6	18516	237	21963	40	244	-3503
January 6, 2018	15	61	18471	244	21756	41	542	-3651
January 6, 2018	16	67.48	18621	269	22103	40	544	-3760
January 6, 2018	17	78.69	19346	196	22515	40	499	-3556
January 6, 2018	18	246.37	20321	107	23384	41	627	-3431
January 6, 2018	19	75.54	20213	67	22470	40	500	-2655
January 6, 2018	20	60.75	19910	116	22396	21	582	-3071
January 6, 2018	21	75.64	19701	145	22696	20	265	-3263
January 6, 2018	22	104	19208	199	22771	19	124	-3540
January 6, 2018	23	58.07	18426	205	21439	21	514	-3316
January 6, 2018	24	51.34	17516	195	20097	20	942	-3258
January 7, 2018	1	48.4	16777	209	19500	20	1076	-3548
January 7, 2018	2	46.71	16322	195	19037	21	1076	-3477
January 7, 2018	3	37.49	16051	178	18653	22	1076	-3346
January 7, 2018	4	25.74	15902	191	18642	20	592	-3045

January 7, 2018	5	11.34	15873	137	18302	20	912	-3092
January 7, 2018	6	7.27	15998	153	18508	19	699	-3054
January 7, 2018	7	14.34	16290	139	18880	19	714	-3065
January 7, 2018	8	14.34	16613	211	19309	19	714	-3041
January 7, 2018	9	44.7	17020	240	20143	19	352	-3237
January 7, 2018	10	14.38	17499	252	20498	20	414	-3143
January 7, 2018	11	14.37	17862	259	21074	20	188	-3039
January 7, 2018	12	45.71	18129	258	21559	20	319	-3564
January 7, 2018	13	47	18344	169	21598	18	732	-3895
January 7, 2018	14	44.4	18391	190	20966	21	1130	-3344
January 7, 2018	15	45.38	18336	194	21120	21	1181	-3630
January 7, 2018	16	39.92	18369	226	21723	21	687	-3669
January 7, 2018	17	45.87	19079	154	22447	19	892	-4020
January 7, 2018	18	52.62	19805	155	23217	17	994	-4121
January 7, 2018	19	62.28	19520	156	23043	21	791	-4092
January 7, 2018	20	41.06	19168	129	22001	21	1828	-4417
January 7, 2018	21	34.24	18502	187	21280	21	1718	-4171
January 7, 2018	22	20.86	17716	191	20033	20	1758	-3759
January 7, 2018	23	28.24	16777	213	19763	20	865	-3499
January 7, 2018	24	27.67	15821	217	19021	21	730	-3563
January 8, 2018	1	0	15126	270	18148	20	423	-2971
January 8, 2018	2	0	14762	236	17856	20	261	-2983
January 8, 2018	3	0	14589	253	17450	19	369	-2826
January 8, 2018	4	0	14447	218	17384	19	369	-2946
January 8, 2018	5	0	14478	264	17287	19	468	-2869
January 8, 2018	6	0	15046	223	17906	19	531	-3049
January 8, 2018	7	1.5	16193	237	18310	19	820	-2506
January 8, 2018	8	11.5	17500	248	19534	19	740	-2396
January 8, 2018	9	11.59	17746	228	19957	19	438	-2409
January 8, 2018	10	9.67	17878	195	20003	20	420	-2360
January 8, 2018	11	14.35	17981	163	20222	20	539	-2547
January 8, 2018	12	69.32	17965	158	19904	19	897	-2634
January 8, 2018	13	41.11	17898	194	20258	19	365	-2507
January 8, 2018	14	18.58	17860	274	19912	19	1482	-3217
January 8, 2018	15	33.46	17738	283	20011	19	1316	-3146
January 8, 2018	16	14.35	17746	297	20422	18	719	-3132
January 8, 2018	17	24.56	18262	250	20912	18	539	-2959
January 8, 2018	18	14.38	18967	274	21165	18	1182	-3002
January 8, 2018	19	14.34	18746	299	20933	19	1235	-3065
January 8, 2018	20	12.47	18452	289	20702	19	1119	-2950
January 8, 2018	21	10.41	18159	314	20574	19	762	-2869
January 8, 2018	22	12.97	17397	347	19651	19	1273	-3068
January 8, 2018	23	0	16260	356	18430	19	959	-2634
January 8, 2018	24	0	15164	355	17771	19	486	-2592
January 9, 2018	1	4.77	14353	359	16945	19	553	-2576
January 9, 2018	2	0	13915	335	16503	19	521	-2691
January 9, 2018	3	0	13740	378	16332	19	519	-2656
January 9, 2018	4	1.11	13692	288	16196	19	444	-2599
January 9, 2018	5	7.76	13884	319	16408	19	448	-2632
January 9, 2018	6	2.22	14511	254	16181	19	867	-2239

January 9, 2018	7	18.28	15867	274	17199	19	896	-2000
January 9, 2018	8	37.56	17284	257	18928	18	811	-2218
January 9, 2018	9	39.53	17467	248	18548	18	1296	-2252
January 9, 2018	10	37.28	17414	283	18334	18	1383	-2146
January 9, 2018	11	39.15	17400	310	18496	19	1188	-2087
January 9, 2018	12	37.97	17382	303	18382	18	1376	-2010
January 9, 2018	13	38.59	17296	335	18628	18	1563	-2613
January 9, 2018	14	39.39	17339	314	18959	19	1215	-2554
January 9, 2018	15	36.56	17373	308	18385	19	1648	-2306
January 9, 2018	16	35.56	17610	273	18591	18	1615	-2219
January 9, 2018	17	42.36	18211	336	19373	18	1614	-2412
January 9, 2018	18	43.85	19145	326	20439	20	1689	-2599
January 9, 2018	19	42.36	18982	324	20333	22	1614	-2635
January 9, 2018	20	43.02	18837	329	20033	22	1689	-2568
January 9, 2018	21	41.34	18446	300	19586	20	1689	-2525
January 9, 2018	22	38.31	17814	243	19081	23	1688	-2687
January 9, 2018	23	41.66	16655	257	18218	23	966	-2264
January 9, 2018	24	30.97	15514	300	17011	23	1454	-2547
January 10, 2018	1	6.57	14705	330	16285	19	1473	-2602
January 10, 2018	2	3.33	14362	339	16287	19	1513	-3063
January 10, 2018	3	0	14174	342	16264	19	1513	-3213
January 10, 2018	4	3.32	14115	301	16403	19	1523	-3460
January 10, 2018	5	0	14252	340	16276	19	1636	-3221
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January 10, 2018	9	13.97	17495	311	19192	19	1325	-2678
January 10, 2018	10	21.61	17210	264	19474	19	718	-2671
January 10, 2018	11	19.91	16957	295	19430	20	399	-2543
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January 10, 2018	13	13.33	16809	303	18574	21	1470	-2880
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January 10, 2018	15	31.24	17142	271	19136	20	608	-2331
January 10, 2018	16	6.19	17390	268	18919	18	1613	-2731
January 10, 2018	17	5.75	17879	313	19344	19	1568	-2724
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January 10, 2018	19	29.48	18424	303	20653	18	730	-2639
January 10, 2018	20	12.84	18200	246	20023	19	1452	-2969
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January 11, 2018	7	0.51	14877	203	18026	18	426	-3370
January 11, 2018	8	6.23	16274	166	18798	19	1254	-3563

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January 11, 2018	12	2.72	16257	285	18779	20	602	-2870
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January 11, 2018	14	10.16	16230	319	19137	20	353	-2985
January 11, 2018	15	6.02	16289	295	19187	19	346	-2938
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January 11, 2018	17	37.6	17150	332	19721	18	413	-2762
January 11, 2018	18	18.28	17798	325	19824	18	1196	-2827
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January 11, 2018	20	13.58	17474	329	19840	18	548	-2569
January 11, 2018	21	19.5	17104	311	19855	18	164	-2602
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January 11, 2018	23	12.12	15287	293	18418	18	304	-3064
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January 12, 2018	10	136.13	16734	299	18594	18	819	-2424
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January 12, 2018	12	78.89	17268	259	18649	19	1477	-2575
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January 12, 2018	14	13.69	17490	252	18492	35	1515	-2157
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January 12, 2018	19	32.77	18996	263	19609	40	1840	-2149
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January 12, 2018	21	31.39	18442	228	19633	39	1760	-2712
January 12, 2018	22	22.75	17781	308	19032	38	1908	-2722
January 12, 2018	23	25.34	16860	290	17931	38	1799	-2426
January 12, 2018	24	12.36	15841	281	17214	38	1566	-2508
January 13, 2018	1	16.98	15166	311	17220	39	1459	-3052
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January 13, 2018	3	56.31	14526	286	17736	35	359	-3187
January 13, 2018	4	19.16	14486	266	17275	39	814	-3194
January 13, 2018	5	9.57	14588	253	16962	38	1103	-3102
January 13, 2018	6	23.78	14889	247	17401	38	760	-2959
January 13, 2018	7	5.23	15426	227	17429	38	1130	-2826
January 13, 2018	8	31.66	16234	212	17790	39	1282	-2631
January 13, 2018	9	74.47	16923	219	18332	39	1250	-2450
January 13, 2018	10	25.32	17342	234	18548	38	1388	-2248

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January 13, 2018	12	32.33	17174	219	18058	38	1641	-2321
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January 13, 2018	14	36.41	16800	194	18719	21	1539	-3187
January 13, 2018	15	40.34	16824	216	18659	18	1632	-3338
January 13, 2018	16	40.95	17277	160	19076	18	1517	-3230
January 13, 2018	17	44.18	18237	145	19713	18	1544	-3025
January 13, 2018	18	64.18	19430	139	21073	19	1527	-3022
January 13, 2018	19	48.35	19364	119	20764	22	1289	-2374
January 13, 2018	20	48.67	18957	156	20596	18	1339	-2832
January 13, 2018	21	53.57	18532	171	20333	18	1539	-3118
January 13, 2018	22	52.06	18056	157	19945	19	1539	-3312
January 13, 2018	23	44.35	17351	164	19111	19	1369	-2926
January 13, 2018	24	47.34	16450	235	17991	19	1574	-2844
January 14, 2018	1	143.83	15882	242	18088	19	1540	-3489
January 14, 2018	2	53.79	15425	236	17687	20	1583	-3493
January 14, 2018	3	47.08	15202	253	17210	20	1858	-3516
January 14, 2018	4	43.03	15128	293	16826	20	2158	-3538
January 14, 2018	5	43.93	15121	289	17037	20	2258	-3837
January 14, 2018	6	45.77	15263	289	17326	20	2258	-3991
January 14, 2018	7	55.15	15661	293	17780	20	303	-2122
January 14, 2018	8	135.01	16320	271	19228	20	975	-3627
January 14, 2018	9	186.96	16715	231	19913	22	866	-3786
January 14, 2018	10	70.4	16940	189	19293	22	805	-2945
January 14, 2018	11	59.68	16893	306	19182	20	698	-2645
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January 14, 2018	13	62.64	16853	317	19516	20	1011	-3477
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January 14, 2018	15	45.83	16915	316	18917	20	1961	-3675
January 14, 2018	16	51.01	17407	305	19885	17	1261	-3499
January 14, 2018	17	57.51	18398	267	20550	19	1182	-3137
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January 14, 2018	20	59.32	19099	203	21555	19	1007	-3266
January 14, 2018	21	97.07	18738	195	21757	19	981	-3753
January 14, 2018	22	65.37	18007	291	21274	19	879	-3762
January 14, 2018	23	57.16	17023	293	19921	20	913	-3512
January 14, 2018	24	38.87	16095	254	18231	22	1890	-3737
January 15, 2018	1	52.75	15432	281	18331	18	1244	-3783
January 15, 2018	2	92.76	15105	217	18681	18	844	-4119
January 15, 2018	3	47.85	14544	275	18238	18	944	-3875
January 15, 2018	4	52.66	14876	300	18381	18	719	-3858
January 15, 2018	5	39.2	15263	190	18344	19	908	-3766
January 15, 2018	6	43.56	15760	257	19200	20	863	-4058
January 15, 2018	7	61.35	17222	241	20939	19	890	-4478
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January 15, 2018	9	96.26	18968	297	22336	20	232	-3416
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January 15, 2018	21	317.77	19621	248	22153	81	862	-3282
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January 16, 2018	1	53.94	16070	253	18253	77	1795	-3758
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January 16, 2018	3	42.2	15332	380	17486	77	1795	-3588
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January 16, 2018	5	38.31	15335	265	17760	75	1384	-3677
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January 17, 2018	13	22.63	17639	286	19370	20	1284	-2593
January 17, 2018	14	14.4	17618	249	19680	20	965	-2818

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January 21, 2018	10	14.4	14812	241	15888	18	1537	-2252
January 21, 2018	11	14.39	14989	234	15927	22	1701	-2282
January 21, 2018	12	14.38	15060	230	16122	22	588	-1538
January 21, 2018	13	14.38	14921	235	16426	22	1055	-2133
January 21, 2018	14	33.71	15281	258	16752	18	1497	-2709
January 21, 2018	15	29.11	15442	255	16766	22	1576	-2618
January 21, 2018	16	25.3	15829	255	16627	23	1626	-2144
January 21, 2018	17	35.02	16579	257	16798	20	1339	-1247
January 21, 2018	18	35.39	17560	232	17493	17	1629	-1335

January 21, 2018	19	34.33	17371	222	17691	19	1616	-1473
January 21, 2018	20	35.49	17089	189	17103	20	1677	-1402
January 21, 2018	21	34.08	16655	233	16718	19	1671	-1362
January 21, 2018	22	33.44	16043	209	16116	20	1686	-1348
January 21, 2018	23	28.98	15157	207	15264	18	1517	-1293
January 21, 2018	24	26.31	14299	237	14945	18	1660	-1886
January 22, 2018	1	47.5	13676	240	14728	19	1668	-2282
January 22, 2018	2	39.53	13349	219	14567	20	1668	-2545
January 22, 2018	3	18.69	13206	234	14429	19	1668	-2542
January 22, 2018	4	15.82	13130	266	14446	18	1668	-2502
January 22, 2018	5	17.68	13275	296	14473	18	1447	-2269
January 22, 2018	6	57.09	13785	278	14904	18	1608	-2440
January 22, 2018	7	56.58	15178	259	15883	19	1225	-1715
January 22, 2018	8	140.61	16658	238	17225	17	1607	-1899
January 22, 2018	9	35.59	17121	218	17829	18	1360	-1844
January 22, 2018	10	28.15	17304	221	18432	17	867	-1801
January 22, 2018	11	24.21	17523	232	18689	17	1257	-2211
January 22, 2018	12	15.15	17641	271	18665	24	1557	-2229
January 22, 2018	13	15.53	17614	312	18757	26	1542	-2382
January 22, 2018	14	27.29	17700	276	18750	18	1557	-2369
January 22, 2018	15	14.37	17679	266	18110	18	1570	-1748
January 22, 2018	16	17.24	17817	330	18302	18	1430	-1607
January 22, 2018	17	20.2	18223	314	18410	18	1303	-1263
January 22, 2018	18	30.44	18843	290	18841	18	1472	-1190
January 22, 2018	19	32.33	18594	291	18789	18	1288	-1195
January 22, 2018	20	30.55	18365	296	18796	18	956	-1053
January 22, 2018	21	18.23	17966	293	18798	18	988	-1511
January 22, 2018	22	35.37	17276	287	18338	18	824	-1585
January 22, 2018	23	29.88	16172	293	17592	18	1121	-2180
January 22, 2018	24	11.01	15016	284	17094	18	684	-2393
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January 23, 2018	3	8.66	13493	364	16049	18	433	-2501
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January 23, 2018	8	9.84	16623	207	18149	43	270	-1678
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January 23, 2018	10	9.02	16796	152	18457	91	662	-2219
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January 23, 2018	12	13.35	16685	154	18607	90	788	-2637
January 23, 2018	13	13.35	16679	209	18737	89	823	-2741
January 23, 2018	14	13.33	16630	257	18666	23	1029	-2763
January 23, 2018	15	13.34	16739	275	18684	20	1145	-2773
January 23, 2018	16	12.72	17026	263	19250	19	893	-2785
January 23, 2018	17	9.57	17644	226	19364	18	1331	-2764
January 23, 2018	18	27.85	18390	239	20215	19	938	-2556
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January 23, 2018	22	12.15	17280	217	18871	19	635	-1929
January 23, 2018	23	7.92	16226	207	17476	19	849	-1828
January 23, 2018	24	3.76	15167	215	17079	19	366	-1933
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January 24, 2018	9	40.63	18147	237	18109	19	1736	-1447
January 24, 2018	10	40.16	17877	243	17754	19	1768	-1345
January 24, 2018	11	38.57	17586	249	17369	20	1645	-1187
January 24, 2018	12	37.4	17366	245	17331	18	1751	-1486
January 24, 2018	13	30.06	17016	190	17387	18	1548	-1820
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January 24, 2018	19	43.92	19475	219	19918	20	1664	-1846
January 24, 2018	20	46.59	19364	246	19643	19	1704	-1743
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January 24, 2018	23	32.35	17302	221	17293	18	1486	-1209
January 24, 2018	24	40.09	16246	250	16586	18	1583	-1574
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January 25, 2018	2	36.57	15167	207	15771	21	1636	-1855
January 25, 2018	3	36.66	15000	211	15722	20	1631	-2017
January 25, 2018	4	20.42	14925	229	15741	20	1641	-2087
January 25, 2018	5	13.32	15128	183	15881	18	1632	-2107
January 25, 2018	6	9.54	15695	175	16217	18	996	-1259
January 25, 2018	7	24.92	17056	186	16801	18	1343	-955
January 25, 2018	8	46.32	18476	167	18405	18	931	-749
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January 25, 2018	10	38.91	18123	158	18420	20	1518	-1711
January 25, 2018	11	35.67	17773	173	18397	19	1461	-1745
January 25, 2018	12	27.73	17498	216	18223	19	1238	-1741
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January 25, 2018	17	45.29	18581	317	19035	134	1451	-1747
January 25, 2018	18	50.28	19338	259	19683	137	1665	-1829
January 25, 2018	19	47.19	19346	269	19829	138	1487	-1646
January 25, 2018	20	42.69	19160	252	19033	139	1660	-1306
January 25, 2018	21	42.56	18869	282	18887	52	1560	-1293
January 25, 2018	22	39.41	18137	231	18076	19	1543	-1175

January 25, 2018	23	37.31	16853	361	16834	19	1517	-1023
January 25, 2018	24	29.91	15828	357	16503	19	1712	-1918
January 26, 2018	1	12.2	15021	365	16293	18	1759	-2538
January 26, 2018	2	7.37	14579	339	16299	18	1455	-2652
January 26, 2018	3	4.73	14327	376	16323	18	1176	-2677
January 26, 2018	4	3.76	14202	379	16672	18	749	-2693
January 26, 2018	5	0.5	14279	351	16825	18	544	-2677
January 26, 2018	6	0.5	14815	359	16694	18	1309	-2798
January 26, 2018	7	32.5	16105	342	18218	19	1342	-3072
January 26, 2018	8	47.24	17341	333	19164	18	890	-2381
January 26, 2018	9	37.77	17377	316	19020	20	1558	-2796
January 26, 2018	10	13.36	16821	317	18643	18	472	-1853
January 26, 2018	11	10.96	16422	297	18583	18	557	-2365
January 26, 2018	12	12.74	16092	283	18642	18	345	-2593
January 26, 2018	13	0.49	15739	309	18011	18	909	-2709
January 26, 2018	14	0	15608	316	17699	18	976	-2725
January 26, 2018	15	0	15614	347	17914	18	761	-2663
January 26, 2018	16	0	15949	316	17805	18	1395	-2920
January 26, 2018	17	4.43	16628	330	18604	18	1261	-2833
January 26, 2018	18	5.78	17547	349	19426	18	1171	-2699
January 26, 2018	19	10.32	17732	328	19850	18	1001	-2758
January 26, 2018	20	13.34	17527	317	19945	18	477	-2536
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January 26, 2018	22	0	16472	312	18844	18	869	-2851
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January 27, 2018	1	0	13505	310	16832	18	282	-3202
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January 27, 2018	5	-3	12415	329	15607	18	408	-3221
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January 27, 2018	7	0	13232	279	16439	18	387	-3277
January 27, 2018	8	0	13975	270	17107	19	302	-3105
January 27, 2018	9	0	14621	263	17949	18	314	-3352
January 27, 2018	10	1.11	15212	278	18278	18	377	-3186
January 27, 2018	11	5.19	15425	267	18487	18	404	-3148
January 27, 2018	12	8.48	15491	256	18455	18	432	-3093
January 27, 2018	13	13.33	15463	261	18540	18	342	-3173
January 27, 2018	14	13.35	15416	252	18468	18	367	-3185
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January 27, 2018	22	2	15026	251	17750	18	331	-2761
January 27, 2018	23	0.96	14356	298	17415	18	333	-3069
January 27, 2018	24	0	13629	273	16780	18	332	-3128

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January 28, 2018	2	0	12589	305	15763	18	138	-2912
January 28, 2018	3	0	12302	277	15556	18	176	-3039
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January 28, 2018	17	20.21	16052	274	17439	18	1759	-2828
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February 2, 2018	5	1.98	14943	334	17184	18	766	-2622
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February 2, 2018	7	20.99	16943	300	18460	18	1327	-2543
February 2, 2018	8	39.02	18314	304	19490	17	1568	-2533
February 2, 2018	9	37.99	18390	279	19404	20	1801	-2457
February 2, 2018	10	36.72	17987	303	19119	20	1637	-2404
February 2, 2018	11	35.73	17704	328	18739	18	1747	-2433
February 2, 2018	12	53.73	17608	304	18579	20	1725	-2464
February 2, 2018	13	35.67	17373	274	18320	19	1606	-2354
February 2, 2018	14	24.91	17301	261	18062	20	1488	-2063
February 2, 2018	15	27.15	17229	314	18246	22	1353	-2157
February 2, 2018	16	38.45	17523	348	18367	18	1540	-2102
February 2, 2018	17	38.84	18268	330	18990	16	1724	-2180
February 2, 2018	18	46.36	19184	327	19850	18	1710	-2055
February 2, 2018	19	38.57	19483	195	19704	19	1806	-1763
February 2, 2018	20	36.72	19260	202	19727	17	1697	-1863
February 2, 2018	21	36.13	18813	204	19479	18	1697	-2044
February 2, 2018	22	27.54	18180	259	19008	18	1716	-2287
February 2, 2018	23	21.24	17253	239	18243	18	1770	-2474
February 2, 2018	24	20.65	16193	220	17897	17	907	-2332
February 3, 2018	1	14.89	15382	298	17018	18	1408	-2587
February 3, 2018	2	12.26	14992	272	16975	19	1055	-2831
February 3, 2018	3	56.52	14719	296	17511	19	472	-2936
February 3, 2018	4	35.26	14630	237	17445	21	487	-2983
February 3, 2018	5	8.91	14620	244	16686	18	1262	-3050
February 3, 2018	6	13.35	14893	253	16746	18	1451	-3027

February 3, 2018	7	11.53	15470	259	17113	18	1404	-2811
February 3, 2018	8	21.15	16192	253	17405	18	1809	-2800
February 3, 2018	9	36.44	16910	233	17999	18	1744	-2670
February 3, 2018	10	58.95	17195	249	18729	19	1424	-2500
February 3, 2018	11	13.35	17001	240	17636	34	1778	-2026
February 3, 2018	12	13.43	16703	253	17938	18	1354	-2400
February 3, 2018	13	9.58	16607	255	17686	18	1803	-2641
February 3, 2018	14	14.23	16524	242	17972	18	1686	-2904
February 3, 2018	15	26.83	16703	245	18424	15	1225	-2773
February 3, 2018	16	31.09	16971	189	19234	17	1151	-3069
February 3, 2018	17	23.23	17425	188	18720	19	1539	-2658
February 3, 2018	18	33.67	18133	254	18777	18	1722	-2062
February 3, 2018	19	34.25	18291	217	19194	18	1299	-1868
February 3, 2018	20	11.52	17798	188	18967	18	805	-1697
February 3, 2018	21	11.47	17326	213	18056	18	1857	-2257
February 3, 2018	22	18.66	16745	206	18130	18	1359	-2547
February 3, 2018	23	18.19	15933	175	17961	18	1136	-2950
February 3, 2018	24	1.47	14985	237	17741	18	369	-2794
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February 4, 2018	8	6.89	14588	216	16564	18	1097	-2757
February 4, 2018	9	9.18	15234	229	16693	19	1538	-2675
February 4, 2018	10	23.89	15839	248	17732	19	884	-2552
February 4, 2018	11	36.3	16311	218	17520	18	1722	-2680
February 4, 2018	12	39.76	16545	236	17677	32	1908	-2756
February 4, 2018	13	36.21	16652	247	17871	20	1798	-2636
February 4, 2018	14	34.32	16610	251	17761	19	1798	-2598
February 4, 2018	15	12.76	16579	243	17788	19	1798	-2767
February 4, 2018	16	2.62	16678	257	17902	18	2014	-2878
February 4, 2018	17	4.31	17109	266	18083	18	2028	-2681
February 4, 2018	18	21.74	17942	238	18707	19	2020	-2538
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February 4, 2018	23	9.75	16070	263	17193	20	2074	-2842
February 4, 2018	24	1.99	15324	238	16676	19	1970	-2935
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February 5, 2018	3	12.14	14456	191	16382	19	927	-2576
February 5, 2018	4	13.33	14507	182	16547	19	873	-2642
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February 5, 2018	14	10.97	17436	261	18695	20	1602	-2540
February 5, 2018	15	7.18	17389	209	18560	22	1677	-2655
February 5, 2018	16	7.17	17583	256	18624	22	1642	-2495
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February 5, 2018	20	29.87	19352	222	20003	20	1684	-2147
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February 5, 2018	22	15.1	18398	229	19188	19	1673	-2244
February 5, 2018	23	23.36	17327	215	17996	19	1603	-2077
February 5, 2018	24	44.49	16298	202	17740	20	1277	-2414
February 6, 2018	1	31.42	15498	283	16874	19	1284	-2258
February 6, 2018	2	26.59	15118	266	16685	19	1173	-2308
February 6, 2018	3	27.05	14884	271	16463	21	878	-2189
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February 6, 2018	5	26.94	15046	270	16671	19	868	-2221
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February 6, 2018	8	38.62	18253	263	18557	18	1658	-1815
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February 6, 2018	14	35.69	17291	244	18208	21	1416	-2092
February 6, 2018	15	34.44	17263	258	18132	21	1695	-2271
February 6, 2018	16	24.31	17434	279	17970	21	1441	-1679
February 6, 2018	17	26.9	18080	282	18601	20	1801	-2065
February 6, 2018	18	34.7	19048	254	19240	19	1677	-1615
February 6, 2018	19	39.06	19522	208	20021	19	1750	-1901
February 6, 2018	20	36.73	19409	252	19685	21	1801	-1824
February 6, 2018	21	34.99	19142	272	19511	20	1819	-1844
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February 6, 2018	23	31.22	17420	289	17823	17	1694	-1695
February 6, 2018	24	33.06	16395	238	17028	18	1554	-1894
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February 7, 2018	2	31.57	15182	325	15863	20	1595	-1915
February 7, 2018	3	28	15071	301	16056	19	1462	-2118
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February 7, 2018	6	30.09	15697	326	16647	20	1437	-2081
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February 7, 2018	9	54.77	18790	265	19190	19	1121	-1245
February 7, 2018	10	47.14	18942	275	19000	19	1525	-1277

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February 7, 2018	12	41.87	18774	281	18992	20	1350	-1183
February 7, 2018	13	31.38	18485	262	18176	20	1664	-931
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February 7, 2018	16	23.54	18142	290	18716	18	1026	-1314
February 7, 2018	17	34.76	18385	338	19206	16	894	-1390
February 7, 2018	18	46.53	19035	295	19647	16	1356	-1705
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February 7, 2018	20	37.39	19443	252	19743	20	1318	-1410
February 7, 2018	21	36.42	19161	251	19288	18	1461	-1312
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February 7, 2018	23	26.04	17235	307	17430	19	1561	-1268
February 7, 2018	24	14.37	16203	283	16158	17	1539	-1173
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February 8, 2018	2	27.69	15159	364	15655	17	1612	-1626
February 8, 2018	3	36.63	15031	376	15489	17	1654	-1672
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February 8, 2018	9	37.46	18696	202	18580	18	1463	-1192
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February 8, 2018	11	46.13	18329	249	18693	17	1710	-1761
February 8, 2018	12	36.22	18019	225	18106	18	1745	-1484
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February 8, 2018	15	6.5	17735	181	18638	19	1518	-2256
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February 13, 2018	23	27.94	16725	329	17835	17	1033	-1786
February 13, 2018	24	23.75	15594	333	16647	18	1550	-2092
February 14, 2018	1	7.97	14795	332	16089	17	1645	-2453
February 14, 2018	2	5.62	14308	322	16192	17	1526	-2916
February 14, 2018	3	0	13972	316	15822	17	1361	-2821
February 14, 2018	4	0	13926	302	16339	17	741	-2823
February 14, 2018	5	0	14048	294	16225	17	1007	-2863
February 14, 2018	6	3.1	14670	331	16158	17	1751	-2879
February 14, 2018	7	10.02	15982	296	16681	17	1572	-1991
February 14, 2018	8	12.52	17096	275	17142	17	1567	-1358
February 14, 2018	9	13.37	17108	265	17719	17	1173	-1533
February 14, 2018	10	13.35	16785	203	17661	17	1567	-2160
February 14, 2018	11	8.74	16422	201	17416	18	1643	-2318
February 14, 2018	12	8.79	16003	238	17642	19	1216	-2571
February 14, 2018	13	17.45	15546	280	17944	17	876	-2918
February 14, 2018	14	16.21	15316	292	17692	17	909	-2984
February 14, 2018	15	10.28	15176	222	17395	17	943	-2951
February 14, 2018	16	14.53	15320	218	17475	17	903	-2867
February 14, 2018	17	22.68	16056	232	17848	17	840	-2487
February 14, 2018	18	28.05	17004	259	18165	17	1450	-2396
February 14, 2018	19	29.36	17614	240	18343	17	1580	-2116
February 14, 2018	20	25.71	17601	305	18375	17	1540	-2058
February 14, 2018	21	23.1	17372	326	18457	17	1245	-2055
February 14, 2018	22	26.28	16674	309	18448	17	402	-1912
February 14, 2018	23	21.43	15590	309	17372	17	459	-1911
February 14, 2018	24	1.03	14565	309	16295	17	991	-2414
February 15, 2018	1	4.91	13887	332	15961	17	1118	-2787
February 15, 2018	2	3.67	13469	344	16075	17	883	-3054
February 15, 2018	3	3.08	13134	343	16243	17	497	-3179
February 15, 2018	4	3.99	13030	346	16244	17	366	-3142
February 15, 2018	5	3.35	13163	353	16158	17	658	-3217
February 15, 2018	6	0	13800	320	16019	17	1191	-3050
February 15, 2018	7	5.23	15066	324	16655	17	1528	-2720
February 15, 2018	8	11.54	16338	308	17834	17	1379	-2619
February 15, 2018	9	13.34	16537	324	17940	17	1528	-2628
February 15, 2018	10	13.33	16406	304	18003	17	1542	-2837
February 15, 2018	11	13.33	16285	299	18096	32	1153	-2727
February 15, 2018	12	13.34	16289	314	17694	17	1689	-2791
February 15, 2018	13	20.82	16189	300	17868	16	1193	-2605
February 15, 2018	14	13.34	16120	326	17569	17	1637	-2749
February 15, 2018	15	11.84	16214	329	17488	17	1654	-2617
February 15, 2018	16	8.74	16333	298	17465	17	1263	-2192
February 15, 2018	17	25.28	16723	333	17391	17	1727	-2113
February 15, 2018	18	26.68	17308	325	17887	17	1697	-2095

February 15, 2018	19	35.56	17669	353	17833	19	1730	-1589
February 15, 2018	20	30.19	17509	327	17532	19	1750	-1362
February 15, 2018	21	27.07	17231	322	17373	18	1728	-1555
February 15, 2018	22	13.91	16550	364	17020	18	1540	-1674
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February 15, 2018	24	12.77	14439	290	15425	18	1478	-2072
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February 16, 2018	3	26.66	13351	317	14937	18	1693	-2954
February 16, 2018	4	13.35	13139	376	14785	17	1685	-2878
February 16, 2018	5	8.49	13260	377	14531	17	1685	-2515
February 16, 2018	6	13.3	13907	387	15270	17	1685	-2655
February 16, 2018	7	6.63	15199	330	16125	17	1201	-1763
February 16, 2018	8	13.36	16548	293	17230	17	984	-1392
February 16, 2018	9	13.36	16854	293	17644	17	1178	-1673
February 16, 2018	10	15.2	16958	261	17922	17	1552	-2277
February 16, 2018	11	19.93	16728	260	18155	18	1444	-2577
February 16, 2018	12	10.09	16291	226	17758	18	1863	-2962
February 16, 2018	13	1.63	15825	246	17579	18	1707	-3178
February 16, 2018	14	1.49	15679	264	17322	17	1724	-3111
February 16, 2018	15	3.59	15569	266	17784	18	1197	-3208
February 16, 2018	16	0	15646	226	17278	18	1482	-2934
February 16, 2018	17	7.04	16270	255	17462	18	1176	-2300
February 16, 2018	18	31.13	17266	231	18035	18	1692	-2447
February 16, 2018	19	38.34	18038	201	19063	20	1915	-2849
February 16, 2018	20	37.03	18057	231	18797	21	1866	-2303
February 16, 2018	21	34.56	17800	294	18397	23	1787	-2130
February 16, 2018	22	23.15	17200	322	17317	22	1780	-1475
February 16, 2018	23	16.4	16259	313	16918	20	1435	-1691
February 16, 2018	24	5.75	15212	315	16240	19	1424	-1996
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February 17, 2018	2	13.35	14048	304	15730	19	1550	-2838
February 17, 2018	3	13.34	13849	256	15589	19	1508	-2933
February 17, 2018	4	13.35	13747	269	15561	19	1447	-2993
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February 17, 2018	6	13.33	14024	216	15794	19	1490	-2994
February 17, 2018	7	12.73	14534	219	16323	19	836	-2344
February 17, 2018	8	6.05	14978	196	16481	19	1165	-2455
February 17, 2018	9	10.93	15463	255	16958	18	1065	-2402
February 17, 2018	10	14.37	15763	292	17498	19	869	-2393
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February 17, 2018	19	31.56	17290	321	17436	19	1745	-1467
February 17, 2018	20	37.55	16912	364	17391	19	1555	-1668

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February 18, 2018	11	6.03	14361	321	15620	18	902	-1711
February 18, 2018	12	9.11	14289	313	15693	18	796	-1847
February 18, 2018	13	14.34	14199	263	16118	18	352	-1962
February 18, 2018	14	8.1	14115	249	15349	18	1391	-2286
February 18, 2018	15	0.49	13968	308	15252	18	1648	-2525
February 18, 2018	16	3.9	14214	276	15779	18	1065	-2379
February 18, 2018	17	6.28	14989	320	16373	19	1024	-2188
February 18, 2018	18	20.78	16021	314	17453	18	1049	-2200
February 18, 2018	19	17.48	16599	345	17974	20	1512	-2482
February 18, 2018	20	8.8	16343	294	17673	19	1489	-2452
February 18, 2018	21	4.21	15869	329	17845	19	878	-2397
February 18, 2018	22	1.47	15326	329	17262	19	870	-2394
February 18, 2018	23	1.3	14622	337	16917	18	419	-2303
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February 19, 2018	3	0	12735	302	15458	18	363	-2710
February 19, 2018	4	0	12618	311	15506	18	275	-2828
February 19, 2018	5	0	12716	311	15448	18	367	-2807
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February 19, 2018	7	0	13672	202	16167	18	225	-2483
February 19, 2018	8	0	13824	242	16305	18	370	-2572
February 19, 2018	9	0	14106	244	16512	17	505	-2637
February 19, 2018	10	0	14352	236	16586	17	721	-2733
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February 19, 2018	13	17.91	15581	226	17813	17	733	-2824
February 19, 2018	14	13.9	15634	260	17649	17	1002	-2825
February 19, 2018	15	14.35	15682	292	17118	17	1530	-2681
February 19, 2018	16	14.38	15798	287	17552	18	1269	-2784
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February 19, 2018	18	6.88	16613	231	17481	18	2083	-2500
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February 19, 2018	21	8.82	16113	278	17533	18	1865	-2845
February 19, 2018	22	21.68	15725	269	17360	18	1211	-2639

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February 20, 2018	2	0	12859	311	15686	18	489	-2916
February 20, 2018	3	0	12636	315	15510	18	455	-2905
February 20, 2018	4	0	12570	262	15403	18	389	-2961
February 20, 2018	5	0	12856	282	15751	18	386	-3007
February 20, 2018	6	0	13363	257	16041	18	424	-2786
February 20, 2018	7	6.48	14821	312	16777	18	797	-2507
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February 20, 2018	9	14.35	16478	254	17489	18	1803	-2563
February 20, 2018	10	28.71	16497	259	18201	19	1042	-2502
February 20, 2018	11	17.35	16548	262	17728	18	1482	-2364
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February 20, 2018	13	14.35	16527	291	17104	19	1607	-1874
February 20, 2018	14	15.41	16409	262	17639	18	885	-1857
February 20, 2018	15	13.21	16332	263	17716	19	820	-1954
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February 20, 2018	18	16.05	17015	282	18252	18	1032	-1934
February 20, 2018	19	6.75	17197	315	18199	18	1304	-1938
February 20, 2018	20	9.44	17069	308	18663	18	606	-1871
February 20, 2018	21	14.33	16611	301	18339	18	451	-1859
February 20, 2018	22	14.49	15920	262	17597	18	742	-2122
February 20, 2018	23	5.87	14903	251	16593	18	591	-2013
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February 21, 2018	1	10.19	13295	259	15536	18	237	-2162
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February 21, 2018	5	0	12634	250	14969	18	508	-2488
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February 21, 2018	8	10.77	15848	279	17424	18	533	-1995
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February 21, 2018	10	21.24	16501	297	18112	18	565	-1954
February 21, 2018	11	15.47	16589	290	18141	19	663	-2014
February 21, 2018	12	22.98	16525	292	17881	18	770	-1788
February 21, 2018	13	28.34	16541	199	17632	18	1051	-1987
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February 21, 2018	17	24.55	16997	242	17787	18	1208	-1881
February 21, 2018	18	31.62	17742	296	18382	17	1693	-2142
February 21, 2018	19	38.05	18161	303	18735	18	1936	-2214
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February 21, 2018	22	38.2	17091	274	17338	19	1862	-1797
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February 22, 2018	12	24.6	17129	261	17364	27	1921	-1773
February 22, 2018	13	13.34	16811	283	16596	23	1931	-1297
February 22, 2018	14	11.52	16460	284	16572	18	1794	-1343
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February 23, 2018	3	0	13490	367	16047	18	543	-2624
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February 24, 2018	24	0	13491	316	15826	18	214	-2070
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February 25, 2018	2	0	12596	249	15399	18	333	-2765
February 25, 2018	3	0	12419	234	15382	18	137	-2744
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February 25, 2018	13	0	13946	326	15952	19	354	-1925
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February 25, 2018	24	0	13601	295	15808	18	214	-2029
February 26, 2018	1	0	12944	330	15168	18	260	-2002
February 26, 2018	2	0	12650	322	15310	18	214	-2482
February 26, 2018	3	0	12493	321	15209	18	137	-2470
February 26, 2018	4	0	12479	329	15048	18	137	-2336

February 26, 2018	5	0	12704	308	15167	18	214	-2328
February 26, 2018	6	0	13444	308	15506	18	805	-2526
February 26, 2018	7	5.43	14867	332	16462	18	679	-2009
February 26, 2018	8	6.15	15892	273	16820	18	1107	-1727
February 26, 2018	9	1.97	15666	319	16843	18	1051	-1804
February 26, 2018	10	0	15262	327	16528	18	1027	-1917
February 26, 2018	11	33.32	15253	326	16973	18	330	-1797
February 26, 2018	12	37.07	15089	279	16959	18	498	-1949
February 26, 2018	13	0	14853	263	16451	18	875	-2097
February 26, 2018	14	0	14671	312	16564	18	459	-1946
February 26, 2018	15	0	14602	337	16398	18	407	-1834
February 26, 2018	16	-2.77	14713	329	16503	18	383	-1805
February 26, 2018	17	3.35	15480	331	17240	18	409	-1901
February 26, 2018	18	22.07	16453	329	17732	18	720	-1772
February 26, 2018	19	30.73	17249	313	18088	18	1457	-1948
February 26, 2018	20	30.31	17352	306	18438	18	1136	-1805
February 26, 2018	21	26.58	17025	329	18481	18	599	-1753
February 26, 2018	22	12.06	16365	308	17456	18	962	-1689
February 26, 2018	23	7.44	15211	314	16869	18	492	-1765
February 26, 2018	24	5.74	14195	368	16157	18	533	-1993
February 27, 2018	1	5.5	13438	381	15571	18	614	-2170
February 27, 2018	2	1.5	13057	390	15378	18	674	-2445
February 27, 2018	3	0	12905	381	15379	18	541	-2505
February 27, 2018	4	0	12821	369	15483	18	406	-2563
February 27, 2018	5	0.98	13000	369	15696	18	393	-2627
February 27, 2018	6	0.99	13665	375	15797	18	443	-2131
February 27, 2018	7	5.91	14990	360	17082	18	654	-2313
February 27, 2018	8	6.08	15909	267	17645	18	811	-2153
February 27, 2018	9	0.49	15525	280	17232	18	726	-2110
February 27, 2018	10	2.38	15007	272	16765	18	620	-2122
February 27, 2018	11	2.49	14605	272	16491	18	607	-2162
February 27, 2018	12	0	14276	296	15983	18	706	-2045
February 27, 2018	13	0	13989	269	15831	19	514	-1977
February 27, 2018	14	-0.01	13910	309	15512	18	511	-1696
February 27, 2018	15	0	13950	279	15842	18	415	-2036
February 27, 2018	16	0	14247	276	15895	19	530	-1935
February 27, 2018	17	0	14929	286	16597	19	461	-1879
February 27, 2018	18	3.43	15699	317	17553	18	721	-2119
February 27, 2018	19	7.48	16492	335	18316	19	747	-2173
February 27, 2018	20	12.2	16605	285	18395	18	871	-2247
February 27, 2018	21	6.03	16366	253	18128	18	826	-2184
February 27, 2018	22	6.41	15705	321	17507	18	985	-2390
February 27, 2018	23	1.39	14678	330	16556	18	863	-2334
February 27, 2018	24	0	13675	314	15865	19	624	-2384
February 28, 2018	1	0	12971	331	15359	19	866	-2741
February 28, 2018	2	0	12580	313	15159	18	742	-2878
February 28, 2018	3	0	12416	293	15084	18	737	-3011
February 28, 2018	4	0	12374	354	15428	18	727	-3452
February 28, 2018	5	0	12567	353	15243	18	711	-2949
February 28, 2018	6	0	13245	345	15690	18	646	-2711

February 28, 2018	7	2.41	14456	317	16703	18	492	-2366
February 28, 2018	8	0	15499	255	17145	18	714	-2042
February 28, 2018	9	0	15494	293	17225	18	941	-2294
February 28, 2018	10	0	15152	308	16823	18	825	-2099
February 28, 2018	11	1.93	14924	276	16646	18	799	-2164
February 28, 2018	12	1.42	14727	318	16450	18	980	-2376
February 28, 2018	13	0	14399	322	15944	20	1114	-2231
February 28, 2018	14	2.82	14407	293	16113	19	996	-2404
February 28, 2018	15	6.03	14507	316	16489	19	974	-2609
February 28, 2018	16	6.06	14822	311	16756	18	988	-2563
February 28, 2018	17	1.44	15373	298	17220	18	992	-2502
February 28, 2018	18	9.45	16026	340	17371	18	1323	-2313
February 28, 2018	19	37.12	16680	325	17848	19	1314	-2223
February 28, 2018	20	19.98	16737	323	17780	19	1552	-2187
February 28, 2018	21	17.61	16549	321	17413	20	1198	-1662
February 28, 2018	22	28.1	15926	265	17276	19	927	-1971
February 28, 2018	23	9.08	14922	243	16577	19	663	-1963
February 28, 2018	24	12.12	13877	252	15918	19	834	-2493
March 1, 2018	1	14.36	13214	264	15627	19	584	-2744
March 1, 2018	2	10.9	12882	276	15736	19	660	-3216
March 1, 2018	3	8.82	12696	286	15691	18	630	-3213
March 1, 2018	4	5.52	12542	289	15099	18	725	-2834
March 1, 2018	5	5.96	12458	316	15390	17	479	-2778
March 1, 2018	6	-1.51	13280	303	15819	19	259	-2363
March 1, 2018	7	3.13	14608	227	16304	19	945	-2419
March 1, 2018	8	6.08	15594	212	17398	18	647	-2268
March 1, 2018	9	9.2	15581	219	17566	18	793	-2474
March 1, 2018	10	5.56	15350	191	17068	18	1134	-2643
March 1, 2018	11	1.45	15227	213	16906	31	814	-2362
March 1, 2018	12	4.88	15348	205	17077	30	739	-2345
March 1, 2018	13	6.1	15349	210	17209	25	728	-2450
March 1, 2018	14	6.1	15360	158	17221	20	808	-2573
March 1, 2018	15	2.22	15371	200	17207	18	735	-2405
March 1, 2018	16	6.7	15708	214	17580	19	711	-2403
March 1, 2018	17	8.12	16459	206	18223	19	659	-2250
March 1, 2018	18	6.06	16909	284	18654	19	898	-2385
March 1, 2018	19	6.01	17214	287	18919	18	910	-2216
March 1, 2018	20	1.7	17153	261	18807	18	519	-1924
March 1, 2018	21	3.89	16842	283	18957	18	268	-2084
March 1, 2018	22	6.89	16194	339	18381	18	566	-2430
March 1, 2018	23	0.94	15173	320	17531	18	546	-2487
March 1, 2018	24	0	14238	366	16527	18	707	-2545
March 2, 2018	1	0	13601	345	16516	18	395	-2877
March 2, 2018	2	0	13231	359	16242	18	353	-2913
March 2, 2018	3	0	13051	372	16188	18	355	-3033
March 2, 2018	4	0	13023	336	16200	18	339	-3106
March 2, 2018	5	0	13173	346	16158	18	272	-2872
March 2, 2018	6	0	13765	330	16392	18	494	-2705
March 2, 2018	7	2.01	15033	352	17423	18	488	-2604
March 2, 2018	8	7.04	16199	201	18001	18	541	-2158

March 2, 2018	9	8.29	16457	210	18373	18	750	-2446
March 2, 2018	10	5.79	16345	171	18236	18	513	-2143
March 2, 2018	11	0	16082	114	17995	18	390	-2131
March 2, 2018	12	0	15758	134	17711	18	556	-2361
March 2, 2018	13	0	15432	186	17397	18	516	-2223
March 2, 2018	14	0	15353	168	17258	18	477	-2172
March 2, 2018	15	0	15325	222	17167	18	514	-2115
March 2, 2018	16	0	15397	232	17203	19	401	-1919
March 2, 2018	17	1.9	15773	304	17762	19	218	-1901
March 2, 2018	18	4.16	16339	280	18436	19	277	-2138
March 2, 2018	19	11.81	17060	312	19033	19	502	-2185
March 2, 2018	20	25.33	17249	363	19235	19	657	-2295
March 2, 2018	21	23.4	17004	342	18996	19	554	-2205
March 2, 2018	22	11.57	16411	345	18516	19	654	-2320
March 2, 2018	23	7.17	15435	336	17594	19	598	-2307
March 2, 2018	24	1.56	14439	356	16599	14	936	-2608
March 3, 2018	1	1.5	13773	303	16266	14	714	-2792
March 3, 2018	2	0	13416	315	15938	13	545	-2661
March 3, 2018	3	0	13174	335	15855	13	562	-2829
March 3, 2018	4	0	13082	328	15781	13	696	-2979
March 3, 2018	5	0.4	13113	311	15804	13	618	-2905
March 3, 2018	6	5.33	13334	307	16013	13	734	-3035
March 3, 2018	7	6.14	13890	285	16026	13	762	-2534
March 3, 2018	8	11.03	14352	271	16525	13	952	-2782
March 3, 2018	9	13.08	14597	308	16638	13	993	-2687
March 3, 2018	10	5.53	14556	284	16837	13	914	-2815
March 3, 2018	11	5.99	14465	280	16837	13	586	-2666
March 3, 2018	12	4.69	14308	276	16522	13	899	-2805
March 3, 2018	13	1.44	14109	278	16396	13	713	-2699
March 3, 2018	14	0	13903	274	16307	15	598	-2673
March 3, 2018	15	0	13724	266	16142	14	574	-2667
March 3, 2018	16	0	13841	245	16164	14	605	-2633
March 3, 2018	17	1.92	14432	246	16769	16	631	-2697
March 3, 2018	18	5.47	15355	245	17579	16	617	-2647
March 3, 2018	19	13.67	16207	240	18467	15	435	-2474
March 3, 2018	20	12.96	16234	256	18561	14	553	-2544
March 3, 2018	21	5.85	15910	250	18254	15	599	-2582
March 3, 2018	22	6.65	15441	341	17822	15	446	-2461
March 3, 2018	23	8.17	14739	320	17196	14	459	-2464
March 3, 2018	24	6.76	13977	355	16542	14	573	-2617
March 4, 2018	1	6.72	13318	341	16304	14	513	-3007
March 4, 2018	2	6.25	12947	276	15579	14	501	-2762
March 4, 2018	3	14.34	12756	341	15646	14	565	-3019
March 4, 2018	4	11.62	12670	308	15704	13	367	-3036
March 4, 2018	5	14.32	12695	318	15749	14	356	-3065
March 4, 2018	6	13.03	12875	306	15668	13	321	-2767
March 4, 2018	7	14.35	13321	250	15885	13	327	-2554
March 4, 2018	8	8.32	13582	250	16157	13	264	-2497
March 4, 2018	9	5.4	13534	320	16040	13	184	-2306
March 4, 2018	10	3.38	13453	271	15910	14	279	-2378

March 4, 2018	11	6.01	13572	305	15959	14	266	-2344
March 4, 2018	12	6.92	13631	273	15988	14	184	-2230
March 4, 2018	13	6.06	13575	260	16033	14	164	-2328
March 4, 2018	14	6.01	13463	236	16053	14	14	-2313
March 4, 2018	15	4.84	13395	273	16015	14	14	-2333
March 4, 2018	16	2.96	13670	289	16121	14	82	-2216
March 4, 2018	17	2.96	14524	276	16963	15	42	-2221
March 4, 2018	18	5.28	15671	285	17529	14	537	-2161
March 4, 2018	19	29.02	16641	240	18327	14	826	-2257
March 4, 2018	20	14.37	16800	225	18180	14	1298	-2354
March 4, 2018	21	14.32	16357	288	17934	14	1202	-2381
March 4, 2018	22	11.49	15775	321	17850	14	486	-2193
March 4, 2018	23	10.89	14907	357	17179	13	332	-2287
March 4, 2018	24	9.56	14093	283	16609	13	253	-2310
March 5, 2018	1	6.05	13521	330	16175	13	114	-2402
March 5, 2018	2	13.67	13265	371	15918	13	414	-2691
March 5, 2018	3	14.32	13143	358	15954	13	564	-2992
March 5, 2018	4	9.13	13190	339	15980	13	564	-2991
March 5, 2018	5	6.04	13434	282	16009	13	564	-2844
March 5, 2018	6	0.5	14107	332	16086	13	995	-2609
March 5, 2018	7	14.74	15462	308	17587	13	668	-2529
March 5, 2018	8	30.64	16558	283	18589	13	717	-2575
March 5, 2018	9	33.48	16429	308	18509	14	604	-2398
March 5, 2018	10	28.92	16021	291	18043	15	679	-2345
March 5, 2018	11	28.85	15854	326	17855	13	551	-2243
March 5, 2018	12	40.95	15698	311	17800	14	428	-2262
March 5, 2018	13	29.33	15546	335	17187	14	887	-2214
March 5, 2018	14	25.92	15597	314	17321	14	635	-2071
March 5, 2018	15	29.47	15579	315	17523	15	538	-2130
March 5, 2018	16	26.13	15809	323	17650	16	926	-2464
March 5, 2018	17	21.68	16351	277	17658	15	1491	-2522
March 5, 2018	18	25.61	17064	295	17883	14	1632	-2199
March 5, 2018	19	29.7	17752	299	18550	14	1544	-1958
March 5, 2018	20	26.81	17870	301	18589	14	1504	-1785
March 5, 2018	21	29.81	17541	312	18223	14	1578	-1909
March 5, 2018	22	29.01	16763	314	18099	14	1411	-2379
March 5, 2018	23	27.87	15689	327	17184	13	1447	-2553
March 5, 2018	24	8.73	14518	301	15806	13	1701	-2515
March 6, 2018	1	10.46	13756	313	15687	13	1255	-2677
March 6, 2018	2	4.78	13360	319	15709	13	756	-2658
March 6, 2018	3	0	13118	345	15618	13	637	-2670
March 6, 2018	4	0.9	13163	261	15945	16	381	-2754
March 6, 2018	5	0	13227	379	16086	16	267	-2695
March 6, 2018	6	0	13870	320	15995	16	1110	-2779
March 6, 2018	7	6.7	15231	303	17095	48	961	-2548
March 6, 2018	8	24.33	16390	258	18259	69	730	-2358
March 6, 2018	9	14.38	16626	242	18712	68	379	-2107
March 6, 2018	10	13.32	16405	208	18510	68	264	-2232
March 6, 2018	11	6.94	16601	277	18363	68	582	-2194
March 6, 2018	12	13.35	16671	266	18392	68	550	-2162

March 6, 2018	13	13.37	16477	289	18359	68	435	-2065
March 6, 2018	14	10.92	16275	295	17464	76	1211	-2228
March 6, 2018	15	19.83	16570	317	18066	68	835	-2072
March 6, 2018	16	24.53	16672	293	18245	68	699	-1965
March 6, 2018	17	18.74	17161	280	18563	68	765	-1934
March 6, 2018	18	17.87	17568	257	18314	67	1233	-1730
March 6, 2018	19	27.13	17946	276	18829	14	1263	-1691
March 6, 2018	20	26.54	17935	297	18590	14	1514	-1709
March 6, 2018	21	34.26	17597	307	18328	14	1398	-1796
March 6, 2018	22	31.16	16798	342	18191	14	877	-1903
March 6, 2018	23	34.99	15682	395	17002	13	1186	-2025
March 6, 2018	24	9.68	14701	346	15663	13	1768	-2248
March 7, 2018	1	9.1	13942	369	15094	13	1536	-2177
March 7, 2018	2	12.11	13547	375	15151	14	1076	-2171
March 7, 2018	3	5.31	13306	373	14827	14	1204	-2200
March 7, 2018	4	13.31	13267	374	15122	13	691	-2082
March 7, 2018	5	13.32	13355	379	15472	13	405	-2020
March 7, 2018	6	3.86	14005	339	15344	14	1496	-2383
March 7, 2018	7	9.29	15280	334	16039	14	1671	-2100
March 7, 2018	8	24.09	16342	308	16812	14	1807	-1954
March 7, 2018	9	15.33	16706	317	17182	14	1727	-1855
March 7, 2018	10	31.84	16647	315	17758	14	953	-1760
March 7, 2018	11	15.58	16587	199	17594	16	1117	-1903
March 7, 2018	12	26.49	16542	231	17693	16	1149	-2033
March 7, 2018	13	21.11	16410	268	17518	15	978	-1804
March 7, 2018	14	14.37	16409	305	17316	15	1493	-2067
March 7, 2018	15	19.5	16405	276	17689	15	907	-1802
March 7, 2018	16	10.69	16514	329	17971	14	1093	-2179
March 7, 2018	17	10.08	16967	302	18182	13	1458	-2318
March 7, 2018	18	14.37	17328	324	18768	14	985	-2067
March 7, 2018	19	14.35	17628	318	18723	13	1502	-2176
March 7, 2018	20	8.95	17734	301	18521	13	1598	-1990
March 7, 2018	21	6.7	17400	322	18372	13	1420	-1993
March 7, 2018	22	8.7	16658	311	18288	13	773	-1999
March 7, 2018	23	9.7	15551	313	17402	13	204	-1666
March 7, 2018	24	4.49	14576	280	16509	14	628	-2147
March 8, 2018	1	2.43	13923	319	15832	13	811	-2319
March 8, 2018	2	0	13401	357	15667	13	646	-2507
March 8, 2018	3	0	13284	368	15681	13	415	-2446
March 8, 2018	4	6.04	13259	313	15804	14	375	-2581
March 8, 2018	5	3.4	13478	240	15591	13	779	-2603
March 8, 2018	6	0.91	14059	315	15569	13	1174	-2348
March 8, 2018	7	9.17	15353	307	17093	13	849	-2312
March 8, 2018	8	23.54	16467	310	18128	13	609	-2049
March 8, 2018	9	23.08	16785	251	18418	13	957	-2398
March 8, 2018	10	22.46	16743	195	18514	13	1008	-2535
March 8, 2018	11	21.56	16596	218	18382	13	931	-2496
March 8, 2018	12	17.75	16543	234	18441	13	688	-2327
March 8, 2018	13	13.36	16394	260	18256	13	780	-2363
March 8, 2018	14	32.21	16454	255	18191	14	829	-2306

March 8, 2018	15	33.93	16450	248	18479	14	692	-2490
March 8, 2018	16	28.62	16541	324	18465	14	1123	-2700
March 8, 2018	17	13.34	16938	330	18416	14	1622	-2674
March 8, 2018	18	11.53	17285	300	18308	14	1531	-2229
March 8, 2018	19	24.85	17732	278	18878	15	1684	-2471
March 8, 2018	20	29.53	17812	322	18955	15	1744	-2488
March 8, 2018	21	51.46	17548	234	19051	14	1374	-2669
March 8, 2018	22	70.28	16752	339	18084	16	1768	-2706
March 8, 2018	23	30.1	15647	386	17178	15	1556	-2590
March 8, 2018	24	9.78	14571	368	16135	15	1507	-2572
March 9, 2018	1	3.17	13881	289	15198	13	1663	-2440
March 9, 2018	2	0	13421	296	14967	13	1460	-2614
March 9, 2018	3	0.37	13053	277	15162	13	1010	-2576
March 9, 2018	4	4.04	13123	308	15469	13	776	-2705
March 9, 2018	5	0	13228	243	14954	13	1382	-2740
March 9, 2018	6	0.87	13958	135	15478	13	1315	-2621
March 9, 2018	7	9.8	15139	261	16980	14	887	-2506
March 9, 2018	8	17.22	16196	224	18002	14	822	-2463
March 9, 2018	9	15.81	16482	236	18457	14	696	-2421
March 9, 2018	10	26.8	16324	276	18660	14	450	-2489
March 9, 2018	11	20.03	16060	346	18514	14	416	-2443
March 9, 2018	12	0.44	15832	325	18000	14	780	-2479
March 9, 2018	13	2.77	15586	325	17656	14	798	-2506
March 9, 2018	14	5.02	15645	310	17437	14	921	-2422
March 9, 2018	15	8.69	15675	318	17635	13	912	-2545
March 9, 2018	16	18.71	15776	314	18229	13	475	-2532
March 9, 2018	17	23.82	16203	315	18437	13	837	-2801
March 9, 2018	18	26.33	16679	309	18758	13	380	-2114
March 9, 2018	19	36.92	17182	313	19310	14	883	-2660
March 9, 2018	20	26.58	17305	280	18934	14	1371	-2554
March 9, 2018	21	30.26	16930	384	18300	14	1287	-2244
March 9, 2018	22	20.21	16353	376	17548	13	1269	-1968
March 9, 2018	23	24.09	15438	392	17142	13	1046	-2297
March 9, 2018	24	12.7	14436	360	16079	13	1348	-2546
March 10, 2018	1	10.22	13785	339	14996	13	1643	-2475
March 10, 2018	2	10.22	13316	293	14512	13	1616	-2458
March 10, 2018	3	13.34	13089	310	14539	13	1385	-2625
March 10, 2018	4	13.35	12963	316	14652	13	1398	-2677
March 10, 2018	5	13.35	13034	343	14842	13	1274	-2698
March 10, 2018	6	13.34	13328	297	15037	13	1190	-2635
March 10, 2018	7	13.34	13825	286	15258	13	1581	-2678
March 10, 2018	8	7.17	14364	258	15614	13	1735	-2589
March 10, 2018	9	11.28	14700	281	15954	13	1585	-2549
March 10, 2018	10	14.36	14711	261	16587	13	972	-2549
March 10, 2018	11	34.88	14829	288	17207	13	253	-2322
March 10, 2018	12	13.64	14941	273	16698	13	1309	-2706
March 10, 2018	13	14.33	14789	279	16126	13	1837	-2793
March 10, 2018	14	23.02	14571	286	16588	13	923	-2565
March 10, 2018	15	10.15	14491	263	16439	13	1111	-2630
March 10, 2018	16	14.37	14581	281	16813	13	266	-2186

March 10, 2018	17	20.95	15138	274	17146	13	286	-2041
March 10, 2018	18	20.31	15806	274	17452	13	631	-2016
March 10, 2018	19	90.35	16427	273	18074	13	920	-2275
March 10, 2018	20	55.54	16356	300	17781	15	1199	-2274
March 10, 2018	21	29.77	15989	319	16885	13	1658	-2104
March 10, 2018	22	13.36	15427	297	16681	13	948	-1774
March 10, 2018	23	17.77	14817	324	15922	13	1638	-2232
March 10, 2018	24	16.98	14047	319	15485	13	1582	-2570
March 11, 2018	1	13.33	13432	299	14412	13	1942	-2431
March 11, 2018	2	13.34	13086	338	14235	13	1931	-2651
March 11, 2018	3	13.33	12969	310	14123	13	1827	-2571
March 11, 2018	4	13.34	12910	316	14148	13	1863	-2667
March 11, 2018	5	13.36	12984	366	14277	13	1861	-2638
March 11, 2018	6	15.81	13271	367	14500	13	1754	-2532
March 11, 2018	7	24.7	13761	284	14944	13	1479	-2405
March 11, 2018	8	54.52	14085	286	15518	13	1236	-2356
March 11, 2018	9	28.72	14246	282	15741	13	888	-2049
March 11, 2018	10	5.87	14214	296	15177	13	1284	-1887
March 11, 2018	11	12.71	14210	276	15759	23	581	-1784
March 11, 2018	12	4.25	13981	341	15831	23	750	-2012
March 11, 2018	13	12.09	13978	342	15446	13	1397	-2365
March 11, 2018	14	6.52	13820	365	15639	13	1182	-2524
March 11, 2018	15	8.99	13948	331	15651	13	1269	-2514
March 11, 2018	16	10.2	14209	328	15473	13	1366	-2168
March 11, 2018	17	23.03	14910	325	16246	13	1011	-2021
March 11, 2018	18	28.84	15457	268	16534	12	709	-1596
March 11, 2018	19	38.26	16101	287	16915	12	1067	-1529
March 11, 2018	20	25.1	16316	352	17088	14	1083	-1452
March 11, 2018	21	38.88	15905	345	16738	13	1078	-1545
March 11, 2018	22	30.04	15197	349	15706	14	1398	-1437
March 11, 2018	23	23.93	14395	316	15271	14	1310	-1819
March 11, 2018	24	22.47	13732	355	14876	13	1453	-2143
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March 12, 2018	2	18.37	13157	372	13968	13	1714	-2051
March 12, 2018	3	14.36	13144	315	14101	13	1591	-2176
March 12, 2018	4	14.35	13303	373	14460	13	1597	-2411
March 12, 2018	5	26.03	13934	369	14612	13	1705	-2000
March 12, 2018	6	34.87	15029	334	15780	12	1738	-2122
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March 12, 2018	8	35.54	16783	293	16988	14	1728	-1573
March 12, 2018	9	35.64	16816	271	17007	13	1628	-1571
March 12, 2018	10	35.26	16496	297	17113	14	1704	-1934
March 12, 2018	11	33.99	16407	292	16974	14	1704	-1984
March 12, 2018	12	33.02	16311	257	16912	13	1704	-1989
March 12, 2018	13	32.56	16263	240	16818	13	1804	-2049
March 12, 2018	14	34.94	16343	250	16854	14	1878	-2128
March 12, 2018	15	34.61	16428	254	16836	14	1904	-2026
March 12, 2018	16	34.95	16626	272	16945	14	1911	-1932
March 12, 2018	17	34.33	16926	265	17201	14	1842	-1779
March 12, 2018	18	34.18	17092	337	17234	15	1842	-1584

March 12, 2018	19	34.76	17590	302	17899	14	1822	-1796
March 12, 2018	20	34.4	17630	307	17895	14	1856	-1766
March 12, 2018	21	32.62	17068	304	17410	15	1767	-1769
March 12, 2018	22	31.6	16046	301	16373	17	1638	-1588
March 12, 2018	23	25.94	15046	329	15494	17	1719	-1746
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March 13, 2018	1	23.95	13878	363	14729	13	1741	-2086
March 13, 2018	2	22.49	13572	382	14478	14	1849	-2314
March 13, 2018	3	26.09	13514	341	14759	14	1781	-2630
March 13, 2018	4	34.35	13600	374	15230	13	1081	-2347
March 13, 2018	5	27.51	14161	314	15284	14	1715	-2480
March 13, 2018	6	34.32	15287	312	16116	14	2010	-2524
March 13, 2018	7	35.57	16508	279	16986	14	1733	-1891
March 13, 2018	8	34.13	16873	247	17204	15	1740	-1806
March 13, 2018	9	33.59	16797	315	17176	14	1773	-1747
March 13, 2018	10	30.55	16668	321	17348	14	1451	-1764
March 13, 2018	11	32.51	16406	274	17136	14	1357	-1754
March 13, 2018	12	18.46	16055	324	16947	14	1354	-1822
March 13, 2018	13	15.57	15873	302	16939	14	1210	-1874
March 13, 2018	14	12.22	15746	333	17119	14	733	-1724
March 13, 2018	15	5.91	15708	292	16605	15	1323	-1835
March 13, 2018	16	14.35	15972	324	17234	15	873	-1797
March 13, 2018	17	14.35	16417	306	17223	17	1348	-1779
March 13, 2018	18	11.57	16663	305	17328	14	1497	-1792
March 13, 2018	19	16.77	17329	308	17487	13	1683	-1494
March 13, 2018	20	26.25	17454	334	17862	13	1733	-1690
March 13, 2018	21	23.91	16907	324	17678	13	1478	-1837
March 13, 2018	22	12.87	15943	324	17278	13	1176	-2068
March 13, 2018	23	1.44	14851	347	15853	13	1622	-2124
March 13, 2018	24	2.55	14076	363	15531	14	1219	-2219
March 14, 2018	1	2.45	13586	376	15602	13	801	-2299
March 14, 2018	2	0	13339	356	15142	13	985	-2392
March 14, 2018	3	0	13304	371	15606	13	797	-2681
March 14, 2018	4	0	13418	278	15436	13	1195	-2838
March 14, 2018	5	4.53	13938	315	15607	13	1431	-2732
March 14, 2018	6	13.78	14985	316	16672	13	1412	-2682
March 14, 2018	7	13.01	16182	237	17304	13	1278	-2054
March 14, 2018	8	24.67	16702	299	18290	13	701	-2029
March 14, 2018	9	16.48	16637	289	18396	13	691	-2058
March 14, 2018	10	28.16	16522	286	18472	13	764	-2320
March 14, 2018	11	15.92	16295	296	17963	13	757	-2076
March 14, 2018	12	14.33	15980	248	17634	13	853	-2137
March 14, 2018	13	14.36	15939	283	17753	13	589	-2133
March 14, 2018	14	14.36	15814	300	17785	14	341	-2009
March 14, 2018	15	5.57	15762	281	17514	15	772	-2131
March 14, 2018	16	19.53	15925	314	17727	13	717	-2185
March 14, 2018	17	30.5	16261	315	17723	13	1097	-2215
March 14, 2018	18	32.62	16516	318	17977	13	888	-2138
March 14, 2018	19	47.77	17303	355	18180	14	1672	-2132
March 14, 2018	20	35.67	17454	343	17879	14	1754	-1669

March 14, 2018	21	25.19	16895	375	17637	14	1555	-1710
March 14, 2018	22	10.91	15800	348	16582	13	1628	-1853
March 14, 2018	23	6.08	14833	363	15492	13	1783	-1968
March 14, 2018	24	12.92	14036	393	15419	13	1283	-2168
March 15, 2018	1	33.18	13601	380	15748	14	800	-2384
March 15, 2018	2	32.45	13380	391	15199	14	1193	-2536
March 15, 2018	3	33.28	13343	365	15108	13	1119	-2516
March 15, 2018	4	33.42	13499	370	15098	13	1417	-2568
March 15, 2018	5	29.99	14050	366	14988	13	1966	-2483
March 15, 2018	6	25.19	15224	274	15671	13	1984	-2099
March 15, 2018	7	30.19	16353	296	16656	13	1741	-1731
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March 15, 2018	9	12.09	16260	333	16864	15	1710	-1850
March 15, 2018	10	8.39	15742	289	16743	16	1162	-1790
March 15, 2018	11	13.32	15391	319	16067	16	1616	-2004
March 15, 2018	12	30.78	15288	292	16704	18	1517	-2538
March 15, 2018	13	21.02	15277	278	16932	17	1218	-2500
March 15, 2018	14	13.34	15300	224	16920	18	969	-2354
March 15, 2018	15	13.35	15350	285	17304	19	362	-2040
March 15, 2018	16	17.1	15570	325	17583	19	301	-1965
March 15, 2018	17	26.12	16060	319	17733	19	246	-1624
March 15, 2018	18	21.65	16424	309	18112	19	490	-1858
March 15, 2018	19	19.46	17132	243	18012	19	1220	-1844
March 15, 2018	20	12.1	17225	270	17663	17	1422	-1438
March 15, 2018	21	7.68	16698	286	17600	16	1402	-1882
March 15, 2018	22	2.43	15762	286	17387	15	726	-1905
March 15, 2018	23	0.98	14754	323	16817	15	521	-2198
March 15, 2018	24	6.24	14015	334	16167	15	771	-2467
March 16, 2018	1	0	13517	318	15270	15	1325	-2632
March 16, 2018	2	0	13338	309	15233	16	1208	-2729
March 16, 2018	3	4.42	13309	322	15440	17	1002	-2731
March 16, 2018	4	4.56	13509	325	15618	15	787	-2523
March 16, 2018	5	4.9	14126	293	15928	15	838	-2298
March 16, 2018	6	6.82	15344	308	16520	14	1578	-2408
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March 16, 2018	8	26.58	16899	311	18296	15	978	-1988
March 16, 2018	9	27.19	16630	343	18159	15	1050	-2138
March 16, 2018	10	20.75	16292	320	17941	14	749	-2078
March 16, 2018	11	56.18	15972	293	17367	14	745	-1895
March 16, 2018	12	53.79	15625	299	17180	15	657	-1838
March 16, 2018	13	14.63	15347	279	16714	16	818	-1787
March 16, 2018	14	13.34	15021	301	16772	14	440	-1780
March 16, 2018	15	2.38	14695	258	16664	14	184	-1722
March 16, 2018	16	0	14748	280	16237	15	505	-1698
March 16, 2018	17	6.3	15194	307	16718	14	478	-1699
March 16, 2018	18	18.44	15797	314	17291	15	624	-1808
March 16, 2018	19	163.73	16733	249	17809	13	1023	-1843
March 16, 2018	20	44.38	17028	263	17486	13	1640	-1718
March 16, 2018	21	25.3	16577	232	17003	13	1728	-1701
March 16, 2018	22	10.25	15804	267	16190	13	1758	-1641

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March 17, 2018	21	32.42	15637	270	16360	15	1241	-1629
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March 18, 2018	6	14.34	13480	313	14647	16	1644	-2365
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March 18, 2018	10	5.82	14018	288	15316	14	1714	-2633
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March 19, 2018	5	15.89	14056	288	15397	13	1679	-2676
March 19, 2018	6	34.49	15636	321	16894	13	1674	-2661
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March 21, 2018	23	14.33	14625	296	15564	12	1247	-1819
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March 22, 2018	1	32.81	13474	297	14744	13	1260	-2201
March 22, 2018	2	22.46	13335	288	14541	13	1343	-2214
March 22, 2018	3	34.79	13415	257	15024	13	1008	-2324
March 22, 2018	4	33.27	13629	262	15485	12	576	-2201
March 22, 2018	5	30.02	14294	214	15408	13	1346	-2254
March 22, 2018	6	32.6	15726	216	16130	13	1869	-2139
March 22, 2018	7	35.69	16912	226	17456	14	1747	-2050
March 22, 2018	8	35.17	16696	280	17153	14	1772	-1910
March 22, 2018	9	34.22	16063	287	17095	13	1626	-2263
March 22, 2018	10	19.71	15487	229	16395	12	1600	-2185
March 22, 2018	11	14.34	15155	242	16056	12	1699	-2305
March 22, 2018	12	14.36	14921	210	16373	12	1004	-2235
March 22, 2018	13	28.96	14883	207	16132	13	1400	-2503
March 22, 2018	14	27.86	14576	283	16051	13	1048	-2284
March 22, 2018	15	26.37	14555	304	15902	13	1093	-2221
March 22, 2018	16	9.57	14865	244	16657	14	428	-2042
March 22, 2018	17	15.99	15291	249	17286	13	164	-2115
March 22, 2018	18	22.69	15836	268	17330	12	760	-2006
March 22, 2018	19	110.84	16733	275	17529	15	1552	-2083
March 22, 2018	20	69.34	17260	310	17475	15	1820	-1651
March 22, 2018	21	34.68	16762	283	17017	15	1783	-1625
March 22, 2018	22	35	15861	272	16072	15	1783	-1606
March 22, 2018	23	25.68	14785	274	15007	15	1672	-1585
March 22, 2018	24	25.24	14009	294	14263	13	1867	-1813
March 23, 2018	1	31.43	13598	301	13938	13	1921	-1870
March 23, 2018	2	19.57	13356	278	14139	13	1237	-1747
March 23, 2018	3	13.34	13316	328	14418	13	965	-1752
March 23, 2018	4	16.6	13556	256	15316	13	492	-1979

March 23, 2018	5	7.6	14073	299	15497	13	745	-1901
March 23, 2018	6	30.25	15442	335	16014	14	1687	-1950
March 23, 2018	7	35.11	16665	276	17204	13	1723	-1981
March 23, 2018	8	35.08	16556	322	17202	14	1784	-2055
March 23, 2018	9	34.36	16039	285	16788	14	1884	-2281
March 23, 2018	10	26.54	15540	309	16476	13	1699	-2289
March 23, 2018	11	5.52	15130	252	16028	14	1699	-2257
March 23, 2018	12	7.56	14848	313	16019	15	1336	-2150
March 23, 2018	13	10.83	14665	321	16085	15	1346	-2336
March 23, 2018	14	5.8	14449	235	15910	15	1295	-2429
March 23, 2018	15	0.49	14274	290	15830	16	902	-2119
March 23, 2018	16	7.71	14529	317	15985	15	997	-2105
March 23, 2018	17	7.35	14969	333	16304	14	1015	-2073
March 23, 2018	18	2.24	15418	321	16083	13	1530	-1859
March 23, 2018	19	44.42	16187	354	16855	12	1612	-1973
March 23, 2018	20	44.31	16700	349	17454	13	1299	-1727
March 23, 2018	21	24.8	16311	340	17193	15	1697	-2179
March 23, 2018	22	21.68	15472	345	16196	13	1686	-1901
March 23, 2018	23	20.66	14428	334	15817	12	1269	-2213
March 23, 2018	24	27.24	13650	356	15410	12	1259	-2591
March 24, 2018	1	6.98	13285	288	14310	12	2083	-2653
March 24, 2018	2	2.7	13112	291	14211	12	1987	-2672
March 24, 2018	3	0	13040	273	14070	12	1995	-2634
March 24, 2018	4	0	13089	272	13980	12	1957	-2460
March 24, 2018	5	13.35	13349	266	14922	12	1419	-2622
March 24, 2018	6	32.17	14035	273	15882	13	992	-2536
March 24, 2018	7	29.75	14668	241	16392	14	875	-2317
March 24, 2018	8	26.02	14849	258	16510	12	1224	-2529
March 24, 2018	9	31.84	14707	257	16553	14	972	-2492
March 24, 2018	10	39.21	14502	297	16409	13	847	-2460
March 24, 2018	11	22.98	14340	289	16098	13	1270	-2640
March 24, 2018	12	12.72	14108	233	15697	13	1248	-2442
March 24, 2018	13	1.11	13820	262	15277	13	1207	-2265
March 24, 2018	14	3.17	13466	190	14968	14	1238	-2450
March 24, 2018	15	4.93	13332	227	15319	14	679	-2371
March 24, 2018	16	0	13590	221	14946	14	1630	-2728
March 24, 2018	17	0	14258	224	15166	13	1833	-2469
March 24, 2018	18	0	14846	209	15704	13	1819	-2406
March 24, 2018	19	3.4	15474	185	16690	13	1329	-2372
March 24, 2018	20	14.34	15864	249	17410	14	1233	-2480
March 24, 2018	21	1.41	15525	239	16844	14	1433	-2454
March 24, 2018	22	0	14959	248	16201	14	1535	-2453
March 24, 2018	23	2.08	14068	317	15845	13	1311	-2668
March 24, 2018	24	0	13532	337	15162	14	1475	-2761
March 25, 2018	1	6.36	13112	382	15225	13	1122	-2804
March 25, 2018	2	13.33	12961	378	15313	13	876	-2824
March 25, 2018	3	6.67	12895	350	15254	13	922	-2834
March 25, 2018	4	12.68	12956	306	15301	13	853	-2834
March 25, 2018	5	13.35	13163	330	15308	13	1041	-2817
March 25, 2018	6	13.48	13631	336	15390	13	1283	-2630

March 25, 2018	7	16.84	14089	297	16195	13	925	-2681
March 25, 2018	8	13.37	14314	333	16073	13	1262	-2573
March 25, 2018	9	1.82	14050	296	15754	13	1130	-2258
March 25, 2018	10	0	13804	283	15235	13	1112	-2172
March 25, 2018	11	0	13616	279	15314	13	1187	-2527
March 25, 2018	12	0	13501	214	15076	14	1171	-2498
March 25, 2018	13	0	13276	248	14990	13	1106	-2527
March 25, 2018	14	0	13054	251	14956	13	1005	-2574
March 25, 2018	15	0	13046	266	15007	13	913	-2513
March 25, 2018	16	0	13519	264	15055	13	1351	-2538
March 25, 2018	17	-0.02	14202	316	15537	13	1573	-2488
March 25, 2018	18	3.42	14890	229	16012	7	1789	-2594
March 25, 2018	19	42.56	15547	316	16957	7	1444	-2494
March 25, 2018	20	25.66	16003	307	17358	6	1537	-2452
March 25, 2018	21	12.06	15543	294	17531	6	935	-2461
March 25, 2018	22	0.92	14663	274	16727	6	787	-2422
March 25, 2018	23	0.5	13777	200	16290	6	419	-2560
March 25, 2018	24	0	13158	218	15876	6	347	-2730
March 26, 2018	1	0	12790	203	15496	6	448	-2815
March 26, 2018	2	0	12650	280	15403	6	471	-2821
March 26, 2018	3	0	12642	236	15332	6	478	-2836
March 26, 2018	4	0	12833	255	15482	5	439	-2807
March 26, 2018	5	0.98	13477	254	15352	5	1176	-2738
March 26, 2018	6	9.24	14922	229	16367	6	1549	-2700
March 26, 2018	7	19.19	16091	253	17693	7	1486	-2664
March 26, 2018	8	13.37	15905	271	17508	6	1489	-2704
March 26, 2018	9	10.43	15229	244	17340	7	962	-2703
March 26, 2018	10	2.37	14696	249	16855	7	978	-2775
March 26, 2018	11	4.97	14419	270	16516	17	1059	-2759
March 26, 2018	12	1.94	14183	273	16829	17	499	-2761
March 26, 2018	13	0	14079	216	16571	8	499	-2706
March 26, 2018	14	0	13951	209	16347	6	614	-2746
March 26, 2018	15	0.94	13944	223	16315	6	602	-2696
March 26, 2018	16	4.57	14378	204	16576	5	808	-2679
March 26, 2018	17	9.69	14989	195	17419	6	499	-2674
March 26, 2018	18	3.94	15490	184	17255	6	1074	-2615
March 26, 2018	19	8.56	16212	167	17406	6	1522	-2472
March 26, 2018	20	4.79	16579	185	17584	7	1541	-2265
March 26, 2018	21	2.99	15965	197	17365	7	1631	-2686
March 26, 2018	22	1.45	14925	199	16746	8	957	-2489
March 26, 2018	23	1.43	13830	191	16253	8	365	-2571
March 26, 2018	24	0	13121	207	15735	8	239	-2573
March 27, 2018	1	0	12687	243	15089	8	497	-2598
March 27, 2018	2	0	12465	243	14922	8	416	-2555
March 27, 2018	3	0	12330	251	14864	8	566	-2768
March 27, 2018	4	0	12472	220	14789	8	566	-2626
March 27, 2018	5	0	13083	190	15342	7	574	-2649
March 27, 2018	6	2.72	14480	166	16020	8	1349	-2676
March 27, 2018	7	36.44	15760	176	17833	8	455	-2279
March 27, 2018	8	23.82	15969	154	18189	10	168	-2176

March 27, 2018	9	38.64	15970	147	17836	9	161	-1794
March 27, 2018	10	49.86	16135	169	17900	8	283	-1938
March 27, 2018	11	45.2	16330	151	18271	13	275	-1967
March 27, 2018	12	32.26	16303	176	18217	15	188	-1739
March 27, 2018	13	35.31	16348	119	18410	14	60	-1873
March 27, 2018	14	38.04	16303	118	18224	12	103	-1800
March 27, 2018	15	31.31	16487	114	17881	11	683	-1923
March 27, 2018	16	35.64	16808	82	18378	15	537	-1996
March 27, 2018	17	25.55	16984	83	18123	11	1070	-2046
March 27, 2018	18	33.84	16796	183	18237	10	1018	-2221
March 27, 2018	19	32.75	17008	233	18542	17	824	-2021
March 27, 2018	20	15.35	16910	280	17736	17	1408	-1905
March 27, 2018	21	25.5	16243	268	17496	15	774	-1661
March 27, 2018	22	13.8	15248	190	17213	13	396	-1983
March 27, 2018	23	4.28	14036	268	16013	13	809	-2394
March 27, 2018	24	11.48	13276	255	15395	13	419	-2316
March 28, 2018	1	15.72	12890	188	14678	13	912	-2497
March 28, 2018	2	17.09	12728	192	14749	13	650	-2455
March 28, 2018	3	0	12424	292	14349	13	1000	-2470
March 28, 2018	4	1.09	12398	282	14434	13	1110	-2500
March 28, 2018	5	19.59	13370	259	14890	12	998	-2375
March 28, 2018	6	36.08	14844	219	15955	13	1508	-2420
March 28, 2018	7	33.16	16095	168	17169	15	1219	-2115
March 28, 2018	8	34.67	16340	176	17200	15	1213	-1873
March 28, 2018	9	33.67	16211	167	17104	14	1217	-1842
March 28, 2018	10	34.3	16056	168	16736	16	1348	-1813
March 28, 2018	11	35.02	15905	150	16506	15	1408	-1813
March 28, 2018	12	71.27	15764	175	16805	14	1058	-1918
March 28, 2018	13	35.34	15621	213	16470	15	1408	-1920
March 28, 2018	14	24.65	15341	232	15717	15	1408	-1333
March 28, 2018	15	31.14	15320	173	15687	15	1408	-1463
March 28, 2018	16	33.17	15528	259	16172	16	1411	-1720
March 28, 2018	17	33.34	15697	202	16703	14	991	-1691
March 28, 2018	18	29	15778	253	16422	16	1408	-1706
March 28, 2018	19	29.21	16337	222	16889	15	1445	-1673
March 28, 2018	20	33.72	16690	342	17307	14	1434	-1688
March 28, 2018	21	30.4	16146	318	16769	14	1422	-1621
March 28, 2018	22	24.26	15108	305	15785	14	1408	-1693
March 28, 2018	23	17.77	14033	335	14970	15	1407	-1938
March 28, 2018	24	13.66	13263	360	14298	13	1030	-1649
March 29, 2018	1	19.83	12871	377	13943	13	1303	-1872
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March 29, 2018	5	23.77	13231	264	14333	12	1354	-2113
March 29, 2018	6	31.94	14615	280	15574	12	1404	-2104
March 29, 2018	7	33.11	15976	276	16688	11	1356	-1791
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March 29, 2018	9	34.49	16193	229	16809	14	1434	-1826
March 29, 2018	10	33.98	16181	294	16889	24	1362	-1753

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March 29, 2018	12	41.92	16046	323	16719	13	1418	-1626
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March 29, 2018	14	0.92	15712	303	16039	16	1376	-1355
March 29, 2018	15	11.5	15742	297	16365	13	1147	-1470
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March 29, 2018	18	6.15	16019	333	16640	15	1265	-1461
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March 30, 2018	8	3.19	13493	279	15206	13	794	-2173
March 30, 2018	9	0	13603	245	14850	13	1176	-2131
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March 30, 2018	21	28.96	14740	260	15024	14	1605	-1349
March 30, 2018	22	15.5	14251	283	14866	13	1196	-1395
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March 31, 2018	3	6.24	12005	273	14743	13	239	-2621
March 31, 2018	4	5.89	12023	307	14603	13	400	-2594
March 31, 2018	5	9.24	12275	311	14712	13	575	-2629
March 31, 2018	6	10.02	12794	316	14563	13	1303	-2668
March 31, 2018	7	6.63	13262	316	15034	13	1269	-2658
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March 31, 2018	15	7.94	13663	231	16203	14	351	-2620
March 31, 2018	16	14.35	14292	253	16836	14	380	-2624
March 31, 2018	17	20.94	14797	232	17287	14	359	-2616
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March 31, 2018	22	0	13692	233	15781	15	357	-2123
March 31, 2018	23	0	12903	198	15167	15	413	-2340
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April 2, 2018	23	32.06	14227	288	14233	13	1746	-1381
April 2, 2018	24	23.62	13455	325	13719	13	1856	-1731
April 3, 2018	1	24.53	13045	348	13512	16	1840	-1836
April 3, 2018	2	16.85	12802	309	13373	16	1872	-2055
April 3, 2018	3	14.35	12761	331	13428	16	1892	-2173
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April 3, 2018	5	18.55	13470	347	14223	16	1904	-2207
April 3, 2018	6	34.92	14821	379	15644	16	1903	-2378
April 3, 2018	7	36.93	15979	270	16756	18	1814	-2316
April 3, 2018	8	79.05	16250	236	17154	19	1719	-2322
April 3, 2018	9	35.86	16161	271	17035	19	1692	-2195
April 3, 2018	10	35.32	16029	270	16654	18	1717	-1926
April 3, 2018	11	18.8	15797	248	16299	27	1717	-1875
April 3, 2018	12	14.37	15636	242	16219	16	1787	-2083
April 3, 2018	13	33.15	15632	316	16355	16	1801	-2232
April 3, 2018	14	103.35	15759	315	16733	16	2017	-2618
April 3, 2018	15	34.82	15989	325	16568	18	1876	-2050
April 3, 2018	16	31.95	16391	313	17013	18	1828	-2023
April 3, 2018	17	33.15	16722	308	17268	17	1828	-1991
April 3, 2018	18	24	16690	287	17689	17	1405	-2094
April 3, 2018	19	37.29	17102	270	18018	17	1620	-2281
April 3, 2018	20	67.08	17183	292	17646	18	1828	-1969
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April 3, 2018	22	41.27	15554	286	15825	18	1799	-1750
April 3, 2018	23	63.13	14556	276	15408	20	1699	-2182
April 3, 2018	24	14.57	13782	341	14759	18	1769	-2328
April 4, 2018	1	15.18	13349	352	14274	12	1754	-2220
April 4, 2018	2	14.36	13052	346	14539	13	1323	-2352
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April 4, 2018	5	0	13504	307	14793	13	1367	-2231
April 4, 2018	6	3.34	14713	288	15586	13	1697	-2294
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April 4, 2018	8	14.34	16298	278	17730	13	1289	-2237
April 4, 2018	9	15.2	16357	288	18018	12	1360	-2510
April 4, 2018	10	39.77	16254	289	17638	12	1087	-2065
April 4, 2018	11	58.12	16015	283	17537	13	1180	-2246
April 4, 2018	12	0.43	15712	257	17245	14	1352	-2483
April 4, 2018	13	0	15572	217	16807	14	1466	-2275
April 4, 2018	14	0.95	15584	172	16854	13	1031	-2183
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April 4, 2018	16	9.18	16018	137	17719	13	392	-1815

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April 4, 2018	21	34.8	16953	276	18447	13	1111	-2260
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April 5, 2018	7	68.14	16713	244	18210	12	592	-1710
April 5, 2018	8	43.77	16419	250	17607	13	876	-1674
April 5, 2018	9	40.26	15904	215	17084	17	1041	-1872
April 5, 2018	10	38.06	15568	245	16897	17	958	-1856
April 5, 2018	11	30.12	15425	242	16432	16	1047	-1856
April 5, 2018	12	34.26	15233	284	16495	14	877	-1806
April 5, 2018	13	40.46	15113	243	16467	14	639	-1659
April 5, 2018	14	40.49	14987	250	16356	15	654	-1757
April 5, 2018	15	17.62	14973	275	15957	17	741	-1350
April 5, 2018	16	20.58	15336	247	16425	16	848	-1625
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April 5, 2018	18	35.27	16103	248	16709	15	989	-1330
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April 5, 2018	20	46.22	17337	281	17961	12	1092	-1445
April 5, 2018	21	41.57	16796	278	17295	14	1094	-1193
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April 5, 2018	23	28.73	14624	307	15692	13	994	-1640
April 5, 2018	24	21.76	13860	359	14921	13	1160	-1762
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April 6, 2018	4	37.3	13257	292	14499	13	1169	-2164
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April 6, 2018	6	41.4	15117	310	16030	12	1204	-1873
April 6, 2018	7	42.67	16262	248	17155	12	993	-1624
April 6, 2018	8	42.9	16547	270	17435	13	1082	-1729
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April 6, 2018	14	28.97	15805	296	17458	14	817	-2112
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April 6, 2018	16	15.57	15766	264	17325	15	1099	-2284
April 6, 2018	17	13.36	15818	297	17295	15	1024	-2120
April 6, 2018	18	7.46	15849	310	17421	15	416	-1656

April 6, 2018	19	6.64	16323	287	17379	15	1057	-1761
April 6, 2018	20	20.74	16771	275	18160	15	674	-1791
April 6, 2018	21	20.57	16351	293	17724	14	787	-1881
April 6, 2018	22	26.53	15501	298	17022	15	714	-1916
April 6, 2018	23	9.84	14399	294	15903	14	1176	-2254
April 6, 2018	24	7.97	13650	318	15404	14	1177	-2548
April 7, 2018	1	14.31	13298	269	15325	14	897	-2511
April 7, 2018	2	8.79	13064	262	15252	14	700	-2564
April 7, 2018	3	14.33	13003	286	14936	13	954	-2589
April 7, 2018	4	14.36	13074	304	14830	13	1226	-2630
April 7, 2018	5	61.63	13441	274	15590	12	416	-2333
April 7, 2018	6	47.18	13948	273	15468	14	913	-2166
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April 7, 2018	9	17.28	14725	216	15529	14	1299	-1800
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April 7, 2018	11	63.37	14653	231	15756	12	1492	-2400
April 7, 2018	12	49.02	14543	247	15280	13	1761	-2222
April 7, 2018	13	31.47	14306	214	15007	13	1662	-2001
April 7, 2018	14	27.69	14101	231	14877	14	1304	-1869
April 7, 2018	15	23.66	14203	242	15384	14	748	-1675
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April 7, 2018	17	36.95	15196	228	16067	15	537	-1208
April 7, 2018	18	41.47	15402	211	16656	15	213	-1296
April 7, 2018	19	35.61	15684	269	16336	15	1060	-1481
April 7, 2018	20	31.68	16031	290	16357	16	1568	-1538
April 7, 2018	21	38.93	15603	317	16251	14	1358	-1639
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April 8, 2018	1	23.8	13024	250	13770	23	1533	-1977
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April 8, 2018	3	39.56	12669	312	14056	24	1412	-2411
April 8, 2018	4	12.24	12674	319	13975	23	1413	-2282
April 8, 2018	5	10.47	12878	349	13634	23	1434	-1818
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April 8, 2018	7	48.07	13618	358	14456	22	1356	-1823
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April 8, 2018	9	25.91	13808	362	14770	25	1239	-1870
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April 8, 2018	11	64.27	14115	320	14979	22	1119	-1618
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April 8, 2018	13	14.54	14008	279	15018	23	1033	-1686
April 8, 2018	14	12.2	13752	306	15177	23	400	-1516
April 8, 2018	15	14.7	13808	326	15223	23	611	-1749
April 8, 2018	16	12.93	14185	323	14932	23	1233	-1671
April 8, 2018	17	20.58	14660	292	15241	24	1233	-1622
April 8, 2018	18	34.12	15016	304	15681	23	1340	-1775
April 8, 2018	19	36.74	15635	302	15907	23	1672	-1636
April 8, 2018	20	41.11	16268	273	16345	23	1712	-1517

April 8, 2018	21	37.1	15977	308	16011	24	1731	-1473
April 8, 2018	22	28.72	15194	320	15308	23	1781	-1562
April 8, 2018	23	23.48	14364	345	14828	23	1681	-1780
April 8, 2018	24	52.43	13675	346	14565	24	1543	-2051
April 9, 2018	1	37.76	13340	375	14430	24	1488	-2200
April 9, 2018	2	38.27	13251	365	14222	23	1571	-2120
April 9, 2018	3	34.48	13245	356	14330	24	1185	-1861
April 9, 2018	4	32.61	13501	350	14416	25	1384	-1965
April 9, 2018	5	39.32	14153	323	14426	24	1648	-1529
April 9, 2018	6	43.9	15509	266	15276	24	1737	-1299
April 9, 2018	7	60.04	16532	254	16340	24	1639	-1256
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April 9, 2018	10	47.76	15557	243	15974	23	1743	-1872
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April 10, 2018	22	10.3	15177	311	15701	22	1588	-1730

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April 14, 2018	20	28.68	16413	207	16583	21	1648	-1659
April 14, 2018	21	45.8	15959	222	16844	20	1132	-1823
April 14, 2018	22	52.7	15121	266	15821	23	1807	-2081
April 14, 2018	23	23.6	14309	276	15285	19	1845	-2446
April 14, 2018	24	11.95	13509	288	14801	19	1500	-2345
April 15, 2018	1	13.36	13074	277	14813	20	1126	-2544
April 15, 2018	2	7.58	12879	286	14593	19	1119	-2481

April 15, 2018	3	4.76	12688	276	14657	19	954	-2571
April 15, 2018	4	0	12681	294	14291	19	1124	-2377
April 15, 2018	5	5.57	12972	251	14319	19	1530	-2576
April 15, 2018	6	79.88	13260	241	14887	19	1230	-2560
April 15, 2018	7	103.22	13697	262	15180	19	833	-1984
April 15, 2018	8	41.68	14397	299	15596	20	832	-1708
April 15, 2018	9	46.16	15088	251	15897	19	939	-1381
April 15, 2018	10	34.03	15639	225	15867	22	1243	-1185
April 15, 2018	11	16.01	16034	234	16317	22	1170	-1232
April 15, 2018	12	48.29	16260	264	16726	18	1155	-1334
April 15, 2018	13	53.85	16194	247	16941	17	1161	-1587
April 15, 2018	14	34.77	16123	183	16785	21	1577	-2000
April 15, 2018	15	33.24	16202	229	16887	22	1367	-1785
April 15, 2018	16	60.83	16561	219	17399	20	1047	-1661
April 15, 2018	17	78.96	16839	246	17644	19	1286	-1755
April 15, 2018	18	30.56	16686	278	17145	21	1360	-1338
April 15, 2018	19	72.79	16639	278	17695	20	435	-1113
April 15, 2018	20	46.27	16691	299	17238	23	488	-591
April 15, 2018	21	32.13	16169	280	16719	22	458	-616
April 15, 2018	22	32.02	15300	293	15930	19	783	-1031
April 15, 2018	23	169.37	14436	290	15330	17	1562	-2112
April 15, 2018	24	148.9	13794	292	14936	20	1384	-2125
April 16, 2018	1	23.31	13427	287	14198	23	1789	-2091
April 16, 2018	2	120.32	13285	348	14209	24	1753	-2242
April 16, 2018	3	57.03	13255	344	14034	22	1728	-2095
April 16, 2018	4	100.87	13407	330	14541	17	1138	-2031
April 16, 2018	5	27.68	13885	270	14474	21	1728	-1921
April 16, 2018	6	33.39	14995	291	14822	21	1334	-827
April 16, 2018	7	35.53	15973	226	15899	20	1192	-898
April 16, 2018	8	35.32	16463	250	16238	20	1462	-949
April 16, 2018	9	45.13	16863	236	17254	17	1006	-1193
April 16, 2018	10	90.51	16886	251	17802	17	1228	-1883
April 16, 2018	11	50.83	16842	243	17915	19	1246	-2021
April 16, 2018	12	45.08	16652	300	17565	19	1401	-1987
April 16, 2018	13	40.2	16502	295	17618	20	1121	-1905
April 16, 2018	14	45.06	16348	304	17464	20	752	-1616
April 16, 2018	15	35.9	16319	284	17203	21	1268	-1835
April 16, 2018	16	35.52	16501	303	17182	22	1365	-1698
April 16, 2018	17	35.75	16727	287	17676	20	981	-1566
April 16, 2018	18	35.47	16633	301	17859	21	913	-1795
April 16, 2018	19	35.75	16820	313	18222	19	992	-2057
April 16, 2018	20	36.42	17025	341	18379	19	996	-1871
April 16, 2018	21	37.4	16492	334	17712	21	1031	-1810
April 16, 2018	22	25.3	15474	328	16478	21	1003	-1535
April 16, 2018	23	0.97	14424	314	15143	20	1778	-2018
April 16, 2018	24	0	13691	322	14811	17	1175	-1924
April 17, 2018	1	3.96	13280	300	15063	17	1163	-2489
April 17, 2018	2	0	13117	307	14853	17	1227	-2580
April 17, 2018	3	11.55	13089	189	14835	17	961	-2488
April 17, 2018	4	0.08	13134	274	14790	17	1187	-2482

April 17, 2018	5	6.97	13735	274	15172	17	1390	-2530
April 17, 2018	6	15.47	14959	269	15735	17	1946	-2404
April 17, 2018	7	50.13	16161	279	17282	17	1285	-2235
April 17, 2018	8	49.44	16407	266	17645	17	1301	-2291
April 17, 2018	9	45.01	16228	256	17368	18	1251	-2062
April 17, 2018	10	44.09	16064	257	17156	18	1199	-1949
April 17, 2018	11	44.02	16063	281	17456	18	1148	-2195
April 17, 2018	12	30.14	15902	281	17340	18	1072	-2239
April 17, 2018	13	20.21	15782	261	16800	19	1198	-1913
April 17, 2018	14	13.34	15551	262	16859	18	1063	-2131
April 17, 2018	15	13.35	15483	277	16769	18	1196	-2197
April 17, 2018	16	42.27	15917	273	17161	19	1252	-2195
April 17, 2018	17	44.06	16297	229	17563	17	1177	-2288
April 17, 2018	18	44.69	16371	244	17728	16	1211	-2326
April 17, 2018	19	44.39	16720	271	18014	19	1177	-2221
April 17, 2018	20	89.51	17108	275	18311	19	1277	-2156
April 17, 2018	21	43.16	16608	285	17606	23	1166	-1806
April 17, 2018	22	27.23	15566	248	16123	22	1165	-1370
April 17, 2018	23	34.49	14515	251	15206	21	950	-1361
April 17, 2018	24	16.15	13775	304	14586	20	1070	-1528
April 18, 2018	1	91.95	13371	288	14562	15	1388	-2221
April 18, 2018	2	27.53	13130	294	14386	18	1387	-2350
April 18, 2018	3	9.66	13076	294	14160	18	1275	-2004
April 18, 2018	4	7.31	13223	304	14499	17	1197	-2109
April 18, 2018	5	25.12	13831	292	15145	17	1232	-2227
April 18, 2018	6	64	15013	298	16010	15	1243	-1941
April 18, 2018	7	138.32	16073	244	17157	15	1132	-2027
April 18, 2018	8	117.64	16143	290	17270	17	1078	-1920
April 18, 2018	9	56.64	15890	294	16790	20	1160	-1719
April 18, 2018	10	49.25	15759	289	16493	22	920	-1384
April 18, 2018	11	47.31	15715	282	16260	20	1075	-1335
April 18, 2018	12	48.54	15534	301	16094	22	1166	-1331
April 18, 2018	13	47.32	15510	295	15804	20	1166	-1229
April 18, 2018	14	47.25	15329	317	15732	18	1166	-1250
April 18, 2018	15	55.2	15341	279	15913	21	1166	-1410
April 18, 2018	16	76.3	15708	284	16189	18	1268	-1462
April 18, 2018	17	47.45	16107	239	16276	21	1278	-1152
April 18, 2018	18	51.82	16145	247	16278	23	1289	-1161
April 18, 2018	19	72.9	16560	255	16609	19	1240	-1081
April 18, 2018	20	94.94	16970	290	17066	20	1381	-1112
April 18, 2018	21	54.84	16467	295	16454	21	1287	-936
April 18, 2018	22	53.57	15413	287	15576	21	1187	-929
April 18, 2018	23	23.46	14287	264	14466	21	1187	-936
April 18, 2018	24	40.69	13508	277	14199	19	918	-1234
April 19, 2018	1	14.41	13120	284	14080	17	1097	-1695
April 19, 2018	2	17.05	12922	275	14067	17	1096	-1856
April 19, 2018	3	32.89	12928	259	14271	17	1240	-2287
April 19, 2018	4	11.14	13029	284	13955	17	1514	-2053
April 19, 2018	5	28.17	13624	284	14445	17	1284	-1791
April 19, 2018	6	64.04	14848	333	15254	16	1341	-1398

April 19, 2018	7	90.13	15910	283	16406	17	1180	-1281
April 19, 2018	8	45.41	15978	243	16417	20	1180	-1250
April 19, 2018	9	53.51	15736	298	16589	18	1160	-1638
April 19, 2018	10	49.85	15607	239	16831	17	1188	-2067
April 19, 2018	11	39.13	15386	211	16764	22	1150	-2214
April 19, 2018	12	14.36	15062	211	16287	22	1150	-2098
April 19, 2018	13	91.79	14976	233	16528	18	1017	-2319
April 19, 2018	14	89.03	14752	295	16416	17	1119	-2427
April 19, 2018	15	14.4	14755	273	16195	17	1288	-2371
April 19, 2018	16	31.71	15043	268	16455	18	948	-2074
April 19, 2018	17	23.86	15361	257	16738	17	1052	-2109
April 19, 2018	18	16.46	15508	286	16843	17	709	-1860
April 19, 2018	19	43.02	16130	296	17226	17	1070	-1948
April 19, 2018	20	68.46	16762	299	17640	15	1017	-1703
April 19, 2018	21	59.88	16383	298	17316	16	1150	-1711
April 19, 2018	22	42.98	15378	253	16094	20	1111	-1477
April 19, 2018	23	32.55	14335	268	14964	17	1094	-1353
April 19, 2018	24	17.13	13604	239	14392	17	774	-1298
April 20, 2018	1	24.78	13245	214	14295	17	1209	-1964
April 20, 2018	2	31.33	13020	264	14544	17	576	-1767
April 20, 2018	3	34.47	12963	283	14506	17	485	-1688
April 20, 2018	4	43.98	13067	259	14775	13	310	-1733
April 20, 2018	5	39.19	13688	249	14683	16	685	-1408
April 20, 2018	6	50.26	14848	294	15764	17	997	-1633
April 20, 2018	7	50.62	15745	285	16627	19	1183	-1710
April 20, 2018	8	62.16	15593	262	16621	19	1147	-1749
April 20, 2018	9	44.1	14959	293	15967	20	1122	-1614
April 20, 2018	10	45.83	14578	278	15897	19	858	-1714
April 20, 2018	11	43.26	14361	263	15729	19	567	-1538
April 20, 2018	12	40.77	14212	269	15428	19	1150	-1937
April 20, 2018	13	35.71	14042	250	15154	20	1113	-1730
April 20, 2018	14	26.37	13828	271	14820	20	1085	-1638
April 20, 2018	15	25	13650	279	14687	21	840	-1546
April 20, 2018	16	27.49	13874	286	15166	17	496	-1518
April 20, 2018	17	41.31	14187	272	15420	17	504	-1438
April 20, 2018	18	23.18	14573	295	15309	17	1088	-1534
April 20, 2018	19	26.88	15082	299	15592	17	1088	-1333
April 20, 2018	20	43.57	15756	307	16265	17	1142	-1370
April 20, 2018	21	46.23	15606	299	15955	17	936	-988
April 20, 2018	22	45.34	14752	309	15052	20	1089	-968
April 20, 2018	23	44.08	13774	294	14059	19	1094	-988
April 20, 2018	24	51.79	12980	332	13726	20	1116	-1454
April 21, 2018	1	75.44	12680	248	13378	19	1212	-1626
April 21, 2018	2	101.62	12442	272	13285	20	1114	-1682
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April 21, 2018	4	55.41	12388	292	13034	20	1114	-1458
April 21, 2018	5	31.1	12667	272	13186	20	1144	-1435
April 21, 2018	6	32.74	13072	272	13408	17	1114	-1163
April 21, 2018	7	14.34	13429	270	14248	18	827	-1338
April 21, 2018	8	14.36	13560	275	14904	17	799	-1838

April 21, 2018	9	36.21	13506	198	15166	17	567	-1968
April 21, 2018	10	42.51	13279	235	14833	18	670	-1952
April 21, 2018	11	34.2	13186	219	14151	20	1075	-1768
April 21, 2018	12	28.31	12892	256	13890	17	1048	-1730
April 21, 2018	13	34.79	12565	246	14080	18	230	-1483
April 21, 2018	14	26.6	12338	257	13652	17	802	-1749
April 21, 2018	15	34.83	12251	234	13717	18	656	-1810
April 21, 2018	16	26.99	12529	235	13873	18	659	-1731
April 21, 2018	17	28.87	13030	227	13767	18	1059	-1561
April 21, 2018	18	12.74	13484	247	13895	18	990	-1210
April 21, 2018	19	13.34	13823	224	14283	17	1109	-1354
April 21, 2018	20	40.29	14335	233	14816	18	954	-1228
April 21, 2018	21	30.99	14238	219	14708	16	1058	-1329
April 21, 2018	22	24.81	13720	221	14073	17	1494	-1598
April 21, 2018	23	50.72	12969	221	13412	16	1700	-1866
April 21, 2018	24	50.7	12334	264	12916	16	1606	-1905
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April 22, 2018	2	13.34	11782	294	12451	17	1527	-1869
April 22, 2018	3	13.38	11770	315	12485	17	1559	-1936
April 22, 2018	4	19.46	11904	231	12678	16	1759	-2253
April 22, 2018	5	25.08	12026	213	12734	17	1775	-2223
April 22, 2018	6	20.86	12185	277	12782	16	1789	-2089
April 22, 2018	7	13.35	12410	271	13004	16	1826	-2101
April 22, 2018	8	9.55	12447	283	13096	16	1765	-1980
April 22, 2018	9	13.34	12375	281	13338	16	1234	-1819
April 22, 2018	10	12.01	12193	275	13467	16	846	-1701
April 22, 2018	11	13.34	12148	215	13549	16	644	-1741
April 22, 2018	12	25.41	12030	286	13735	16	351	-1735
April 22, 2018	13	8.4	11785	273	13316	16	827	-1967
April 22, 2018	14	6.14	11650	294	13323	17	580	-1894
April 22, 2018	15	5.87	11734	270	13511	17	313	-1786
April 22, 2018	16	6.56	12188	239	13833	16	263	-1696
April 22, 2018	17	6.06	12845	204	13802	17	982	-1753
April 22, 2018	18	8.05	13419	222	13808	17	1539	-1730
April 22, 2018	19	10.91	13855	219	14299	17	1521	-1775
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April 22, 2018	22	5.74	13377	231	14392	17	958	-1758
April 22, 2018	23	9.38	12574	214	13891	16	603	-1792
April 22, 2018	24	8.24	11936	229	13846	16	580	-2222
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April 23, 2018	3	0	11403	212	13631	16	396	-2432
April 23, 2018	4	0	11654	189	13860	16	458	-2535
April 23, 2018	5	3.17	12429	159	14400	16	465	-2428
April 23, 2018	6	5.76	13634	163	14807	16	1298	-2435
April 23, 2018	7	1.98	14525	195	15316	17	1576	-2243
April 23, 2018	8	13.17	14457	221	15629	16	1298	-2267
April 23, 2018	9	15.99	14036	209	15529	16	1125	-2475
April 23, 2018	10	12.44	13664	148	15442	16	733	-2371

April 23, 2018	11	13.19	13598	147	15287	16	613	-2211
April 23, 2018	12	8.6	13454	166	15171	16	593	-2048
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April 23, 2018	18	33.12	14566	221	15128	17	1762	-2115
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April 23, 2018	21	27.89	15019	226	15249	16	1713	-1704
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April 23, 2018	23	25.08	12804	267	14193	19	727	-1762
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April 26, 2018	15	5.87	13531	243	15457	16	434	-2140
April 26, 2018	16	22.65	13783	239	15323	16	715	-2045
April 26, 2018	17	26.03	14108	244	15590	16	742	-2087
April 26, 2018	18	22.78	14358	167	15325	18	1025	-1880
April 26, 2018	19	14.54	14737	219	15194	18	1608	-1826
April 26, 2018	20	26.12	15334	214	15938	18	1369	-1795
April 26, 2018	21	13.97	15187	254	15869	18	1296	-1717
April 26, 2018	22	14.35	14247	216	15050	18	1189	-1757
April 26, 2018	23	9.67	13171	234	14698	18	756	-2039
April 26, 2018	24	4.59	12378	254	14066	18	1110	-2394
April 27, 2018	1	5.72	11957	174	13823	18	821	-2479
April 27, 2018	2	7.75	11760	207	13725	18	724	-2473
April 27, 2018	3	13.33	11716	211	13695	18	726	-2489
April 27, 2018	4	13.32	11838	211	13665	18	694	-2263
April 27, 2018	5	16.04	12448	212	14019	18	981	-2248
April 27, 2018	6	19.59	13586	221	14439	17	1403	-1942
April 27, 2018	7	12.74	14518	215	15011	17	1527	-1834
April 27, 2018	8	15.97	14587	213	15064	17	1458	-1770
April 27, 2018	9	25.9	14310	226	15063	17	1445	-1978
April 27, 2018	10	29.99	14113	222	15146	17	1466	-2330
April 27, 2018	11	13.37	13941	222	15049	17	1400	-2254
April 27, 2018	12	29.2	13725	206	15422	17	1112	-2573
April 27, 2018	13	4.78	13707	203	14724	17	1711	-2472
April 27, 2018	14	16.3	13682	215	15286	17	1241	-2641

April 27, 2018	15	18.09	13713	221	15519	17	904	-2454
April 27, 2018	16	16.7	13846	237	15517	17	1033	-2470
April 27, 2018	17	49.5	14146	235	15207	18	1409	-2257
April 27, 2018	18	13.37	14224	200	15256	18	1572	-2302
April 27, 2018	19	13.37	14571	216	15735	17	1164	-2098
April 27, 2018	20	9.12	14993	218	16344	18	877	-1855
April 27, 2018	21	7.81	14658	222	16014	17	968	-2007
April 27, 2018	22	3.16	13931	157	15587	17	645	-2048
April 27, 2018	23	2.46	12795	264	14861	17	787	-2509
April 27, 2018	24	8.11	12080	287	14320	17	566	-2453
April 28, 2018	1	1.63	11673	235	13927	18	576	-2525
April 28, 2018	2	1.18	11399	222	13763	17	593	-2690
April 28, 2018	3	0	11325	198	13657	17	592	-2712
April 28, 2018	4	0	11316	199	13703	16	512	-2701
April 28, 2018	5	0	11472	203	13740	16	617	-2563
April 28, 2018	6	0	11901	229	14014	16	466	-2362
April 28, 2018	7	2.45	12623	162	14545	16	504	-2298
April 28, 2018	8	7.16	13340	177	15409	16	489	-2424
April 28, 2018	9	5.48	13901	184	15886	16	758	-2499
April 28, 2018	10	5.88	14146	180	16163	16	977	-2831
April 28, 2018	11	5.89	14248	170	16309	16	939	-2820
April 28, 2018	12	6.72	14133	176	16589	16	577	-2845
April 28, 2018	13	5.1	13809	185	16389	18	449	-2786
April 28, 2018	14	3.99	13537	172	16022	17	515	-2767
April 28, 2018	15	5.93	13512	182	15985	18	446	-2692
April 28, 2018	16	9.71	13741	148	16034	17	419	-2614
April 28, 2018	17	13.34	14073	185	16539	18	359	-2681
April 28, 2018	18	6.5	14225	183	16606	18	292	-2412
April 28, 2018	19	5.76	14323	195	16531	18	381	-2432
April 28, 2018	20	10.87	14519	234	16535	18	289	-2180
April 28, 2018	21	8.19	14336	233	16231	18	728	-2267
April 28, 2018	22	2.24	13722	228	15718	18	653	-2413
April 28, 2018	23	8.27	12914	235	15158	18	239	-2273
April 28, 2018	24	2.72	12228	231	14562	18	249	-2325
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April 29, 2018	3	0	11426	270	13808	18	310	-2417
April 29, 2018	4	0	11389	260	13778	18	317	-2436
April 29, 2018	5	0	11624	234	13966	18	285	-2420
April 29, 2018	6	4.3	11986	217	14296	18	319	-2432
April 29, 2018	7	5.83	12329	232	14726	18	282	-2417
April 29, 2018	8	6.05	12629	210	15219	18	243	-2548
April 29, 2018	9	5.8	12613	230	15106	18	396	-2606
April 29, 2018	10	0	12505	219	15100	18	408	-2783
April 29, 2018	11	0	12539	224	15104	18	373	-2753
April 29, 2018	12	0	12618	235	15186	18	345	-2649
April 29, 2018	13	0	12406	199	15064	18	373	-2784
April 29, 2018	14	0	12204	207	14787	18	284	-2653
April 29, 2018	15	0	12281	215	14737	18	199	-2458
April 29, 2018	16	1.41	12650	219	15108	18	264	-2514

April 29, 2018	17	4.48	13157	170	15445	18	264	-2401
April 29, 2018	18	9.07	13476	240	15535	18	189	-2022
April 29, 2018	19	10.88	13831	243	15540	18	503	-2003
April 29, 2018	20	40.54	14430	202	16230	18	256	-1916
April 29, 2018	21	13.35	14466	239	15752	18	1077	-2037
April 29, 2018	22	13.65	13701	220	15354	17	561	-1928
April 29, 2018	23	7.19	12793	220	14801	17	358	-2127
April 29, 2018	24	4.43	12111	234	14474	18	290	-2320
April 30, 2018	1	0	11758	234	14148	18	307	-2436
April 30, 2018	2	2.14	11641	263	13996	18	349	-2436
April 30, 2018	3	0	11641	264	13946	18	250	-2300
April 30, 2018	4	0	11844	208	14103	18	250	-2351
April 30, 2018	5	4.15	12496	218	14467	18	434	-2253
April 30, 2018	6	3.45	13607	156	14999	18	708	-1910
April 30, 2018	7	11.5	14566	142	16088	18	399	-1790
April 30, 2018	8	8.53	14534	174	15818	17	744	-1870
April 30, 2018	9	31.29	14107	170	16039	17	274	-2010
April 30, 2018	10	25.68	13867	146	15795	19	345	-2142
April 30, 2018	11	5.75	13697	182	15643	22	368	-2113
April 30, 2018	12	5.91	13594	189	15364	23	500	-2074
April 30, 2018	13	3.46	13536	205	15272	18	558	-2096
April 30, 2018	14	1.75	13431	128	15413	18	312	-2136
April 30, 2018	15	-0.03	13372	181	15309	18	506	-2180
April 30, 2018	16	0	13642	193	15484	18	495	-2144
April 30, 2018	17	5.81	14045	191	16011	17	242	-2102
April 30, 2018	18	5.39	14295	178	16148	17	432	-2162
April 30, 2018	19	5.8	14626	175	16300	17	949	-2424
April 30, 2018	20	7.18	15125	184	16538	17	1338	-2574
April 30, 2018	21	5.91	14975	195	16729	17	1039	-2545
April 30, 2018	22	1.86	13857	200	16200	17	390	-2461
April 30, 2018	23	0	12631	196	15159	17	236	-2463
April 30, 2018	24	-0.05	11828	173	13922	17	443	-2208
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May 1, 2018	2	-3	11173	202	13308	18	322	-2174
May 1, 2018	3	-3	11117	196	13292	17	395	-2334
May 1, 2018	4	-3	11356	125	13112	17	369	-1942
May 1, 2018	5	-0.82	11907	149	13890	17	379	-2148
May 1, 2018	6	0	12883	190	14906	17	411	-2280
May 1, 2018	7	3.77	14099	191	16222	17	504	-2486
May 1, 2018	8	9.24	14252	171	16243	17	421	-2315
May 1, 2018	9	6.48	14056	158	16081	16	467	-2304
May 1, 2018	10	5.81	13850	146	15976	16	432	-2405
May 1, 2018	11	0.86	13638	159	15878	16	413	-2405
May 1, 2018	12	0	13511	176	15642	16	330	-2307
May 1, 2018	13	0	13550	179	15550	16	445	-2237
May 1, 2018	14	0	13524	178	15400	16	445	-2198
May 1, 2018	15	0	13625	186	15720	16	445	-2329
May 1, 2018	16	0	13889	204	15933	16	397	-2292
May 1, 2018	17	0.38	14196	187	16289	17	341	-2292
May 1, 2018	18	0	14332	168	16504	17	299	-2326

May 1, 2018	19	0	14550	165	16911	17	223	-2467
May 1, 2018	20	0.39	14962	159	17286	17	399	-2612
May 1, 2018	21	1.94	14757	183	17350	17	464	-2802
May 1, 2018	22	0	13702	160	16227	17	250	-2605
May 1, 2018	23	-0.48	12509	205	14708	17	270	-2271
May 1, 2018	24	-3	11650	218	13853	17	379	-2284
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May 2, 2018	3	-4	10788	232	13101	17	279	-2356
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May 2, 2018	5	-2.53	11369	208	13618	17	421	-2471
May 2, 2018	6	-0.03	12390	204	14599	17	445	-2471
May 2, 2018	7	0	13508	188	15687	17	474	-2425
May 2, 2018	8	0	13790	161	15356	17	349	-1737
May 2, 2018	9	0	13744	190	15702	17	484	-2239
May 2, 2018	10	0	13890	198	16112	18	494	-2535
May 2, 2018	11	0	14199	181	16401	20	480	-2477
May 2, 2018	12	0	14425	185	16673	18	449	-2466
May 2, 2018	13	0	14648	179	16938	18	409	-2428
May 2, 2018	14	0	14640	179	17044	17	433	-2546
May 2, 2018	15	0	14746	194	17043	17	426	-2457
May 2, 2018	16	10.25	15099	162	17360	17	384	-2475
May 2, 2018	17	8.35	15318	156	17620	17	336	-2434
May 2, 2018	18	9.61	15331	148	17423	17	339	-2311
May 2, 2018	19	39.3	15569	169	17121	17	770	-2192
May 2, 2018	20	62.37	15885	186	17394	15	472	-1775
May 2, 2018	21	9.36	15635	196	16596	17	1337	-1948
May 2, 2018	22	8.03	14452	188	16009	17	814	-2002
May 2, 2018	23	1.94	13247	181	15257	17	481	-2171
May 2, 2018	24	0	12474	193	14778	17	483	-2560
May 3, 2018	1	-0.01	11969	182	14341	17	495	-2462
May 3, 2018	2	-1.65	11596	184	14028	17	304	-2498
May 3, 2018	3	-3	11463	224	13913	17	275	-2483
May 3, 2018	4	-3	11384	182	13889	17	284	-2483
May 3, 2018	5	-0.67	11951	101	14229	17	163	-2337
May 3, 2018	6	-0.02	12930	121	15119	17	412	-2517
May 3, 2018	7	8.6	14247	62	16309	17	370	-2448
May 3, 2018	8	7.75	14879	74	17155	17	388	-2652
May 3, 2018	9	6.2	14981	133	17274	17	267	-2392
May 3, 2018	10	20.59	15157	104	17306	15	214	-2325
May 3, 2018	11	29.61	15384	116	17648	15	297	-2381
May 3, 2018	12	4.44	15474	78	16905	18	1169	-2406
May 3, 2018	13	0	15461	136	16447	19	1547	-2338
May 3, 2018	14	0	15385	124	16496	19	1151	-1952
May 3, 2018	15	0	15367	134	16845	18	542	-1898
May 3, 2018	16	4.41	15469	131	17262	18	306	-1971
May 3, 2018	17	24.84	15512	131	17349	18	390	-2138
May 3, 2018	18	5.93	15291	119	16740	18	768	-2149
May 3, 2018	19	21.09	15375	154	16991	18	1086	-2563
May 3, 2018	20	19.98	15624	191	16707	18	1607	-2408

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May 3, 2018	22	7.68	14239	214	15908	18	722	-2102
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May 4, 2018	3	-0.69	11274	140	13810	17	281	-2568
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May 4, 2018	13	0	14399	163	16401	18	139	-1985
May 4, 2018	14	0	14200	210	16268	19	222	-1964
May 4, 2018	15	0	14071	186	16067	19	247	-2020
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May 4, 2018	17	-0.48	12991	144	15040	19	254	-2081
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May 5, 2018	5	-4.07	10691	129	13093	17	324	-2512
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May 5, 2018	8	-3.08	11893	129	13846	17	242	-1987
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May 7, 2018	9	22.15	13596	225	16272	16	173	-2644
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May 8, 2018	16	17.05	14199	209	15170	16	1131	-1896
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May 8, 2018	18	45.53	14932	268	16563	17	681	-2096
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May 8, 2018	20	38.2	15448	270	16309	19	1153	-1640
May 8, 2018	21	22.42	15301	246	16251	19	985	-1636
May 8, 2018	22	11.35	14133	257	15298	16	978	-1811
May 8, 2018	23	10.79	12837	262	14251	16	557	-1696
May 8, 2018	24	0.44	11942	249	13890	16	485	-2073
May 9, 2018	1	0	11505	269	13892	16	289	-2369
May 9, 2018	2	-0.54	11233	253	13494	16	384	-2375
May 9, 2018	3	-2.28	11134	265	13326	16	384	-2302
May 9, 2018	4	-2.04	11183	271	13413	16	474	-2416
May 9, 2018	5	-0.06	11678	255	13671	16	441	-2209
May 9, 2018	6	-0.26	12700	273	14476	16	474	-2057
May 9, 2018	7	3.53	13816	283	15660	16	394	-2000
May 9, 2018	8	9.05	14040	276	15861	16	384	-2041
May 9, 2018	9	8.45	14023	206	15962	16	384	-2194
May 9, 2018	10	6.8	13958	234	15972	16	353	-2165
May 9, 2018	11	17.83	14005	231	16134	18	410	-2280
May 9, 2018	12	0	13973	174	15945	16	351	-2037
May 9, 2018	13	0	14018	217	15840	16	358	-2038
May 9, 2018	14	0.49	14102	287	15985	16	335	-2029
May 9, 2018	15	3.34	14291	251	16228	16	441	-2138
May 9, 2018	16	21.63	14816	243	16609	16	424	-2091
May 9, 2018	17	31	15016	248	17077	16	398	-2195
May 9, 2018	18	12.42	15037	243	16989	16	341	-2033
May 9, 2018	19	20.91	15192	235	17218	16	218	-2016
May 9, 2018	20	5.96	15377	253	17343	16	379	-2004
May 9, 2018	21	2.45	15101	236	17438	16	254	-2115
May 9, 2018	22	0	13956	231	15889	17	256	-1901
May 9, 2018	23	-0.81	12750	283	14827	17	189	-1924
May 9, 2018	24	-3.33	11773	276	13742	16	294	-1808
May 10, 2018	1	-3.87	11239	304	13348	16	314	-2118
May 10, 2018	2	-3.92	10961	319	13501	16	313	-2528

May 10, 2018	3	-4.03	10871	280	13410	16	298	-2519
May 10, 2018	4	-4	10935	267	13391	16	369	-2548
May 10, 2018	5	-3.92	11415	202	13328	16	351	-2058
May 10, 2018	6	-1.7	12573	220	14496	16	281	-2041
May 10, 2018	7	0	13903	209	15676	16	445	-2081
May 10, 2018	8	0	14452	255	16362	16	366	-2053
May 10, 2018	9	3.4	14650	212	16457	16	468	-2150
May 10, 2018	10	4.89	14798	187	16774	16	320	-2131
May 10, 2018	11	13.31	14802	166	16825	16	367	-2217
May 10, 2018	12	9.07	14641	256	16679	16	319	-2115
May 10, 2018	13	7.07	14595	243	16642	16	311	-2071
May 10, 2018	14	7.7	14510	258	16348	16	362	-1988
May 10, 2018	15	0	14463	285	16469	23	359	-2011
May 10, 2018	16	0	14554	283	16491	19	332	-2046
May 10, 2018	17	0	14612	261	16548	18	332	-2043
May 10, 2018	18	0	14511	166	16322	18	324	-1988
May 10, 2018	19	0	14618	214	16542	18	347	-2015
May 10, 2018	20	0	14824	239	16523	18	415	-1929
May 10, 2018	21	0.48	14744	240	16603	18	473	-1983
May 10, 2018	22	-0.02	13700	243	15560	18	425	-2009
May 10, 2018	23	-1.3	12563	215	14413	18	400	-1984
May 10, 2018	24	-3.5	11786	238	13847	18	351	-2100
May 11, 2018	1	-3.93	11396	229	13492	18	369	-2142
May 11, 2018	2	-3.42	11137	223	13727	18	355	-2605
May 11, 2018	3	-3.42	11089	227	13655	18	336	-2609
May 11, 2018	4	-2.94	11256	207	13783	18	321	-2625
May 11, 2018	5	-2.03	11766	224	13888	18	244	-2088
May 11, 2018	6	-0.38	12755	242	14681	18	348	-1938
May 11, 2018	7	3.89	13833	244	15768	18	346	-1963
May 11, 2018	8	5.89	13926	237	15796	18	306	-1873
May 11, 2018	9	5.87	13824	246	15815	18	270	-2007
May 11, 2018	10	6.25	13722	242	15735	18	322	-2061
May 11, 2018	11	12.77	13694	244	15811	18	332	-2067
May 11, 2018	12	13.89	13661	252	15722	18	384	-2098
May 11, 2018	13	14.21	13734	240	15806	18	360	-2049
May 11, 2018	14	15.26	13732	269	16193	18	370	-2534
May 11, 2018	15	10.9	13565	250	15562	18	733	-2370
May 11, 2018	16	7.92	13795	281	16002	18	287	-2266
May 11, 2018	17	10.72	14220	249	16215	18	329	-2110
May 11, 2018	18	13.34	14342	266	16590	18	358	-2335
May 11, 2018	19	15.83	14635	325	16810	18	535	-2415
May 11, 2018	20	27.75	14915	283	16677	18	811	-2225
May 11, 2018	21	17.94	14734	254	16582	18	786	-2318
May 11, 2018	22	11.53	13872	234	16384	18	282	-2464
May 11, 2018	23	9.57	12764	253	15240	19	360	-2510
May 11, 2018	24	7.75	11960	269	14621	18	369	-2731
May 12, 2018	1	9.61	11495	272	14319	18	410	-2937
May 12, 2018	2	1.89	11229	225	14047	18	434	-2945
May 12, 2018	3	0.86	11048	218	13831	18	523	-3049
May 12, 2018	4	-0.01	11046	228	13844	18	415	-2934

May 12, 2018	5	4.17	11270	199	14049	18	379	-2942
May 12, 2018	6	1.41	11584	178	13996	18	462	-2688
May 12, 2018	7	5.28	12133	226	14509	18	344	-2558
May 12, 2018	8	19.23	12830	139	15101	18	524	-2743
May 12, 2018	9	35.54	13110	133	15657	18	357	-2800
May 12, 2018	10	161.67	12963	109	15386	18	459	-2638
May 12, 2018	11	18.32	12739	169	15023	18	328	-2424
May 12, 2018	12	5.84	12715	125	15119	18	214	-2507
May 12, 2018	13	5.81	12512	186	15043	18	214	-2550
May 12, 2018	14	5.05	12203	204	14929	18	214	-2609
May 12, 2018	15	-0.03	12024	234	14854	18	215	-2694
May 12, 2018	16	0.95	12192	201	14985	18	244	-2759
May 12, 2018	17	5.61	12709	206	15390	18	214	-2725
May 12, 2018	18	15.54	13079	200	15580	18	214	-2641
May 12, 2018	19	143.4	13318	190	15826	18	425	-2728
May 12, 2018	20	60.83	13594	219	15773	18	839	-2729
May 12, 2018	21	5.01	13635	215	15356	19	936	-2320
May 12, 2018	22	7.33	13038	213	15397	18	287	-2368
May 12, 2018	23	2.9	12252	205	14449	18	149	-2081
May 12, 2018	24	3.88	11510	247	14331	18	259	-2754
May 13, 2018	1	5.31	11054	286	14001	18	465	-3015
May 13, 2018	2	2.35	10764	226	13738	18	357	-3041
May 13, 2018	3	-1.41	10641	294	13578	18	290	-2882
May 13, 2018	4	-0.03	10616	295	13583	19	348	-2947
May 13, 2018	5	4.23	10759	309	13705	19	342	-2963
May 13, 2018	6	-2.19	10807	258	13648	18	376	-2773
May 13, 2018	7	1.35	11180	217	13910	18	303	-2760
May 13, 2018	8	5.8	11635	206	14574	18	216	-2887
May 13, 2018	9	-1.37	11702	208	14473	18	214	-2594
May 13, 2018	10	-0.71	11618	177	14465	18	295	-2767
May 13, 2018	11	-3	11620	241	14597	18	263	-2827
May 13, 2018	12	-3	11609	259	14590	18	213	-2794
May 13, 2018	13	0.39	11444	247	14579	18	270	-2981
May 13, 2018	14	5.78	11379	248	14581	18	275	-3087
May 13, 2018	15	5.82	11583	259	14707	18	233	-2996
May 13, 2018	16	0.67	12055	218	14838	18	189	-2704
May 13, 2018	17	6.54	12584	221	15359	18	189	-2807
May 13, 2018	18	7.88	13062	230	15455	19	189	-2378
May 13, 2018	19	67.01	13389	207	15710	18	321	-2476
May 13, 2018	20	44.67	13852	221	15769	17	874	-2485
May 13, 2018	21	14.61	14115	236	15948	16	1045	-2467
May 13, 2018	22	15.25	13329	221	15671	16	375	-2430
May 13, 2018	23	12.96	12339	278	14960	17	395	-2604
May 13, 2018	24	4.6	11596	319	14333	16	293	-2611
May 14, 2018	1	2.9	11114	283	14218	17	314	-2968
May 14, 2018	2	-0.01	10881	297	14052	16	390	-3146
May 14, 2018	3	0	10771	298	14389	17	284	-3528
May 14, 2018	4	-3.17	10848	260	13896	16	294	-2949
May 14, 2018	5	0.82	11439	245	14224	17	292	-2741
May 14, 2018	6	19.21	12553	246	15019	17	388	-2724

May 14, 2018	7	28.69	13760	241	15770	17	919	-2613
May 14, 2018	8	16.49	14118	190	15772	17	1332	-2779
May 14, 2018	9	12.94	14141	221	15862	17	1341	-2672
May 14, 2018	10	19.82	14150	222	16130	17	643	-2420
May 14, 2018	11	23.59	13953	220	16262	22	974	-2688
May 14, 2018	12	13.06	14199	291	16511	22	1050	-2923
May 14, 2018	13	5.87	14238	247	16639	16	525	-2592
May 14, 2018	14	8.71	14281	253	16843	16	345	-2549
May 14, 2018	15	12.66	14366	203	17008	17	314	-2654
May 14, 2018	16	5.84	14750	237	16958	16	583	-2541
May 14, 2018	17	6.99	15148	248	17458	16	485	-2573
May 14, 2018	18	5.76	15274	257	17616	16	431	-2538
May 14, 2018	19	8.65	15397	245	17084	16	1053	-2460
May 14, 2018	20	18.38	15634	245	16899	16	1542	-2545
May 14, 2018	21	11.52	15558	225	16570	16	1681	-2387
May 14, 2018	22	6.51	14454	272	16041	16	835	-2158
May 14, 2018	23	4.46	13195	317	15451	16	672	-2571
May 14, 2018	24	0.4	12183	307	14628	16	200	-2299
May 15, 2018	1	0	11675	271	14501	16	314	-2822
May 15, 2018	2	0.39	11416	290	14253	16	303	-2845
May 15, 2018	3	3.47	11323	297	14119	17	384	-2857
May 15, 2018	4	3.19	11304	284	14208	16	345	-2950
May 15, 2018	5	3.77	11901	213	14292	16	762	-3018
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May 15, 2018	7	112.5	14449	208	16225	17	1175	-2702
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May 15, 2018	10	148.39	15156	201	16124	17	1440	-2120
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May 15, 2018	12	5.73	14992	236	15863	17	1459	-2030
May 15, 2018	13	5.69	14731	224	15888	17	1017	-1833
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May 15, 2018	16	40.17	14606	279	15878	17	221	-1307
May 15, 2018	17	45.86	15016	287	15959	17	669	-1405
May 15, 2018	18	6.11	15059	280	15994	17	814	-1407
May 15, 2018	19	13.65	15198	231	16034	17	790	-1374
May 15, 2018	20	6.32	15326	238	16241	17	798	-1349
May 15, 2018	21	4.82	15211	197	16379	17	701	-1596
May 15, 2018	22	2.53	14141	188	15567	17	724	-1780
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May 15, 2018	24	5.66	11976	265	14103	17	357	-2084
May 16, 2018	1	4.32	11475	265	14040	17	444	-2633
May 16, 2018	2	1.32	11218	258	13657	17	401	-2488
May 16, 2018	3	0	11116	307	13923	17	397	-2861
May 16, 2018	4	0	11225	304	14073	17	387	-2891
May 16, 2018	5	2.87	11711	306	14604	17	314	-2933
May 16, 2018	6	3.31	12669	316	14912	17	372	-2348
May 16, 2018	7	9.29	13775	308	15852	17	364	-2166
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May 16, 2018	9	14.36	13752	293	16185	17	289	-2376
May 16, 2018	10	17.94	13583	269	16045	17	177	-2388
May 16, 2018	11	7.34	13644	264	16130	22	143	-2391
May 16, 2018	12	12.64	13690	283	16275	25	210	-2474
May 16, 2018	13	14.37	13814	264	16291	25	73	-2308
May 16, 2018	14	15.42	13925	238	16387	24	202	-2464
May 16, 2018	15	14.45	14086	241	16434	24	466	-2584
May 16, 2018	16	15.5	14533	240	16146	24	939	-2367
May 16, 2018	17	39.48	15113	249	16245	24	1636	-2506
May 16, 2018	18	19.47	15206	230	16273	24	1238	-2005
May 16, 2018	19	14.37	15495	220	15945	24	1491	-1662
May 16, 2018	20	28.26	15624	249	16422	24	1167	-1652
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May 16, 2018	23	4.43	13211	235	15382	23	433	-2255
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May 18, 2018	7	0	13194	280	15793	16	305	-2595
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May 18, 2018	9	-0.08	13159	223	15736	16	214	-2438
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May 18, 2018	13	0	12859	298	15528	18	292	-2689
May 18, 2018	14	0	12691	326	15214	17	214	-2406
May 18, 2018	15	0	12663	337	15245	18	305	-2564
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May 20, 2018	22	11.46	12850	268	14907	18	1132	-3022
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May 20, 2018	24	5.89	11255	301	14004	18	379	-2843
May 21, 2018	1	3.3	10678	291	13775	18	273	-2941
May 21, 2018	2	-1.01	10484	291	13534	18	274	-2942
May 21, 2018	3	-4	10320	270	13230	18	276	-2730
May 21, 2018	4	-3.92	10181	238	13281	18	283	-2989
May 21, 2018	5	-3	10228	245	13440	18	275	-3102
May 21, 2018	6	-2.45	10384	262	13397	18	273	-2941
May 21, 2018	7	-2.5	10688	271	13659	18	231	-2874
May 21, 2018	8	-4.3	10967	204	13766	18	190	-2608
May 21, 2018	9	-4.1	11113	242	13674	18	240	-2583
May 21, 2018	10	-4	11304	209	13774	18	189	-2428
May 21, 2018	11	-3	11451	197	13853	18	189	-2409
May 21, 2018	12	-3	11507	204	14039	18	189	-2565
May 21, 2018	13	-3	11393	185	14105	18	189	-2558
May 21, 2018	14	-3	11431	181	14110	18	189	-2528
May 21, 2018	15	-0.74	11756	195	14384	18	189	-2583
May 21, 2018	16	7.06	12351	183	14862	18	189	-2567
May 21, 2018	17	11.95	13074	193	15734	18	225	-2615
May 21, 2018	18	13.76	13315	199	15597	18	732	-2610
May 21, 2018	19	10.42	13500	167	15507	16	903	-2581
May 21, 2018	20	11.16	13783	197	15618	16	1166	-2665
May 21, 2018	21	3.22	13669	206	15320	16	1428	-2644
May 21, 2018	22	0.87	12938	195	14813	16	686	-2327
May 21, 2018	23	-0.02	11846	194	14250	16	379	-2548
May 21, 2018	24	-2.14	11052	249	13615	18	289	-2437
May 22, 2018	1	-3.58	10757	287	13183	18	215	-2403
May 22, 2018	2	-3.42	10542	281	13199	18	279	-2606
May 22, 2018	3	-0.21	10560	294	13379	18	205	-2725
May 22, 2018	4	0	10714	301	13468	18	245	-2730
May 22, 2018	5	6.77	11375	269	13794	18	289	-2641
May 22, 2018	6	7.54	12491	212	14257	18	1184	-2836
May 22, 2018	7	12.47	13963	167	15124	16	1580	-2681
May 22, 2018	8	26.51	14609	166	15982	17	1084	-2391
May 22, 2018	9	13.31	14772	198	15934	19	1428	-2488
May 22, 2018	10	13.31	14929	221	15795	19	1700	-2334
May 22, 2018	11	13.32	14936	202	15845	17	1615	-2357
May 22, 2018	12	12.75	14910	217	16010	16	1598	-2532
May 22, 2018	13	12.78	14978	204	15978	21	1810	-2547
May 22, 2018	14	28.06	14933	169	16047	24	1613	-2573

May 22, 2018	15	12.12	14958	181	15871	16	1823	-2567
May 22, 2018	16	13.66	15131	199	16094	15	1840	-2610
May 22, 2018	17	13.39	15364	204	16126	17	1835	-2392
May 22, 2018	18	5.86	15275	202	16209	19	1788	-2574
May 22, 2018	19	11.36	15315	198	16293	21	1506	-2349
May 22, 2018	20	7.16	15472	205	16260	20	1713	-2287
May 22, 2018	21	6.11	15208	226	16087	23	1817	-2406
May 22, 2018	22	6.81	14100	223	15475	25	1499	-2620
May 22, 2018	23	5.95	12835	279	15120	25	647	-2624
May 22, 2018	24	6.49	11964	310	14813	25	231	-2664
May 23, 2018	1	9.14	11584	303	14646	29	382	-3174
May 23, 2018	2	5.76	11313	323	14302	30	442	-3067
May 23, 2018	3	5.76	11101	326	13972	30	305	-2786
May 23, 2018	4	-0.01	11047	306	13855	29	226	-2587
May 23, 2018	5	0.24	11430	327	14034	29	285	-2422
May 23, 2018	6	4.71	12334	276	14566	29	313	-2238
May 23, 2018	7	9.22	13566	266	15085	29	936	-2236
May 23, 2018	8	9.2	13876	279	15347	23	1017	-2169
May 23, 2018	9	8.39	13889	242	15475	19	916	-2181
May 23, 2018	10	5.83	13877	300	15323	33	1201	-2267
May 23, 2018	11	6.51	13973	326	15540	22	1147	-2275
May 23, 2018	12	5.83	13970	313	15837	19	688	-2177
May 23, 2018	13	5.86	14104	339	16127	19	732	-2311
May 23, 2018	14	11.27	14188	319	16404	19	476	-2307
May 23, 2018	15	10.55	14390	337	16494	20	554	-2277
May 23, 2018	16	8.11	14798	339	16624	23	821	-2316
May 23, 2018	17	10.43	15241	319	16852	21	1021	-2303
May 23, 2018	18	7.93	15450	292	16880	19	977	-2092
May 23, 2018	19	24.14	15735	249	17246	20	1044	-2304
May 23, 2018	20	27.85	15838	261	17403	20	1066	-2290
May 23, 2018	21	31.14	15720	315	17344	18	1003	-2250
May 23, 2018	22	41.11	14605	278	16441	19	549	-2023
May 23, 2018	23	10.29	13265	293	15366	18	531	-2219
May 23, 2018	24	6.02	12210	276	14422	17	367	-2135
May 24, 2018	1	0.83	11578	309	14212	17	320	-2502
May 24, 2018	2	-0.01	11266	254	13817	17	321	-2468
May 24, 2018	3	-0.01	11080	289	13657	17	282	-2430
May 24, 2018	4	-0.02	11090	290	13679	17	247	-2414
May 24, 2018	5	-0.45	11469	308	13829	17	321	-2216
May 24, 2018	6	3.99	12432	295	14724	17	278	-2250
May 24, 2018	7	18.03	13775	262	15875	16	387	-2240
May 24, 2018	8	16.12	14182	298	15773	16	955	-2106
May 24, 2018	9	13.35	14273	257	15793	17	820	-2025
May 24, 2018	10	15.29	14430	300	16088	18	545	-1914
May 24, 2018	11	13.38	14538	297	16416	17	542	-2059
May 24, 2018	12	14.76	14693	328	16680	17	390	-2016
May 24, 2018	13	13.38	14921	301	16340	17	1180	-2064
May 24, 2018	14	13.36	15106	315	16273	18	1346	-2061
May 24, 2018	15	13.33	15421	289	17012	18	875	-2134
May 24, 2018	16	11.49	15906	317	17455	20	862	-2051

May 24, 2018	17	13.56	16269	322	17492	19	1115	-1960
May 24, 2018	18	27.25	16421	314	17400	19	1410	-2042
May 24, 2018	19	32.78	16603	312	17969	19	1334	-2374
May 24, 2018	20	31.13	16658	311	17972	19	1490	-2373
May 24, 2018	21	9.66	16358	286	17448	34	1356	-2045
May 24, 2018	22	4.29	15193	317	16988	19	715	-2077
May 24, 2018	23	1.45	13752	324	16233	19	359	-2382
May 24, 2018	24	0	12602	308	15118	19	388	-2478
May 25, 2018	1	0	11935	332	14645	19	475	-2704
May 25, 2018	2	0	11464	304	14218	19	444	-2709
May 25, 2018	3	-0.25	11259	289	13877	19	459	-2693
May 25, 2018	4	-3	11176	282	13810	19	307	-2411
May 25, 2018	5	0	11700	326	14439	19	215	-2656
May 25, 2018	6	2.32	12746	338	15389	19	382	-2688
May 25, 2018	7	7.32	14177	261	16373	19	459	-2423
May 25, 2018	8	13.29	14991	264	17216	18	391	-2431
May 25, 2018	9	24.88	15330	294	17756	18	382	-2452
May 25, 2018	10	29.26	15647	228	18026	18	496	-2643
May 25, 2018	11	29.32	15789	263	17825	18	1063	-2833
May 25, 2018	12	17.68	15844	278	17468	18	1377	-2715
May 25, 2018	13	8.23	16042	244	17174	19	1680	-2428
May 25, 2018	14	5.86	16309	250	17037	18	1785	-2268
May 25, 2018	15	1.42	16555	254	17249	19	1884	-2292
May 25, 2018	16	6.22	16919	330	17755	18	1683	-2238
May 25, 2018	17	14.93	17337	291	18100	17	1887	-2347
May 25, 2018	18	14.35	17375	274	17989	18	1963	-2271
May 25, 2018	19	15.3	17439	296	17856	21	1866	-2052
May 25, 2018	20	23.85	17314	251	18015	20	1812	-2234
May 25, 2018	21	13.55	17016	241	17778	19	1884	-2333
May 25, 2018	22	4.36	15837	258	16953	18	1736	-2382
May 25, 2018	23	0.88	14333	232	15952	18	1021	-2327
May 25, 2018	24	1.33	13240	254	15488	17	516	-2481
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May 26, 2018	2	-0.03	11953	255	14324	17	482	-2556
May 26, 2018	3	-0.25	11651	293	14168	19	482	-2632
May 26, 2018	4	-2.93	11471	282	13965	18	473	-2621
May 26, 2018	5	0	11531	274	13978	17	409	-2530
May 26, 2018	6	-0.03	11754	226	13910	17	485	-2381
May 26, 2018	7	2.87	12517	231	14637	17	386	-2298
May 26, 2018	8	15.28	13480	250	15657	18	409	-2330
May 26, 2018	9	44.14	14328	208	16481	17	435	-2355
May 26, 2018	10	35.7	14850	219	16719	17	842	-2471
May 26, 2018	11	27.65	15414	240	16748	17	1068	-2163
May 26, 2018	12	33.28	15730	266	17329	16	1370	-2686
May 26, 2018	13	32.46	15696	233	17141	18	1409	-2600
May 26, 2018	14	27.86	15780	215	16892	18	1409	-2267
May 26, 2018	15	30.51	15991	257	17061	18	1432	-2251
May 26, 2018	16	34.74	16333	266	17411	18	1502	-2352
May 26, 2018	17	35.44	16650	234	17328	18	1959	-2331
May 26, 2018	18	32.32	16437	226	17261	18	1959	-2496

May 26, 2018	19	28.81	16185	245	17108	18	1642	-2313
May 26, 2018	20	48.34	15916	230	16569	18	1699	-2107
May 26, 2018	21	15.23	15649	218	16297	20	1812	-2062
May 26, 2018	22	13.28	14787	237	15991	18	1314	-2264
May 26, 2018	23	9.61	13608	246	15434	18	447	-2092
May 26, 2018	24	5.46	12569	270	14879	18	729	-2771
May 27, 2018	1	5.71	11874	278	14504	18	417	-2732
May 27, 2018	2	5.95	11463	287	14243	18	564	-3019
May 27, 2018	3	5.85	11196	291	14155	18	389	-3008
May 27, 2018	4	5.76	11064	331	13977	18	417	-2988
May 27, 2018	5	5.73	10950	340	13864	18	403	-2953
May 27, 2018	6	0	11024	269	13544	18	370	-2594
May 27, 2018	7	3.83	11611	275	13883	18	239	-2261
May 27, 2018	8	4.77	12454	251	14519	18	208	-2040
May 27, 2018	9	12.71	13305	275	15380	18	411	-2238
May 27, 2018	10	12.07	14007	259	15700	18	1064	-2525
May 27, 2018	11	10.3	14523	286	15969	18	1300	-2434
May 27, 2018	12	22.38	14945	207	16210	19	1478	-2492
May 27, 2018	13	12.17	15201	261	16583	18	1235	-2334
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May 27, 2018	16	34.84	16721	285	17453	19	1904	-2530
May 27, 2018	17	37.01	17213	246	17666	19	1861	-2205
May 27, 2018	18	38.26	17436	266	17708	18	1905	-1910
May 27, 2018	19	34.36	17302	263	17648	19	1797	-1784
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May 28, 2018	15	33.56	19162	201	18908	71	2044	-1720
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May 28, 2018	22	29.06	18217	223	17948	75	1943	-1444
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May 29, 2018	13	36.87	17988	282	17827	22	2033	-1566
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June 1, 2018	20	21.95	18107	227	18080	22	1760	-1430
June 1, 2018	21	5.31	17428	193	17181	22	1780	-1218
June 1, 2018	22	8.41	16177	240	16585	22	1424	-1562
June 1, 2018	23	1.44	14511	334	15798	22	1709	-2512
June 1, 2018	24	0.87	13224	350	15078	22	1195	-2618

June 2, 2018	1	1.44	12386	282	14850	21	616	-2739
June 2, 2018	2	0	11821	277	14229	21	263	-2331
June 2, 2018	3	-0.08	11509	302	13705	21	312	-2092
June 2, 2018	4	-0.02	11318	310	13693	21	245	-2290
June 2, 2018	5	-0.01	11312	303	13818	21	235	-2440
June 2, 2018	6	0	11514	309	14111	21	253	-2534
June 2, 2018	7	0	12086	302	14453	21	363	-2362
June 2, 2018	8	0.48	12649	297	14979	21	480	-2419
June 2, 2018	9	1.85	12977	293	15053	21	592	-2306
June 2, 2018	10	9.48	13223	285	15182	21	842	-2481
June 2, 2018	11	45.27	13403	248	15736	21	309	-2383
June 2, 2018	12	14.36	13510	289	15368	21	1065	-2578
June 2, 2018	13	14.36	13430	237	15318	20	1172	-2621
June 2, 2018	14	8.35	13431	240	15512	20	708	-2428
June 2, 2018	15	8.67	13647	235	15436	20	1332	-2734
June 2, 2018	16	10.82	14129	243	15705	20	1365	-2652
June 2, 2018	17	24.79	14780	231	16318	19	1550	-2850
June 2, 2018	18	31.95	15115	228	16685	19	1325	-2666
June 2, 2018	19	34.05	15194	218	16782	18	1300	-2630
June 2, 2018	20	32.09	14915	233	16562	19	1354	-2676
June 2, 2018	21	19.2	14756	234	16027	19	1800	-2701
June 2, 2018	22	13.5	14046	280	15204	20	1705	-2515
June 2, 2018	23	4.87	13155	280	14382	19	1623	-2371
June 2, 2018	24	12.94	12204	282	13948	20	1039	-2462
June 3, 2018	1	8.85	11529	303	13879	20	814	-2763
June 3, 2018	2	12.24	11051	315	13976	20	336	-2923
June 3, 2018	3	5.76	10795	291	13786	20	341	-2951
June 3, 2018	4	0.93	10658	303	13648	20	253	-2867
June 3, 2018	5	0	10607	283	13515	20	341	-2898
June 3, 2018	6	-1.49	10717	335	13197	20	280	-2379
June 3, 2018	7	3.78	11200	254	13613	20	284	-2456
June 3, 2018	8	5.89	11766	264	14036	20	294	-2311
June 3, 2018	9	15.49	12405	290	14633	20	551	-2611
June 3, 2018	10	15.7	13009	325	15121	21	716	-2476
June 3, 2018	11	77.25	13559	266	15551	21	1044	-2739
June 3, 2018	12	14.38	13886	315	15377	21	1472	-2580
June 3, 2018	13	14.37	14138	296	15553	21	1607	-2678
June 3, 2018	14	22.24	14263	281	15699	21	961	-2109
June 3, 2018	15	35.69	14463	298	16092	21	836	-2129
June 3, 2018	16	58.82	14872	271	16615	21	514	-1988
June 3, 2018	17	59.81	15191	321	16854	20	474	-1759
June 3, 2018	18	19.5	15100	318	16797	21	222	-1595
June 3, 2018	19	11.54	15096	297	16631	21	606	-1787
June 3, 2018	20	10.03	15141	265	16576	22	756	-1862
June 3, 2018	21	0	14813	274	16007	22	1284	-2011
June 3, 2018	22	-0.03	13934	260	15519	22	965	-2175
June 3, 2018	23	-0.03	12918	263	15000	22	752	-2557
June 3, 2018	24	0	12108	294	14900	22	297	-2734
June 4, 2018	1	0	11569	286	14462	22	310	-2747
June 4, 2018	2	-0.11	11318	306	14165	22	222	-2672

June 4, 2018	3	-0.03	11206	326	14054	21	293	-2745
June 4, 2018	4	-0.03	11259	264	14087	21	304	-2778
June 4, 2018	5	0	11653	245	14375	21	273	-2696
June 4, 2018	6	0	12634	187	15207	23	274	-2673
June 4, 2018	7	0	13983	213	16340	23	695	-2770
June 4, 2018	8	0	14557	202	16791	23	699	-2690
June 4, 2018	9	2.38	14716	215	17235	22	562	-2809
June 4, 2018	10	0	14896	195	17521	15	280	-2704
June 4, 2018	11	1.72	14855	192	17461	14	474	-2794
June 4, 2018	12	0	14690	228	17332	15	439	-2770
June 4, 2018	13	0	14772	207	17309	24	489	-2819
June 4, 2018	14	0	14655	244	16825	25	387	-2357
June 4, 2018	15	0	14474	222	16316	15	340	-1905
June 4, 2018	16	0	14651	232	16671	15	194	-1970
June 4, 2018	17	0.94	14963	226	16743	15	418	-2103
June 4, 2018	18	4.86	14995	245	17027	15	236	-2070
June 4, 2018	19	13.73	15157	244	17035	15	430	-2108
June 4, 2018	20	10.09	15308	254	17076	15	477	-2114
June 4, 2018	21	16.9	15290	229	16980	15	668	-2125
June 4, 2018	22	17.1	14294	193	16718	14	437	-2615
June 4, 2018	23	10.23	12971	205	15709	14	242	-2712
June 4, 2018	24	0.48	12072	214	14505	15	241	-2377
June 5, 2018	1	0	11533	244	14110	17	228	-2472
June 5, 2018	2	-0.05	11253	203	13803	16	227	-2472
June 5, 2018	3	-0.02	11187	210	13683	16	221	-2489
June 5, 2018	4	-0.01	11188	249	13761	16	201	-2438
June 5, 2018	5	0	11614	209	14072	15	239	-2472
June 5, 2018	6	2.15	12517	244	14657	16	526	-2403
June 5, 2018	7	9.47	13782	233	15755	15	664	-2463
June 5, 2018	8	6.66	14144	239	16182	15	422	-2148
June 5, 2018	9	6.01	14296	246	16194	16	645	-2362
June 5, 2018	10	5.9	14414	207	16610	16	327	-2250
June 5, 2018	11	12.96	14489	210	16844	16	419	-2564
June 5, 2018	12	5.88	14489	233	16798	28	427	-2504
June 5, 2018	13	5.97	14527	243	16959	18	403	-2583
June 5, 2018	14	2.95	14311	215	16629	17	365	-2311
June 5, 2018	15	0.09	14346	232	16483	17	415	-2251
June 5, 2018	16	9.5	14591	255	16995	17	340	-2463
June 5, 2018	17	5.86	14750	226	17063	17	447	-2499
June 5, 2018	18	5.87	14689	246	16990	17	352	-2357
June 5, 2018	19	13.02	14872	247	17037	18	376	-2293
June 5, 2018	20	7.96	15024	247	17202	18	323	-2240
June 5, 2018	21	17.45	14954	255	17127	18	452	-2339
June 5, 2018	22	16.49	14118	285	15867	18	834	-2239
June 5, 2018	23	11.51	12943	251	15260	18	468	-2466
June 5, 2018	24	14.34	12144	255	14687	18	271	-2541
June 6, 2018	1	14.36	11649	249	14359	16	332	-2823
June 6, 2018	2	14.34	11394	241	13995	16	282	-2612
June 6, 2018	3	10.81	11284	250	14048	16	221	-2727
June 6, 2018	4	5.91	11328	227	14082	16	275	-2814

June 6, 2018	5	2.89	11766	213	13890	16	291	-2195
June 6, 2018	6	8.38	12785	231	14609	16	519	-2167
June 6, 2018	7	25.17	14049	214	15391	15	875	-2094
June 6, 2018	8	17.12	14473	218	15973	15	1144	-2425
June 6, 2018	9	5.94	14573	212	15725	24	1297	-2213
June 6, 2018	10	5.91	14591	230	15948	26	1223	-2311
June 6, 2018	11	5.8	14579	209	15804	17	1330	-2237
June 6, 2018	12	6.91	14421	217	16055	17	916	-2326
June 6, 2018	13	5.26	14421	143	16127	17	772	-2311
June 6, 2018	14	9.41	14341	168	16409	17	361	-2261
June 6, 2018	15	5.89	14359	215	16545	17	316	-2260
June 6, 2018	16	5.87	14615	220	16598	15	502	-2251
June 6, 2018	17	8.79	14872	244	16775	16	682	-2375
June 6, 2018	18	23.95	14875	255	16775	16	496	-2164
June 6, 2018	19	29.06	15117	285	17076	15	427	-2162
June 6, 2018	20	22.41	15347	305	17080	15	737	-2244
June 6, 2018	21	12.97	15336	283	16315	15	1496	-2168
June 6, 2018	22	10.05	14351	348	15353	15	1219	-1886
June 6, 2018	23	5.67	13166	295	14755	15	1085	-2366
June 6, 2018	24	3.91	12199	338	14417	15	660	-2541
June 7, 2018	1	5.88	11667	308	14414	15	287	-2844
June 7, 2018	2	6.62	11397	278	14255	15	286	-2868
June 7, 2018	3	5.9	11283	310	14121	15	328	-2913
June 7, 2018	4	5.8	11294	278	14072	15	409	-2902
June 7, 2018	5	5.86	11697	293	14348	15	315	-2714
June 7, 2018	6	4.12	12626	302	14722	15	803	-2566
June 7, 2018	7	11.02	13933	243	15793	15	685	-2347
June 7, 2018	8	8.9	14435	258	16081	15	1004	-2347
June 7, 2018	9	2.31	14314	268	16425	14	710	-2393
June 7, 2018	10	5.83	14249	262	16745	30	258	-2493
June 7, 2018	11	8.99	14407	209	16797	35	362	-2623
June 7, 2018	12	12.02	14530	239	16865	35	573	-2757
June 7, 2018	13	12	14689	244	16939	35	321	-2363
June 7, 2018	14	13.11	14866	284	16840	35	735	-2497
June 7, 2018	15	12.28	15070	248	16847	36	819	-2396
June 7, 2018	16	11	15321	196	16720	35	861	-2092
June 7, 2018	17	18.71	15547	231	16533	34	937	-1790
June 7, 2018	18	19.24	15605	255	16587	34	1465	-2149
June 7, 2018	19	30.19	15869	311	16595	34	1757	-2207
June 7, 2018	20	35.21	16038	324	16599	33	1911	-2195
June 7, 2018	21	35.36	15985	329	16987	35	1644	-2300
June 7, 2018	22	15.12	15103	348	15762	34	1708	-2003
June 7, 2018	23	17.76	13802	320	15009	33	1726	-2495
June 7, 2018	24	4.77	12735	370	14416	33	1056	-2238
June 8, 2018	1	14.34	12059	353	14109	33	1137	-2797
June 8, 2018	2	14.37	11738	355	14302	33	545	-2779
June 8, 2018	3	12.23	11560	354	14247	34	469	-2769
June 8, 2018	4	7.31	11479	352	14057	33	453	-2634
June 8, 2018	5	4.09	11766	359	13926	33	884	-2641
June 8, 2018	6	3.02	12632	343	14420	33	1050	-2429

June 8, 2018	7	18.06	13929	315	15470	13	1116	-2331
June 8, 2018	8	14.38	14507	236	15844	15	1084	-2175
June 8, 2018	9	18.11	14703	188	15919	16	1484	-2390
June 8, 2018	10	14.36	14854	172	16056	16	1562	-2495
June 8, 2018	11	16.91	15007	240	16368	22	1236	-2356
June 8, 2018	12	25.42	15096	198	16674	73	895	-2342
June 8, 2018	13	29.12	15076	296	16852	69	861	-2342
June 8, 2018	14	25.02	15156	316	17084	69	704	-2308
June 8, 2018	15	16.79	15292	295	16725	69	917	-2126
June 8, 2018	16	16.16	15695	322	16895	35	1201	-2158
June 8, 2018	17	30.02	16088	313	17319	64	1434	-2478
June 8, 2018	18	23.54	16304	317	17041	66	1768	-2290
June 8, 2018	19	34.58	16374	321	17574	66	1211	-2184
June 8, 2018	20	35.31	16059	328	17477	67	885	-2093
June 8, 2018	21	27.8	15908	327	17480	65	940	-2264
June 8, 2018	22	19.82	15051	319	16064	16	1271	-1950
June 8, 2018	23	12.25	13705	382	14949	14	1426	-2272
June 8, 2018	24	12.38	12668	400	14580	14	1390	-2886
June 9, 2018	1	12.32	12000	278	14105	14	1136	-2906
June 9, 2018	2	14.33	11552	318	14145	14	993	-3288
June 9, 2018	3	13.62	11192	295	13468	14	1170	-3104
June 9, 2018	4	9.44	11056	312	13575	14	606	-2885
June 9, 2018	5	10.82	11078	296	13808	14	750	-3183
June 9, 2018	6	10.12	11257	301	13950	14	399	-2794
June 9, 2018	7	3.19	11864	298	14051	14	723	-2573
June 9, 2018	8	28.64	12757	217	15202	14	393	-2785
June 9, 2018	9	26.13	13329	274	15988	13	352	-2712
June 9, 2018	10	30.28	13612	242	15903	15	913	-2917
June 9, 2018	11	31.29	13873	267	16188	14	910	-2949
June 9, 2018	12	25.78	13876	255	15853	15	1295	-2957
June 9, 2018	13	16.05	13894	238	15639	14	1293	-2727
June 9, 2018	14	14.34	13834	243	15135	15	1444	-2366
June 9, 2018	15	12.29	13954	254	15112	15	1501	-2310
June 9, 2018	16	14.35	14247	255	16001	15	916	-2421
June 9, 2018	17	8.96	14509	258	15966	15	1365	-2546
June 9, 2018	18	14.35	14579	268	16488	15	614	-2317
June 9, 2018	19	14.33	14569	267	16129	14	1012	-2312
June 9, 2018	20	14.7	14460	259	16458	14	722	-2463
June 9, 2018	21	12.24	14424	263	16311	15	1119	-2687
June 9, 2018	22	5.09	13772	240	15793	14	763	-2514
June 9, 2018	23	4.78	12773	281	15134	14	794	-2829
June 9, 2018	24	2.87	11906	267	14586	14	274	-2671
June 10, 2018	1	0.98	11255	366	14654	14	286	-3324
June 10, 2018	2	0	10868	361	14076	14	433	-3355
June 10, 2018	3	0	10648	353	13823	14	384	-3197
June 10, 2018	4	0	10501	325	13453	13	294	-2884
June 10, 2018	5	0	10463	251	13388	15	343	-2975
June 10, 2018	6	-0.07	10472	267	13222	14	305	-2732
June 10, 2018	7	0	10937	295	13590	14	329	-2637
June 10, 2018	8	3.31	11565	183	14309	14	256	-2767

June 10, 2018	9	5.86	12109	229	14852	14	294	-2730
June 10, 2018	10	5.86	12428	220	15331	14	231	-2719
June 10, 2018	11	5.78	12593	202	15393	14	321	-2811
June 10, 2018	12	3.46	12696	181	15454	14	255	-2736
June 10, 2018	13	0	12761	230	15556	15	243	-2725
June 10, 2018	14	1.25	12860	193	15579	14	248	-2725
June 10, 2018	15	4.25	13124	238	15750	15	414	-2805
June 10, 2018	16	9.53	13590	249	16227	15	313	-2748
June 10, 2018	17	10.83	14093	254	16821	15	246	-2705
June 10, 2018	18	17.46	14356	202	16848	15	246	-2522
June 10, 2018	19	14.49	14471	206	16628	15	300	-2208
June 10, 2018	20	11.59	14534	223	16626	15	431	-2265
June 10, 2018	21	10.99	14542	251	16569	15	643	-2378
June 10, 2018	22	3.2	13770	258	15700	15	849	-2408
June 10, 2018	23	6.26	12668	261	15002	15	449	-2463
June 10, 2018	24	3.35	11816	306	14481	14	387	-2727
June 11, 2018	1	0	11236	312	13875	15	428	-2628
June 11, 2018	2	0	10993	328	13982	14	309	-2945
June 11, 2018	3	0	10843	300	13873	14	303	-2995
June 11, 2018	4	0	10887	340	13811	14	357	-2919
June 11, 2018	5	0	11197	284	13662	13	428	-2545
June 11, 2018	6	-0.01	12262	353	14174	14	384	-1943
June 11, 2018	7	5.76	13532	304	15466	14	269	-1880
June 11, 2018	8	7.41	13982	249	16001	15	201	-1856
June 11, 2018	9	4.84	14044	266	16056	14	236	-1880
June 11, 2018	10	5.84	14172	271	16025	14	344	-1895
June 11, 2018	11	5.85	14286	262	16128	20	389	-1917
June 11, 2018	12	8.02	14346	233	16177	13	221	-1803
June 11, 2018	13	14.33	14485	277	16366	14	255	-1837
June 11, 2018	14	14.33	14614	253	16431	14	315	-1864
June 11, 2018	15	14.34	14904	261	16741	14	220	-1866
June 11, 2018	16	16.2	15461	266	16886	15	544	-1737
June 11, 2018	17	25.18	16079	255	17112	14	1085	-1840
June 11, 2018	18	28.71	16348	275	16951	16	1397	-1700
June 11, 2018	19	41.37	16570	262	17661	15	562	-1440
June 11, 2018	20	24.93	16389	277	17203	16	1323	-1696
June 11, 2018	21	30.12	16125	267	17466	15	579	-1638
June 11, 2018	22	10.96	14965	270	16422	14	997	-1862
June 11, 2018	23	2.42	13509	278	15297	14	749	-2170
June 11, 2018	24	1.45	12462	343	14952	15	228	-2327
June 12, 2018	1	6.07	11899	303	14310	14	278	-2330
June 12, 2018	2	5.92	11541	333	14133	13	600	-2757
June 12, 2018	3	5.7	11358	312	14169	13	267	-2693
June 12, 2018	4	0	11406	329	13967	14	305	-2444
June 12, 2018	5	0.94	11625	364	13716	13	274	-1986
June 12, 2018	6	6.51	12697	293	13978	13	737	-1806
June 12, 2018	7	23.61	14069	297	15435	12	845	-1872
June 12, 2018	8	14.35	14573	289	15168	14	1450	-1685
June 12, 2018	9	27.81	14753	300	15478	10	1330	-1764
June 12, 2018	10	29.34	15053	309	15742	11	1152	-1553

June 12, 2018	11	30	15316	270	15782	18	1240	-1428
June 12, 2018	12	28.83	15589	250	15957	18	1205	-1377
June 12, 2018	13	34.72	15965	297	16847	12	668	-1347
June 12, 2018	14	35.45	16245	302	16923	29	897	-1321
June 12, 2018	15	36.12	16815	287	17206	66	1023	-1266
June 12, 2018	16	39.84	17520	298	17900	78	1008	-1291
June 12, 2018	17	47.27	17976	260	17929	67	1261	-998
June 12, 2018	18	36.94	17924	281	17531	67	1826	-1212
June 12, 2018	19	38.5	17943	282	17350	67	1856	-1045
June 12, 2018	20	36.35	17774	241	17291	67	1821	-1141
June 12, 2018	21	35.89	17516	261	17094	65	1876	-1202
June 12, 2018	22	25.19	16411	234	16001	13	1799	-1072
June 12, 2018	23	16.71	14993	248	14848	13	1921	-1467
June 12, 2018	24	18.3	13957	290	14459	13	1785	-2086
June 13, 2018	1	33.49	13170	265	14547	11	922	-2024
June 13, 2018	2	30.28	12745	242	14611	12	311	-1993
June 13, 2018	3	35.85	12570	239	14281	13	324	-1813
June 13, 2018	4	43.87	12570	276	14213	13	389	-1780
June 13, 2018	5	22.09	12957	288	13895	13	1248	-1882
June 13, 2018	6	23.59	14133	296	14896	12	1443	-1986
June 13, 2018	7	43.88	15633	282	15735	12	1749	-1588
June 13, 2018	8	37.24	16279	270	15905	15	1917	-1201
June 13, 2018	9	21.94	16637	289	16173	13	1867	-1171
June 13, 2018	10	13.35	16946	253	16294	14	1989	-997
June 13, 2018	11	10.5	17265	207	16892	16	1305	-749
June 13, 2018	12	5.99	17624	229	17521	16	1329	-985
June 13, 2018	13	13.34	18039	242	18553	15	1386	-1737
June 13, 2018	14	20.35	18249	291	18726	14	1835	-2058
June 13, 2018	15	15.12	18224	268	18869	13	1811	-2200
June 13, 2018	16	5.8	17864	240	18699	13	1277	-1828
June 13, 2018	17	11.55	18004	266	19021	15	1014	-1813
June 13, 2018	18	13.35	17702	243	18954	14	643	-1638
June 13, 2018	19	8.13	17273	290	18603	14	824	-1831
June 13, 2018	20	5.87	16916	251	17928	14	1340	-2092
June 13, 2018	21	12.07	16471	272	17390	15	1397	-1995
June 13, 2018	22	10.12	15371	243	16402	14	1330	-2055
June 13, 2018	23	7.21	13920	257	15473	15	1368	-2544
June 13, 2018	24	6.52	12852	273	15156	15	707	-2579
June 14, 2018	1	2.68	12153	244	14807	14	309	-2594
June 14, 2018	2	0	11735	259	14184	14	408	-2499
June 14, 2018	3	0	11554	248	14188	14	408	-2652
June 14, 2018	4	0	11522	282	14093	14	398	-2601
June 14, 2018	5	0	11824	318	14415	14	398	-2586
June 14, 2018	6	1.59	12828	290	15121	15	346	-2306
June 14, 2018	7	6.02	14204	275	15759	14	789	-2049
June 14, 2018	8	12.73	14842	289	16350	13	1060	-2212
June 14, 2018	9	13.37	15091	313	16891	13	730	-2144
June 14, 2018	10	7.09	15260	313	16288	13	1553	-2153
June 14, 2018	11	16.91	15258	229	16490	14	1120	-2023
June 14, 2018	12	6.03	15223	262	16494	14	1201	-2144

June 14, 2018	13	9.06	15436	216	16944	14	1260	-2534
June 14, 2018	14	5.87	15553	180	17151	14	1086	-2543
June 14, 2018	15	5.77	15813	235	17512	16	800	-2315
June 14, 2018	16	16.65	16361	251	18081	16	808	-2387
June 14, 2018	17	33.03	16752	290	18202	16	1137	-2331
June 14, 2018	18	31.76	16881	260	17896	15	1424	-2121
June 14, 2018	19	34.72	17041	221	17380	15	1771	-1828
June 14, 2018	20	34.55	16927	141	16892	16	1832	-1617
June 14, 2018	21	32.92	16534	256	16507	15	1958	-1657
June 14, 2018	22	20.32	15583	242	15558	15	1962	-1670
June 14, 2018	23	15.46	14181	286	14617	15	1951	-2167
June 14, 2018	24	10.84	13034	295	14291	15	1301	-2164
June 15, 2018	1	9.41	12334	271	14164	15	818	-2217
June 15, 2018	2	13.62	11875	286	13866	15	784	-2381
June 15, 2018	3	14.31	11671	284	13743	15	509	-2314
June 15, 2018	4	14.33	11686	288	13887	15	630	-2569
June 15, 2018	5	5.97	12045	206	13973	15	832	-2537
June 15, 2018	6	17.4	12995	307	14327	15	1241	-2246
June 15, 2018	7	16.4	14224	299	14858	15	1592	-1869
June 15, 2018	8	14.37	14777	320	15379	14	1361	-1633
June 15, 2018	9	20.12	15049	308	15735	15	1320	-1663
June 15, 2018	10	26.26	15264	280	15855	32	1828	-2045
June 15, 2018	11	29.78	15434	235	16178	36	1654	-2112
June 15, 2018	12	30.01	15637	260	16912	34	980	-2081
June 15, 2018	13	32.91	15978	235	16589	35	1713	-2114
June 15, 2018	14	17.43	16113	256	16472	35	1847	-1883
June 15, 2018	15	23.75	16327	274	16711	35	1926	-2068
June 15, 2018	16	31.06	16796	266	17290	35	1749	-2034
June 15, 2018	17	32.78	17226	259	17318	36	1817	-1664
June 15, 2018	18	40.68	17266	258	17189	33	1842	-1492
June 15, 2018	19	36.7	17196	268	17209	32	1783	-1535
June 15, 2018	20	35.24	16690	328	16804	36	1763	-1443
June 15, 2018	21	34.06	16421	280	16381	35	1782	-1392
June 15, 2018	22	28.84	15418	286	15888	34	1390	-1505
June 15, 2018	23	18.51	14082	301	15223	35	1264	-1999
June 15, 2018	24	10.76	12891	380	14661	35	573	-1852
June 16, 2018	1	13.3	12215	285	14051	36	744	-2201
June 16, 2018	2	17.09	11728	330	14242	34	438	-2583
June 16, 2018	3	11.46	11355	306	13895	33	474	-2533
June 16, 2018	4	13.32	11220	321	13930	34	214	-2580
June 16, 2018	5	5.59	11178	309	13805	33	268	-2555
June 16, 2018	6	1.82	11445	291	13832	34	134	-2199
June 16, 2018	7	10.72	12150	276	14550	33	201	-2362
June 16, 2018	8	10.85	13066	236	14645	34	837	-2299
June 16, 2018	9	9.73	13924	269	14870	34	1689	-2311
June 16, 2018	10	17.77	14482	267	15307	15	1377	-2054
June 16, 2018	11	39.31	14909	248	15770	12	792	-1739
June 16, 2018	12	40.09	15202	243	15856	14	1254	-1879
June 16, 2018	13	38.11	15398	249	16408	15	1174	-2168
June 16, 2018	14	14.98	15628	245	16123	14	1162	-1583

June 16, 2018	15	17.69	16047	267	16331	13	1304	-1525
June 16, 2018	16	29.25	16611	269	16635	13	1642	-1564
June 16, 2018	17	50.36	17194	281	17051	11	1804	-1698
June 16, 2018	18	41.92	17367	277	17101	14	1841	-1510
June 16, 2018	19	40.79	17226	281	16901	15	1841	-1381
June 16, 2018	20	38.34	16930	260	16687	15	1816	-1494
June 16, 2018	21	41.63	16811	267	16939	13	1401	-1565
June 16, 2018	22	32.4	16037	267	16837	13	874	-1611
June 16, 2018	23	31.14	14799	255	15529	16	1261	-1801
June 16, 2018	24	10.87	13684	266	14695	15	1664	-2257
June 17, 2018	1	11.46	12835	298	14127	14	1314	-2122
June 17, 2018	2	12.07	12237	228	14144	14	724	-2219
June 17, 2018	3	8.96	11844	261	13984	13	752	-2518
June 17, 2018	4	7.08	11554	269	14153	13	121	-2314
June 17, 2018	5	6.48	11369	260	13998	13	216	-2514
June 17, 2018	6	1.39	11510	284	13771	13	159	-2002
June 17, 2018	7	7.14	12336	252	14392	14	231	-2094
June 17, 2018	8	15.91	13606	279	15144	15	291	-1666
June 17, 2018	9	12.71	14811	298	16025	15	274	-1303
June 17, 2018	10	12.19	15830	283	16795	13	414	-1166
June 17, 2018	11	16.38	16709	314	17391	13	808	-1373
June 17, 2018	12	18.38	17354	312	18142	13	724	-1439
June 17, 2018	13	36.02	17933	258	18448	15	1110	-1682
June 17, 2018	14	35.97	18502	209	18782	15	1268	-1702
June 17, 2018	15	38.95	18940	250	18828	15	1853	-1676
June 17, 2018	16	37.93	19376	240	19119	15	1876	-1370
June 17, 2018	17	38.48	19872	203	19248	13	1815	-939
June 17, 2018	18	36.35	19911	176	19248	14	1827	-912
June 17, 2018	19	36.96	19772	196	19405	14	1793	-1172
June 17, 2018	20	36.9	19592	200	19357	13	1793	-1253
June 17, 2018	21	35.22	19673	201	19474	13	1793	-1332
June 17, 2018	22	28.19	18764	212	18759	13	1545	-1266
June 17, 2018	23	31.1	17288	278	17593	13	1831	-1677
June 17, 2018	24	14.15	15983	345	16979	13	1542	-2005
June 18, 2018	1	11.46	15106	312	16642	13	960	-2007
June 18, 2018	2	13.64	14609	315	16817	13	401	-2148
June 18, 2018	3	14.32	14207	328	16640	13	348	-2357
June 18, 2018	4	5.81	14153	317	16754	13	97	-2307
June 18, 2018	5	6.17	14554	271	16953	13	205	-2299
June 18, 2018	6	20.47	15801	291	17262	13	352	-1597
June 18, 2018	7	33.07	17910	220	18488	13	1011	-1552
June 18, 2018	8	36.42	19198	233	19590	13	1447	-1635
June 18, 2018	9	37.38	20052	170	20109	13	1845	-1730
June 18, 2018	10	38.66	20750	187	20732	13	1817	-1566
June 18, 2018	11	37.4	20640	70	20538	32	1817	-1530
June 18, 2018	12	36.68	20451	75	20246	23	1831	-1599
June 18, 2018	13	41.73	20427	84	20502	14	1817	-1823
June 18, 2018	14	39.48	20350	97	20578	63	1817	-2009
June 18, 2018	15	37.86	20469	79	20664	67	1817	-1928
June 18, 2018	16	33.63	20429	97	20564	67	1844	-1842

June 18, 2018	17	35.47	20561	117	20308	67	1817	-1623
June 18, 2018	18	33.97	20400	118	20172	67	1810	-1427
June 18, 2018	19	38.74	20364	110	19742	67	1824	-1271
June 18, 2018	20	39.1	20194	169	19721	78	1824	-1259
June 18, 2018	21	36.28	19680	173	19384	68	1824	-1293
June 18, 2018	22	24.98	18327	206	18087	18	1902	-1280
June 18, 2018	23	23.99	16547	289	16577	16	1857	-1542
June 18, 2018	24	14.27	15126	238	15762	16	2061	-2315
June 19, 2018	1	10.85	14137	311	15082	17	1929	-2487
June 19, 2018	2	8.97	13313	316	15076	17	886	-2244
June 19, 2018	3	13.33	12985	301	15149	16	795	-2601
June 19, 2018	4	13.33	12751	320	15306	16	424	-2599
June 19, 2018	5	9.14	13001	312	15008	15	968	-2581
June 19, 2018	6	8.4	13973	328	15171	15	1263	-2104
June 19, 2018	7	11.48	15397	267	15617	15	1772	-1635
June 19, 2018	8	13.36	15787	271	16449	14	1057	-1288
June 19, 2018	9	17.21	15995	238	16943	14	736	-1440
June 19, 2018	10	26.07	16191	192	17489	14	440	-1440
June 19, 2018	11	29.41	16436	267	17587	14	775	-1664
June 19, 2018	12	33.12	16570	258	17523	13	951	-1624
June 19, 2018	13	33.35	16705	249	17319	13	1402	-1577
June 19, 2018	14	37.25	16967	258	17498	14	1490	-1578
June 19, 2018	15	37.1	17313	273	17473	14	1712	-1375
June 19, 2018	16	33.85	17768	275	17711	14	1897	-1379
June 19, 2018	17	36.19	18133	227	18058	13	1543	-1227
June 19, 2018	18	35.25	17923	229	17949	13	1586	-1376
June 19, 2018	19	34.4	17692	208	17603	13	1762	-1410
June 19, 2018	20	31.74	17395	234	17476	13	1531	-1352
June 19, 2018	21	34.44	17067	227	17303	13	1694	-1442
June 19, 2018	22	40.64	16364	226	16618	11	1812	-1767
June 19, 2018	23	36.78	14928	209	15760	13	1237	-1813
June 19, 2018	24	22.73	13614	321	15192	14	650	-1830
June 20, 2018	1	13.35	12966	331	14488	14	1202	-2322
June 20, 2018	2	8.99	12521	290	14057	14	1214	-2343
June 20, 2018	3	12.68	12289	226	14080	14	1030	-2516
June 20, 2018	4	13.29	12262	218	14124	14	914	-2544
June 20, 2018	5	7.4	12643	317	14335	14	959	-2437
June 20, 2018	6	10.22	13593	293	14872	14	1110	-2133
June 20, 2018	7	27.86	14842	292	15550	16	1088	-1504
June 20, 2018	8	13.34	15444	310	16345	14	741	-1344
June 20, 2018	9	32.79	15734	280	16845	13	732	-1554
June 20, 2018	10	29.28	15818	274	16825	13	819	-1560
June 20, 2018	11	32.79	15941	261	16286	12	1748	-1785
June 20, 2018	12	26.02	16015	246	16493	12	1567	-1825
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June 20, 2018	14	17.17	16352	207	16393	13	1818	-1560
June 20, 2018	15	18.84	16629	209	16674	14	1822	-1639
June 20, 2018	16	22.95	17210	230	17360	13	1817	-1709
June 20, 2018	17	29.52	17722	230	17527	13	2026	-1591
June 20, 2018	18	32.65	17874	239	17741	13	1982	-1587

June 20, 2018	19	29.85	17889	223	17666	13	1978	-1607
June 20, 2018	20	22.61	17539	266	17351	13	1923	-1393
June 20, 2018	21	14.69	17274	282	17236	12	2063	-1679
June 20, 2018	22	14.59	16309	277	16928	13	1537	-1840
June 20, 2018	23	23.12	14813	287	16296	13	1257	-2275
June 20, 2018	24	10.85	13611	322	15622	14	951	-2563
June 21, 2018	1	12.22	12780	340	15258	13	583	-2510
June 21, 2018	2	10.79	12254	346	14903	13	296	-2441
June 21, 2018	3	5.63	11992	331	14614	13	350	-2549
June 21, 2018	4	2.9	11989	280	14388	13	251	-2234
June 21, 2018	5	0.38	12263	241	14506	13	262	-2166
June 21, 2018	6	4.59	13252	248	15377	13	261	-2156
June 21, 2018	7	9.6	14497	254	16204	13	1109	-2560
June 21, 2018	8	14.36	14976	211	16545	13	991	-2312
June 21, 2018	9	13.63	15107	248	16387	14	991	-1937
June 21, 2018	10	12.91	15312	331	16366	13	1144	-1786
June 21, 2018	11	14.32	15469	287	16560	14	907	-1632
June 21, 2018	12	13.69	15569	278	16561	15	1310	-1990
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June 21, 2018	15	5.82	16003	309	16698	15	1653	-1955
June 21, 2018	16	14.35	16447	290	17749	30	1052	-1962
June 21, 2018	17	45.5	16887	309	18588	12	609	-1951
June 21, 2018	18	14.34	17019	243	17905	14	1364	-1816
June 21, 2018	19	35.97	17003	216	18208	14	1144	-1925
June 21, 2018	20	26.56	16638	224	18006	15	749	-1660
June 21, 2018	21	7.64	16302	261	17354	13	1237	-1691
June 21, 2018	22	3.8	15399	267	16909	13	602	-1739
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June 21, 2018	24	0	12875	264	15370	13	428	-2591
June 22, 2018	1	-0.07	12086	294	14670	13	340	-2407
June 22, 2018	2	-1.81	11699	272	14180	13	374	-2549
June 22, 2018	3	-4.35	11460	251	13680	13	348	-2114
June 22, 2018	4	-4.25	11493	267	13553	13	293	-2043
June 22, 2018	5	-3.28	11740	227	13976	13	233	-2160
June 22, 2018	6	-0.97	12708	221	14904	13	288	-2232
June 22, 2018	7	0	13942	210	16071	13	281	-2114
June 22, 2018	8	1.87	14462	225	16830	13	326	-2383
June 22, 2018	9	5.58	14691	253	17086	13	294	-2356
June 22, 2018	10	6.34	14803	298	17187	13	295	-2315
June 22, 2018	11	5.82	14887	335	17267	13	352	-2352
June 22, 2018	12	3.49	15025	336	17292	13	271	-2167
June 22, 2018	13	5.76	15221	335	17569	13	329	-2308
June 22, 2018	14	5.85	15308	278	17543	13	323	-2226
June 22, 2018	15	5.78	15446	287	17755	13	315	-2286
June 22, 2018	16	2.23	15731	336	17824	13	493	-2240
June 22, 2018	17	5.82	15874	280	17994	13	541	-2370
June 22, 2018	18	5.84	15697	333	17954	13	561	-2445
June 22, 2018	19	3.14	15627	329	17889	13	663	-2470
June 22, 2018	20	5.8	15581	325	18048	13	543	-2659

June 22, 2018	21	5.36	15529	306	18328	14	346	-2692
June 22, 2018	22	8.07	14786	314	17599	14	260	-2736
June 22, 2018	23	5.55	13628	297	16428	13	248	-2575
June 22, 2018	24	1.8	12609	321	15366	13	234	-2566
June 23, 2018	1	0	12079	293	14851	14	224	-2665
June 23, 2018	2	0	11726	309	14565	14	346	-2775
June 23, 2018	3	0.85	11487	311	14335	14	284	-2730
June 23, 2018	4	1.33	11505	311	14326	17	243	-2708
June 23, 2018	5	0	11507	253	13803	18	249	-2134
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June 23, 2018	18	5.85	15014	327	15955	17	1404	-1855
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June 23, 2018	20	5.92	14802	329	15815	17	1174	-1790
June 23, 2018	21	13.02	14880	309	16036	17	1024	-1815
June 23, 2018	22	15.27	14298	333	15759	17	1184	-2250
June 23, 2018	23	15.79	13310	263	14991	17	1245	-2552
June 23, 2018	24	14.34	12506	309	14844	17	499	-2505
June 24, 2018	1	21.81	11921	355	14434	17	446	-2526
June 24, 2018	2	13.62	11546	322	14149	17	394	-2606
June 24, 2018	3	14.34	11283	388	14039	17	358	-2670
June 24, 2018	4	14.33	11220	286	13802	17	358	-2589
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June 24, 2018	6	6.06	11317	285	13967	17	258	-2555
June 24, 2018	7	3.78	11819	277	14274	18	194	-2290
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June 24, 2018	9	13.69	13381	275	15733	17	194	-2199
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June 24, 2018	11	14.34	14282	249	16569	17	357	-2310
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June 24, 2018	13	9.44	14497	273	16707	18	454	-2372
June 24, 2018	14	5.82	14332	266	16381	18	613	-2288
June 24, 2018	15	15.74	14385	276	16658	18	599	-2557
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June 24, 2018	17	6.07	15030	218	17066	17	671	-2499
June 24, 2018	18	5.87	15034	220	17177	19	658	-2533
June 24, 2018	19	10.11	15086	259	17175	19	584	-2448
June 24, 2018	20	5.89	15087	284	17016	19	834	-2431
June 24, 2018	21	12.95	15042	319	16881	19	891	-2338
June 24, 2018	22	17.25	14435	348	16109	14	1279	-2525

June 24, 2018	23	10.11	13294	305	15654	14	701	-2647
June 24, 2018	24	4.75	12370	327	14800	14	415	-2382
June 25, 2018	1	3.79	11736	312	14390	14	338	-2592
June 25, 2018	2	3.4	11494	229	13913	14	414	-2530
June 25, 2018	3	0.77	11388	221	13963	14	358	-2645
June 25, 2018	4	3.34	11445	219	14035	14	282	-2575
June 25, 2018	5	2.42	11804	167	14281	14	338	-2580
June 25, 2018	6	2.57	12761	160	14918	14	340	-2303
June 25, 2018	7	7.65	14020	163	15731	14	578	-2004
June 25, 2018	8	5.86	14440	150	16120	13	245	-1737
June 25, 2018	9	6.1	14514	225	16350	13	282	-1854
June 25, 2018	10	14.33	14679	210	16502	13	248	-1833
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June 25, 2018	12	14.34	14966	207	16672	13	358	-1890
June 25, 2018	13	5.9	15049	236	16850	12	418	-1920
June 25, 2018	14	9.63	15163	228	17014	12	310	-1886
June 25, 2018	15	14.36	15434	225	17105	12	425	-1906
June 25, 2018	16	10.72	15987	228	17014	12	1027	-1906
June 25, 2018	17	11.57	16515	194	17062	12	1316	-1675
June 25, 2018	18	28.43	16820	219	17780	12	1129	-1853
June 25, 2018	19	33.25	17007	221	17643	12	1587	-1886
June 25, 2018	20	32.57	16695	235	17311	14	1603	-1811
June 25, 2018	21	18.39	16467	208	16746	13	1790	-1700
June 25, 2018	22	11.03	15477	233	16105	12	1645	-1856
June 25, 2018	23	7.27	14085	238	15281	12	1047	-1873
June 25, 2018	24	7.5	12888	268	14805	12	394	-1949
June 26, 2018	1	4.88	12258	258	14278	13	227	-1916
June 26, 2018	2	-0.07	11833	263	13873	13	233	-1930
June 26, 2018	3	-0.72	11592	246	13655	13	192	-1910
June 26, 2018	4	-1.06	11602	277	13700	14	192	-1935
June 26, 2018	5	-0.43	11893	261	13960	13	193	-1921
June 26, 2018	6	-0.54	12793	232	14646	14	223	-1806
June 26, 2018	7	6.43	14050	237	15831	18	426	-1962
June 26, 2018	8	13.63	14528	201	16009	18	674	-1876
June 26, 2018	9	14.35	14722	213	16338	18	499	-1858
June 26, 2018	10	12.34	14921	193	16258	18	792	-1875
June 26, 2018	11	13.69	15074	189	16465	18	740	-1871
June 26, 2018	12	14.34	15112	244	16481	19	848	-1885
June 26, 2018	13	14.36	15297	266	16328	14	1347	-1970
June 26, 2018	14	14.38	15512	251	16461	14	1313	-1952
June 26, 2018	15	25.99	15822	245	16535	15	1524	-1955
June 26, 2018	16	88.03	16485	272	17019	14	1636	-1947
June 26, 2018	17	19.01	16993	251	17416	14	1817	-1935
June 26, 2018	18	7.48	16979	287	17301	15	1865	-1689
June 26, 2018	19	5.79	16842	255	17042	19	1867	-1620
June 26, 2018	20	3.72	16577	260	17107	15	1807	-1809
June 26, 2018	21	9.48	16483	281	17206	15	1524	-1852
June 26, 2018	22	12.08	15639	281	16956	15	982	-1958
June 26, 2018	23	7.82	14199	274	16173	16	294	-1925
June 26, 2018	24	0.46	13155	243	15186	15	294	-1964

June 27, 2018	1	0	12442	287	14658	15	278	-2043
June 27, 2018	2	-0.04	12121	279	14288	15	194	-2008
June 27, 2018	3	-0.15	12008	308	14102	14	194	-1910
June 27, 2018	4	-0.1	12060	294	14200	14	213	-1984
June 27, 2018	5	0	12453	302	14352	15	197	-1883
June 27, 2018	6	11.21	13402	258	15371	15	194	-1841
June 27, 2018	7	5.44	14773	184	15932	15	954	-1811
June 27, 2018	8	6.53	15582	193	16348	15	1176	-1781
June 27, 2018	9	10.78	16078	220	16740	17	1283	-1669
June 27, 2018	10	13.65	16364	269	17089	21	1329	-1694
June 27, 2018	11	14.38	16570	266	17384	21	1354	-1849
June 27, 2018	12	14.37	16637	253	17537	22	1293	-1849
June 27, 2018	13	31.59	16767	244	18235	21	430	-1691
June 27, 2018	14	35.27	16851	264	17979	15	939	-1789
June 27, 2018	15	35.29	16882	212	17854	17	1043	-1833
June 27, 2018	16	35.87	17076	262	17971	16	1151	-1850
June 27, 2018	17	36.37	17335	269	17554	15	1665	-1592
June 27, 2018	18	33.41	17177	252	17080	15	1987	-1611
June 27, 2018	19	35.51	17161	233	16996	15	1984	-1521
June 27, 2018	20	38.01	17203	307	17034	14	2042	-1558
June 27, 2018	21	42.51	17102	321	17032	16	2037	-1566
June 27, 2018	22	22.53	16125	312	16306	16	1751	-1529
June 27, 2018	23	19.14	14910	290	15179	15	1802	-1723
June 27, 2018	24	8.51	13823	287	14749	14	1198	-1819
June 28, 2018	1	21.42	13247	229	14588	15	599	-1921
June 28, 2018	2	14.35	12752	230	14544	15	379	-1925
June 28, 2018	3	7.16	12478	289	14364	15	358	-1901
June 28, 2018	4	14.33	12494	305	14477	14	289	-1926
June 28, 2018	5	11.97	12970	302	14806	14	290	-1912
June 28, 2018	6	27.47	14045	302	15444	14	770	-1893
June 28, 2018	7	18.11	15392	296	16554	15	742	-1573
June 28, 2018	8	30.89	16199	296	16762	14	1569	-1708
June 28, 2018	9	18.23	16529	298	16791	14	1822	-1694
June 28, 2018	10	34.99	16926	296	17061	14	1822	-1694
June 28, 2018	11	36.46	17380	282	17528	14	1822	-1694
June 28, 2018	12	37.71	17566	313	17820	14	1838	-1694
June 28, 2018	13	38.16	18100	298	18200	14	1877	-1696
June 28, 2018	14	39.14	18463	316	18646	12	1973	-1863
June 28, 2018	15	39.69	18814	331	19019	14	1877	-1736
June 28, 2018	16	40.78	19374	315	19772	15	1877	-1968
June 28, 2018	17	48.72	19924	279	20002	15	2005	-1867
June 28, 2018	18	61.67	20101	277	20192	15	2056	-2031
June 28, 2018	19	65.78	20125	280	20527	16	2014	-2157
June 28, 2018	20	42.41	19691	277	20257	16	2004	-2111
June 28, 2018	21	38.66	19397	287	19507	17	1999	-1774
June 28, 2018	22	36.38	18375	285	18657	17	1699	-1655
June 28, 2018	23	26.72	16751	340	16798	15	1927	-1528
June 28, 2018	24	20.72	15322	336	15928	13	1524	-1756
June 29, 2018	1	12.91	14318	330	14970	14	2011	-2215
June 29, 2018	2	6.49	13645	330	14650	14	1885	-2414

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June 29, 2018	5	4.21	13364	364	14920	14	1231	-2272
June 29, 2018	6	16.9	14346	337	16010	14	544	-1900
June 29, 2018	7	33.24	15932	281	17130	14	804	-1730
June 29, 2018	8	37.36	17114	263	17799	15	972	-1415
June 29, 2018	9	38.46	17959	278	18077	14	1859	-1654
June 29, 2018	10	40.3	18573	269	18673	14	1944	-1701
June 29, 2018	11	41.86	19197	195	19232	15	1909	-1753
June 29, 2018	12	40.34	19538	236	19710	15	1865	-1735
June 29, 2018	13	40.25	19885	231	20003	16	1865	-1710
June 29, 2018	14	40.45	20115	221	20310	16	1902	-1837
June 29, 2018	15	40.24	20278	132	20602	16	1865	-2005
June 29, 2018	16	44.58	20521	112	20423	15	1868	-1766
June 29, 2018	17	40.08	20858	87	20976	16	1865	-1823
June 29, 2018	18	40.24	20874	77	20874	17	1832	-1721
June 29, 2018	19	40.18	20684	106	20644	15	1902	-1736
June 29, 2018	20	39.11	20236	117	20227	15	1806	-1621
June 29, 2018	21	38.78	19856	141	19969	17	1853	-1766
June 29, 2018	22	27.16	18893	228	18890	17	1808	-1495
June 29, 2018	23	35.2	17296	304	18099	15	1345	-1789
June 29, 2018	24	31.55	15898	318	17364	14	764	-1907
June 30, 2018	1	14.4	14864	311	16904	14	851	-2509
June 30, 2018	2	7.65	14136	314	16196	15	855	-2531
June 30, 2018	3	0	13672	281	15881	15	479	-2379
June 30, 2018	4	3.01	13429	270	15775	15	479	-2607
June 30, 2018	5	14.34	13328	265	15583	14	479	-2529
June 30, 2018	6	14.34	13531	243	15899	13	424	-2569
June 30, 2018	7	3.57	14329	239	16011	14	556	-2081
June 30, 2018	8	2.17	15702	251	16612	14	1171	-1851
June 30, 2018	9	26.66	17069	239	18047	13	741	-1605
June 30, 2018	10	38.34	18247	235	18627	12	1903	-2049
June 30, 2018	11	38.67	19098	205	19431	13	1808	-1966
June 30, 2018	12	39.6	19798	213	19974	13	1783	-1799
June 30, 2018	13	39.37	20220	164	20285	14	1827	-1731
June 30, 2018	14	37.74	20401	153	20427	14	1738	-1588
June 30, 2018	15	34.21	20478	109	20552	17	1815	-1668
June 30, 2018	16	34.46	20667	68	20547	16	1765	-1580
June 30, 2018	17	35.9	20789	86	20838	16	1766	-1676
June 30, 2018	18	35.94	20762	101	20719	14	1757	-1604
June 30, 2018	19	35.97	20592	98	20504	14	1765	-1585
June 30, 2018	20	33.74	20306	131	20255	15	1873	-1696
June 30, 2018	21	36.88	20242	191	20461	15	1740	-1696
June 30, 2018	22	23.86	19532	232	19408	15	1866	-1440
June 30, 2018	23	21.74	18275	213	18081	15	1880	-1403
June 30, 2018	24	12.26	17010	250	17293	15	1509	-1474
July 1, 2018	1	14.32	16073	247	16314	15	1919	-1764
July 1, 2018	2	14.35	15288	275	16107	14	1793	-2261
July 1, 2018	3	14.35	14672	264	16299	14	1000	-2254
July 1, 2018	4	9.16	14284	263	15921	13	967	-2235

July 1, 2018	5	14.34	14025	267	16007	13	612	-2222
July 1, 2018	6	2.16	14076	275	15725	14	886	-2215
July 1, 2018	7	2.23	15041	259	15997	14	1319	-1986
July 1, 2018	8	9.91	16368	258	16734	14	1885	-1977
July 1, 2018	9	29.16	17664	255	17701	14	1805	-1672
July 1, 2018	10	37.49	18780	217	18643	13	1808	-1521
July 1, 2018	11	38.26	19472	197	19281	13	1818	-1437
July 1, 2018	12	38.08	19757	201	19595	14	1657	-1295
July 1, 2018	13	39.58	19924	170	20708	13	748	-1379
July 1, 2018	14	37.93	20026	101	20703	15	772	-1331
July 1, 2018	15	35.59	20102	90	20094	15	1251	-1148
July 1, 2018	16	35.67	20359	98	20418	15	1212	-1197
July 1, 2018	17	35.8	20660	89	20781	15	1466	-1491
July 1, 2018	18	35.58	20778	95	20611	15	1632	-1402
July 1, 2018	19	37.37	20634	87	20294	15	1589	-1119
July 1, 2018	20	35.45	20020	126	19934	15	1481	-1116
July 1, 2018	21	31.89	19666	156	19525	16	1304	-813
July 1, 2018	22	32.29	19056	210	19101	15	1098	-978
July 1, 2018	23	31.02	17940	203	18547	15	1098	-1389
July 1, 2018	24	15.62	16799	226	17871	15	785	-1545
July 2, 2018	1	20.89	15779	207	17472	14	277	-1666
July 2, 2018	2	6.82	15129	205	16837	15	163	-1557
July 2, 2018	3	0	14685	200	16337	15	279	-1654
July 2, 2018	4	0	14472	212	16095	15	250	-1607
July 2, 2018	5	0	14289	258	16026	15	247	-1653
July 2, 2018	6	1.58	14621	213	16132	15	258	-1524
July 2, 2018	7	12.3	15663	207	17177	13	180	-1483
July 2, 2018	8	15.61	16821	209	17527	14	978	-1465
July 2, 2018	9	33.55	18112	216	18369	13	1290	-1404
July 2, 2018	10	37.6	19109	209	19527	13	1253	-1468
July 2, 2018	11	42.6	19891	192	20141	14	1252	-1372
July 2, 2018	12	40.33	20319	180	20464	14	1709	-1648
July 2, 2018	13	37.25	20160	164	20439	15	1778	-1681
July 2, 2018	14	32.79	20098	179	20466	15	1690	-1641
July 2, 2018	15	31.38	20033	115	20586	15	1273	-1535
July 2, 2018	16	30.64	20069	135	20209	15	1700	-1521
July 2, 2018	17	36.47	20611	83	20855	15	1601	-1545
July 2, 2018	18	33.8	20630	48	20488	15	1764	-1348
July 2, 2018	19	37.43	20626	48	20574	15	1757	-1442
July 2, 2018	20	35.46	20229	59	20052	15	1836	-1366
July 2, 2018	21	34.04	19877	133	19803	15	1790	-1402
July 2, 2018	22	35.38	18987	170	18980	19	1613	-1417
July 2, 2018	23	21.95	17367	196	17418	19	1814	-1525
July 2, 2018	24	8.5	15904	223	15662	19	1717	-1151
July 3, 2018	1	10.85	14822	313	15203	20	1557	-1500
July 3, 2018	2	6.7	14146	326	14916	18	1171	-1550
July 3, 2018	3	2.79	13657	304	14822	18	858	-1635
July 3, 2018	4	0.46	13378	310	14882	18	524	-1558
July 3, 2018	5	-1.8	13559	300	15118	18	494	-1609
July 3, 2018	6	27.25	14571	298	16128	18	338	-1622

July 3, 2018	7	34.52	16185	280	17049	18	970	-1549
July 3, 2018	8	33.82	17386	256	17559	18	1571	-1450
July 3, 2018	9	35.78	18297	259	17942	22	1746	-1093
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July 3, 2018	11	38.35	19570	211	19549	29	1706	-1457
July 3, 2018	12	38.49	19853	127	19834	46	1711	-1464
July 3, 2018	13	37.74	20163	92	20032	78	1706	-1480
July 3, 2018	14	40.31	20518	86	20236	72	1706	-1542
July 3, 2018	15	38.62	20754	52	20537	72	1651	-1453
July 3, 2018	16	36.35	21096	42	20603	80	1789	-1369
July 3, 2018	17	39.23	21513	42	20855	70	1707	-1107
July 3, 2018	18	40.82	21677	35	21086	68	1781	-1191
July 3, 2018	19	42.61	21711	38	21119	69	1781	-1200
July 3, 2018	20	40.93	21185	53	20644	23	1784	-1046
July 3, 2018	21	39.9	20676	122	19821	14	1783	-753
July 3, 2018	22	34.71	19602	185	19316	14	1783	-1193
July 3, 2018	23	32.06	17820	206	17831	16	1765	-1354
July 3, 2018	24	29.77	16169	227	16685	17	1716	-1851
July 4, 2018	1	21.56	15105	259	15867	14	1800	-2198
July 4, 2018	2	9.55	14432	244	15322	14	1805	-2326
July 4, 2018	3	14.33	13924	262	15304	14	1196	-2261
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July 4, 2018	5	-0.01	13942	304	15234	14	1302	-2251
July 4, 2018	6	3.75	14874	296	15703	15	1485	-1954
July 4, 2018	7	19.58	16472	311	16565	16	1588	-1326
July 4, 2018	8	24.53	17826	295	17196	15	1725	-756
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July 4, 2018	11	40.67	20193	177	19570	23	1822	-956
July 4, 2018	12	41.92	20548	108	19553	24	1831	-720
July 4, 2018	13	46.26	20965	96	20291	17	1742	-1036
July 4, 2018	14	41.35	21292	102	21129	17	1351	-1164
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July 4, 2018	17	57.08	22421	26	21183	71	1522	-311
July 4, 2018	18	61.98	22525	26	21033	70	1705	-298
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July 4, 2018	20	44.81	21929	26	20688	70	1587	-251
July 4, 2018	21	48.57	21723	29	20654	73	1358	-350
July 4, 2018	22	35.27	20711	94	19823	65	1706	-741
July 4, 2018	23	30.71	18995	169	18442	20	1859	-1030
July 4, 2018	24	28.96	17409	184	17537	20	1740	-1511
July 5, 2018	1	16.8	16265	214	16606	19	1738	-1799
July 5, 2018	2	5.93	15584	228	16232	21	1740	-2124
July 5, 2018	3	0	15146	242	15932	19	1719	-2194
July 5, 2018	4	0	14965	308	15867	17	1615	-2194
July 5, 2018	5	4.76	15195	329	15964	16	1780	-2217
July 5, 2018	6	15.12	16117	316	16779	16	1730	-2196
July 5, 2018	7	28.99	17909	299	17743	18	1764	-1405
July 5, 2018	8	43.34	19312	318	19021	20	1744	-1156

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July 5, 2018	11	39.34	899	62	20730	129	1711	-573
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July 5, 2018	13	40.6	817	45	21051	120	1785	-375
July 5, 2018	14	38.77	11631	44	21535	165	1846	-862
July 5, 2018	15	37.22	22758	43	21856	98	1649	-761
July 5, 2018	16	36.9	22580	26	21870	75	1612	-501
July 5, 2018	17	32.71	22260	27	20886	76	2251	-825
July 5, 2018	18	31.52	21726	53	20477	74	1964	-697
July 5, 2018	19	44.73	21636	54	20794	74	1736	-1080
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July 6, 2018	16	3.11	16704	285	18416	18	1348	-2678
July 6, 2018	17	7.48	17131	291	18315	18	1370	-2166
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July 7, 2018	1	7.64	12268	280	15065	20	249	-2628
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July 7, 2018	4	-2.7	11362	233	14117	20	159	-2562
July 7, 2018	5	-2.55	11326	225	14058	20	159	-2555
July 7, 2018	6	-1.4	11542	266	14253	19	159	-2581
July 7, 2018	7	2.44	12190	259	14725	18	279	-2586
July 7, 2018	8	4.6	12999	263	15530	18	159	-2405
July 7, 2018	9	25.2	13723	265	15962	18	796	-2706
July 7, 2018	10	26.4	14190	284	16139	19	1073	-2718

July 7, 2018	11	27.6	14509	258	16176	19	1226	-2576
July 7, 2018	12	14.37	14707	267	16253	18	924	-2167
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July 7, 2018	14	5.81	14963	254	16969	19	459	-2208
July 7, 2018	15	12.28	15307	275	17081	20	620	-2163
July 7, 2018	16	22.8	15871	246	17269	20	1049	-2233
July 7, 2018	17	33.62	16489	242	17372	22	1504	-2099
July 7, 2018	18	48.63	16847	250	17808	19	1502	-2158
July 7, 2018	19	39.14	16865	229	17424	20	1588	-1886
July 7, 2018	20	17.33	16323	264	16909	22	1512	-1702
July 7, 2018	21	14.37	15945	269	16557	22	1554	-1699
July 7, 2018	22	10.15	15210	282	15849	21	1525	-1751
July 7, 2018	23	8.35	14156	258	15359	20	1164	-1941
July 7, 2018	24	6.73	13140	319	15017	19	996	-2413
July 8, 2018	1	4.43	12364	311	14880	19	675	-2820
July 8, 2018	2	5.28	11874	288	14742	20	349	-2923
July 8, 2018	3	0	11540	295	14351	19	349	-2806
July 8, 2018	4	-0.31	11398	309	14146	19	259	-2761
July 8, 2018	5	-3.64	11238	290	13821	18	349	-2660
July 8, 2018	6	-4.18	11219	283	13722	18	349	-2542
July 8, 2018	7	0.23	11831	234	14323	18	349	-2610
July 8, 2018	8	17.79	12760	246	15382	18	169	-2593
July 8, 2018	9	2.53	13592	243	15641	19	591	-2367
July 8, 2018	10	7.26	14322	238	16047	19	769	-2262
July 8, 2018	11	14.35	14953	227	16453	21	863	-2170
July 8, 2018	12	14.36	15439	241	16708	22	1292	-2292
July 8, 2018	13	22.8	15834	245	17157	23	931	-1968
July 8, 2018	14	28.8	16172	254	17787	23	869	-2225
July 8, 2018	15	26.41	16782	227	17646	21	1668	-2237
July 8, 2018	16	35.09	17562	242	18635	20	965	-1931
July 8, 2018	17	33.3	18426	238	18730	18	1544	-1713
July 8, 2018	18	34.64	18725	246	18927	21	1747	-1662
July 8, 2018	19	34.66	18720	235	18896	24	1846	-1715
July 8, 2018	20	31.2	18269	239	18619	20	1847	-1773
July 8, 2018	21	31.96	17841	256	18337	22	1856	-2035
July 8, 2018	22	17.96	16858	256	17435	25	1856	-1971
July 8, 2018	23	10.03	15527	291	16033	21	1925	-2042
July 8, 2018	24	8.06	14291	289	15376	22	1786	-2401
July 9, 2018	1	4.05	13393	267	15037	21	1300	-2536
July 9, 2018	2	0.84	12806	298	14960	21	982	-2747
July 9, 2018	3	6.08	12459	305	15174	21	383	-2738
July 9, 2018	4	1.86	12370	292	15063	21	329	-2667
July 9, 2018	5	0.84	12596	274	15184	20	349	-2620
July 9, 2018	6	6.45	13518	262	15734	19	633	-2691
July 9, 2018	7	19.34	15071	261	16487	19	764	-2012
July 9, 2018	8	28.16	16298	272	16999	18	1461	-1981
July 9, 2018	9	28.4	17101	283	17344	17	1836	-1745
July 9, 2018	10	31.75	17839	286	18340	16	1743	-1914
July 9, 2018	11	31.52	18398	262	18810	19	1555	-1730
July 9, 2018	12	31.87	18998	216	19257	20	1571	-1649

July 9, 2018	13	30.7	19586	197	19644	17	1736	-1631
July 9, 2018	14	31.44	19992	227	20063	20	1717	-1558
July 9, 2018	15	29.76	20314	139	20498	26	1736	-1757
July 9, 2018	16	30.2	20811	145	21141	29	1782	-1992
July 9, 2018	17	36.63	21125	76	21521	26	1863	-2372
July 9, 2018	18	34.78	21123	51	21612	26	1912	-2280
July 9, 2018	19	39.63	21002	49	20681	22	1975	-1638
July 9, 2018	20	33.24	20576	99	20452	21	1966	-1695
July 9, 2018	21	37.08	20396	179	20691	18	1926	-2015
July 9, 2018	22	33.84	19287	191	19741	21	1926	-2057
July 9, 2018	23	21.49	17506	221	18048	21	1773	-1970
July 9, 2018	24	23.47	16068	248	17107	18	1695	-2393
July 10, 2018	1	23.69	15106	207	16104	19	1790	-2416
July 10, 2018	2	18.55	14420	260	15661	17	1787	-2639
July 10, 2018	3	16.8	14086	319	15528	17	1671	-2736
July 10, 2018	4	14.37	13898	297	15464	17	1340	-2503
July 10, 2018	5	4.05	14233	295	15274	17	1498	-2157
July 10, 2018	6	15.53	15196	265	15928	17	1716	-2209
July 10, 2018	7	22.82	16468	250	16529	17	1835	-1628
July 10, 2018	8	31.25	17419	208	17442	15	1891	-1684
July 10, 2018	9	42.34	18264	225	18569	16	1156	-1306
July 10, 2018	10	51.49	18848	226	19499	16	1156	-1537
July 10, 2018	11	51.01	19311	238	19836	22	1261	-1532
July 10, 2018	12	47.86	19687	247	20195	31	1261	-1441
July 10, 2018	13	40.84	19893	264	20117	20	1253	-1218
July 10, 2018	14	39.96	20126	287	20479	24	1253	-1302
July 10, 2018	15	50.31	20522	224	21036	20	1043	-1250
July 10, 2018	16	36.21	20683	233	21366	27	1198	-1356
July 10, 2018	17	35.68	20766	88	21102	25	1645	-1781
July 10, 2018	18	33.55	20592	152	20718	21	1634	-1549
July 10, 2018	19	32.02	20152	176	20243	17	1839	-1723
July 10, 2018	20	36.34	19484	171	19691	23	1839	-1816
July 10, 2018	21	32.24	18888	242	19179	23	1831	-1836
July 10, 2018	22	27.06	17695	276	17941	19	1831	-1735
July 10, 2018	23	11.75	15956	342	16575	18	1708	-1954
July 10, 2018	24	6.09	14606	333	15991	18	1291	-2255
July 11, 2018	1	5.98	13722	336	15686	18	1008	-2587
July 11, 2018	2	10.67	13174	347	15673	18	342	-2571
July 11, 2018	3	14.37	12804	341	15777	18	199	-2775
July 11, 2018	4	15.46	12651	335	15554	18	299	-2792
July 11, 2018	5	21.47	12935	304	15784	18	313	-2832
July 11, 2018	6	23.55	13803	293	15828	18	864	-2626
July 11, 2018	7	28.63	15154	289	16465	18	970	-1980
July 11, 2018	8	28.63	16160	300	16687	16	1588	-1798
July 11, 2018	9	31.02	16711	297	17238	16	1714	-1840
July 11, 2018	10	31.5	17091	316	17460	20	1718	-1651
July 11, 2018	11	31.57	17428	323	17715	22	1736	-1590
July 11, 2018	12	30.57	17681	289	17755	22	1724	-1390
July 11, 2018	13	32.31	17930	321	18307	19	1766	-1641
July 11, 2018	14	32.02	18481	265	18587	19	1796	-1594

July 11, 2018	15	32.31	18810	274	18979	24	1799	-1642
July 11, 2018	16	33.63	19292	234	19210	23	1816	-1590
July 11, 2018	17	39.42	19757	242	19730	21	1927	-1712
July 11, 2018	18	60.95	19909	292	19933	19	1912	-1691
July 11, 2018	19	57.41	19722	284	19826	21	1937	-1670
July 11, 2018	20	46.22	19151	322	19391	27	1912	-1747
July 11, 2018	21	45.86	18619	324	18868	21	1738	-1547
July 11, 2018	22	36.07	17364	322	17890	21	1512	-1610
July 11, 2018	23	32.44	15775	323	16994	22	1057	-1855
July 11, 2018	24	26.95	14469	329	16241	21	298	-1696
July 12, 2018	1	21.84	13547	332	15255	21	948	-2234
July 12, 2018	2	25	12990	284	15056	20	830	-2472
July 12, 2018	3	21.5	12581	249	15010	21	541	-2539
July 12, 2018	4	15.53	12504	196	14878	20	503	-2570
July 12, 2018	5	14.34	12759	177	14781	21	445	-2161
July 12, 2018	6	5.14	13583	167	15220	22	572	-1960
July 12, 2018	7	6.78	14965	167	15859	20	1146	-1825
July 12, 2018	8	23.31	15995	230	16299	20	1727	-1706
July 12, 2018	9	28.9	16724	140	16859	18	1822	-1677
July 12, 2018	10	28.72	17352	131	17259	22	1722	-1415
July 12, 2018	11	29.44	17812	134	17670	24	1847	-1455
July 12, 2018	12	31.69	18272	159	17928	20	1847	-1283
July 12, 2018	13	31.98	18706	148	18475	21	1808	-1418
July 12, 2018	14	32.53	19143	136	18824	21	1976	-1535
July 12, 2018	15	35.96	19540	177	19345	20	1909	-1559
July 12, 2018	16	42.32	20131	179	19948	21	1855	-1510
July 12, 2018	17	49.42	20643	116	20269	19	1941	-1497
July 12, 2018	18	42.52	20503	120	20086	21	1879	-1341
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July 12, 2018	20	35.72	19796	141	19360	20	1841	-1244
July 12, 2018	21	35.35	19480	125	19123	21	1841	-1272
July 12, 2018	22	33.62	18135	193	18401	26	1598	-1517
July 12, 2018	23	26.66	16598	258	16908	25	1833	-1728
July 12, 2018	24	29.18	15273	260	16109	20	1444	-1855
July 13, 2018	1	37.45	14473	245	15734	19	1374	-2265
July 13, 2018	2	42.41	13912	281	15763	16	858	-2329
July 13, 2018	3	46.53	13529	265	15858	16	297	-2290
July 13, 2018	4	15.52	13382	275	15429	19	469	-2188
July 13, 2018	5	13.61	13724	295	15374	18	1017	-2310
July 13, 2018	6	8.24	14510	320	15812	18	943	-1925
July 13, 2018	7	26.79	15837	282	16455	17	1602	-1878
July 13, 2018	8	42.39	17158	294	17020	18	1804	-1392
July 13, 2018	9	45.1	18105	297	17960	15	1831	-1368
July 13, 2018	10	35.07	18830	267	18326	20	1910	-1020
July 13, 2018	11	35.33	19487	278	18915	21	1836	-1036
July 13, 2018	12	46.54	19889	282	19730	26	1841	-1342
July 13, 2018	13	56.34	20274	225	20329	56	1841	-1635
July 13, 2018	14	56.91	20521	231	20532	85	1849	-1614
July 13, 2018	15	51.03	20488	160	20215	77	1849	-1333
July 13, 2018	16	43.47	20458	130	19905	75	2244	-1563

July 13, 2018	17	50.94	20700	181	20257	75	2106	-1594
July 13, 2018	18	48.92	20627	143	20137	74	1965	-1434
July 13, 2018	19	48.44	20578	145	20230	75	1818	-1484
July 13, 2018	20	66.58	20070	251	19996	25	1867	-1493
July 13, 2018	21	56.63	19643	233	19964	20	1818	-1659
July 13, 2018	22	35.87	18591	270	18997	20	1697	-1623
July 13, 2018	23	30.82	16962	296	17805	20	1226	-1444
July 13, 2018	24	28.96	15749	245	16504	21	1189	-1622
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July 14, 2018	2	35.35	14113	276	15570	19	612	-1680
July 14, 2018	3	48.95	13641	253	15620	17	433	-2092
July 14, 2018	4	14.36	13415	255	15372	17	201	-1802
July 14, 2018	5	23.29	13436	268	15813	18	193	-2282
July 14, 2018	6	15.62	13591	279	15891	18	208	-2195
July 14, 2018	7	28.02	14386	209	16317	18	174	-1858
July 14, 2018	8	36.96	15626	259	16751	17	179	-1146
July 14, 2018	9	37.62	16750	255	17342	24	1150	-1417
July 14, 2018	10	52.13	17778	286	17969	21	1774	-1653
July 14, 2018	11	41.97	18457	253	18498	21	1774	-1515
July 14, 2018	12	33.79	18619	281	18495	25	1774	-1298
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July 14, 2018	14	39.28	18656	270	18957	23	1764	-1762
July 14, 2018	15	34.92	18653	269	19214	20	1649	-1951
July 14, 2018	16	34.47	18758	248	19099	22	1677	-1815
July 14, 2018	17	31.87	18851	259	19041	21	1717	-1619
July 14, 2018	18	32.08	18777	262	19222	19	1426	-1705
July 14, 2018	19	32.23	18519	249	18876	20	1545	-1697
July 14, 2018	20	31.84	18165	224	18454	20	1693	-1782
July 14, 2018	21	38.22	18107	277	18250	20	1679	-1605
July 14, 2018	22	33.03	17392	302	17484	20	1775	-1516
July 14, 2018	23	29.24	16241	296	16616	21	1829	-1752
July 14, 2018	24	23.8	15147	306	15428	16	1682	-1596
July 15, 2018	1	18.15	14289	282	15130	15	1060	-1485
July 15, 2018	2	15.61	13692	290	14725	17	1328	-2003
July 15, 2018	3	39.88	13398	203	14972	14	841	-2215
July 15, 2018	4	14.38	13099	305	14711	17	1177	-2440
July 15, 2018	5	19.16	13008	298	15025	16	1000	-2660
July 15, 2018	6	19.81	13118	311	15244	17	288	-2158
July 15, 2018	7	35.61	13971	299	16004	16	159	-1952
July 15, 2018	8	32.52	15215	313	16581	16	537	-1596
July 15, 2018	9	44.67	16536	265	17125	19	1423	-1757
July 15, 2018	10	32.74	17678	216	17520	19	1657	-1291
July 15, 2018	11	41.53	18492	218	18223	22	1706	-1317
July 15, 2018	12	34.48	18884	296	18589	23	1894	-1289
July 15, 2018	13	38.21	19352	287	19394	23	1886	-1662
July 15, 2018	14	40.08	19668	283	19620	21	1891	-1520
July 15, 2018	15	43.61	19973	311	19743	20	1833	-1342
July 15, 2018	16	50.21	20597	255	20157	22	1894	-1244
July 15, 2018	17	97.28	21089	133	20142	21	2049	-1014
July 15, 2018	18	53.82	21280	60	19684	21	2382	-697

July 15, 2018	19	70.96	21067	50	19793	20	2384	-1016
July 15, 2018	20	48.34	20597	112	19651	20	1812	-663
July 15, 2018	21	36.95	20405	196	19518	21	1854	-743
July 15, 2018	22	35.06	19458	199	18652	20	1842	-777
July 15, 2018	23	33.01	17901	263	17772	20	1670	-1159
July 15, 2018	24	32.41	16493	245	16818	20	1088	-1168
July 16, 2018	1	22.49	15518	298	15701	15	1714	-1477
July 16, 2018	2	17.8	14912	298	15461	14	1517	-1728
July 16, 2018	3	16.65	14499	288	15592	13	1101	-1902
July 16, 2018	4	14.37	14366	300	15697	13	987	-2016
July 16, 2018	5	14.33	14704	255	15508	13	1153	-1706
July 16, 2018	6	10.31	15657	227	15702	13	1194	-1047
July 16, 2018	7	27.16	17271	212	16756	13	1686	-970
July 16, 2018	8	30.59	18578	239	17651	16	2043	-897
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July 16, 2018	10	31.62	20367	131	19844	17	1911	-1179
July 16, 2018	11	32.18	20903	124	20577	58	1724	-1364
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July 16, 2018	13	30.83	21201	40	20670	65	1947	-1398
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July 16, 2018	17	31.68	20801	75	20270	71	1989	-1386
July 16, 2018	18	25.95	20426	115	19536	68	2415	-1290
July 16, 2018	19	29.88	20199	93	19649	68	1825	-1240
July 16, 2018	20	30.81	20022	125	19685	68	1542	-1167
July 16, 2018	21	34.14	19816	115	19821	65	1456	-1408
July 16, 2018	22	29.15	18686	187	18634	18	1744	-1387
July 16, 2018	23	25.41	17139	190	17183	12	1744	-1549
July 16, 2018	24	47.04	15957	206	15911	10	1780	-1517
July 17, 2018	1	39.67	15018	197	15796	16	1403	-1743
July 17, 2018	2	14.35	14468	190	15324	16	1461	-2095
July 17, 2018	3	14.33	13989	189	15445	16	1146	-2273
July 17, 2018	4	14.33	13706	239	15713	16	494	-2210
July 17, 2018	5	15.57	13960	223	16222	16	200	-2257
July 17, 2018	6	22.47	14797	231	16349	16	699	-2056
July 17, 2018	7	31.1	16074	254	16880	16	1105	-1762
July 17, 2018	8	29.36	16978	219	17312	17	1814	-1746
July 17, 2018	9	31.3	17448	253	17632	18	1918	-1734
July 17, 2018	10	31.36	17744	241	18008	17	1919	-1779
July 17, 2018	11	31.41	17929	266	18681	21	1699	-2024
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July 17, 2018	13	24.98	18288	266	19165	34	1680	-2138
July 17, 2018	14	14.7	18358	267	19076	69	1520	-1907
July 17, 2018	15	18.2	18651	262	19462	68	1470	-2046
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July 17, 2018	18	30.28	19387	289	20102	69	1287	-1774
July 17, 2018	19	30.02	19121	262	19713	70	1623	-1954
July 17, 2018	20	22.81	18500	260	18781	69	1834	-1778

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July 17, 2018	23	13.05	15337	271	16175	17	1759	-2212
July 17, 2018	24	10.84	14088	275	15506	17	1355	-2418
July 18, 2018	1	12.42	13372	218	15406	17	932	-2695
July 18, 2018	2	13.62	12828	227	15576	16	293	-2714
July 18, 2018	3	14.31	12577	206	15463	17	271	-2848
July 18, 2018	4	0	12438	282	15288	17	230	-2725
July 18, 2018	5	-0.02	12765	282	15081	16	630	-2550
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July 18, 2018	7	22.03	14791	247	16811	16	466	-2209
July 18, 2018	8	28.5	15411	248	17562	17	159	-1972
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July 18, 2018	11	28.98	16321	258	17753	17	995	-2163
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July 18, 2018	14	14.34	16877	221	17484	18	1498	-1899
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July 18, 2018	17	57.56	18364	273	18880	17	1429	-1809
July 18, 2018	18	72.13	18463	274	18798	19	1775	-1850
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July 18, 2018	20	32.05	17946	267	18117	21	1847	-1632
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July 18, 2018	22	18.12	16565	304	16730	19	1707	-1483
July 18, 2018	23	19.59	15026	310	16174	17	1251	-1984
July 18, 2018	24	18.44	13818	285	15597	17	1071	-2476
July 19, 2018	1	54.28	13105	292	15470	17	626	-2673
July 19, 2018	2	29.25	12583	326	14904	17	795	-2730
July 19, 2018	3	32.03	12320	314	14987	16	288	-2579
July 19, 2018	4	14.39	12321	327	14941	17	200	-2449
July 19, 2018	5	14.36	12631	326	15115	17	200	-2317
July 19, 2018	6	21.68	13366	312	15309	17	244	-1858
July 19, 2018	7	27.96	14566	281	15739	28	852	-1710
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July 19, 2018	9	17.9	15777	256	16089	42	1658	-1619
July 19, 2018	10	28.51	16207	264	16938	61	1262	-1779
July 19, 2018	11	28.53	16668	274	17398	107	1442	-2021
July 19, 2018	12	28.52	16880	286	17990	132	1168	-2101
July 19, 2018	13	28.52	17223	270	18148	128	1286	-2040
July 19, 2018	14	28.53	17627	288	17989	123	1818	-1959
July 19, 2018	15	29.01	18051	270	18688	123	1502	-2015
July 19, 2018	16	34.92	18767	277	19413	38	1603	-2090
July 19, 2018	17	41.64	19365	283	19969	20	1732	-2092
July 19, 2018	18	45.66	19647	284	20132	20	1948	-2088
July 19, 2018	19	47.05	19712	279	19978	20	1948	-1895
July 19, 2018	20	42.44	19176	286	19238	20	1973	-1585
July 19, 2018	21	36.47	18762	282	18711	21	1911	-1471
July 19, 2018	22	16.49	17502	291	17550	19	1836	-1321

July 19, 2018	23	10	15942	324	16516	16	1511	-1696
July 19, 2018	24	13.77	14606	341	15825	17	1212	-2024
July 20, 2018	1	4.49	13764	300	15698	17	976	-2403
July 20, 2018	2	5.65	13125	323	15658	16	543	-2670
July 20, 2018	3	10.04	12816	317	15662	16	259	-2764
July 20, 2018	4	12.89	12741	291	15786	16	259	-2956
July 20, 2018	5	5.1	12990	282	16144	16	200	-3068
July 20, 2018	6	1.37	13864	231	16261	16	200	-2423
July 20, 2018	7	23.1	15231	217	16856	16	159	-1685
July 20, 2018	8	27.55	16266	204	17671	17	775	-1779
July 20, 2018	9	27.21	17173	158	17580	16	1550	-1805
July 20, 2018	10	28.45	17920	175	18157	16	1546	-1633
July 20, 2018	11	28.38	18470	194	18896	16	1373	-1619
July 20, 2018	12	28.46	18937	197	19429	17	1445	-1803
July 20, 2018	13	28.43	19234	228	19691	30	1526	-1803
July 20, 2018	14	29.62	19556	261	19846	24	1698	-1795
July 20, 2018	15	35.36	19831	261	20022	15	1734	-1756
July 20, 2018	16	36.73	20057	279	20264	16	1734	-1795
July 20, 2018	17	50.58	20395	251	20027	17	1698	-1096
July 20, 2018	18	60.69	20298	226	19710	18	1748	-960
July 20, 2018	19	51.67	19987	235	19628	20	1892	-1220
July 20, 2018	20	116.35	19528	292	19712	19	1563	-1477
July 20, 2018	21	35.07	19162	283	19159	21	1578	-1307
July 20, 2018	22	31.18	18155	293	18605	23	1558	-1652
July 20, 2018	23	30.35	16738	250	17680	18	805	-1493
July 20, 2018	24	35.4	15538	276	17251	16	989	-2377
July 21, 2018	1	41.87	14570	256	16744	17	644	-2602
July 21, 2018	2	33.78	13937	289	16411	17	509	-2635
July 21, 2018	3	14.35	13493	270	16073	17	287	-2501
July 21, 2018	4	13.54	13259	267	15987	16	208	-2613
July 21, 2018	5	0	13218	265	15782	16	208	-2473
July 21, 2018	6	3.22	13352	285	16012	16	212	-2553
July 21, 2018	7	7.17	14160	259	16222	16	159	-2033
July 21, 2018	8	19.56	15160	288	16873	16	663	-2104
July 21, 2018	9	19.74	16157	270	17100	16	1423	-2068
July 21, 2018	10	29.46	16795	252	17541	16	1578	-2043
July 21, 2018	11	31.67	17196	275	18125	17	1184	-1907
July 21, 2018	12	31.54	17262	273	18387	19	1198	-2023
July 21, 2018	13	31.14	17069	278	18577	19	413	-1598
July 21, 2018	14	28.28	16918	285	17741	18	1327	-1847
July 21, 2018	15	29.3	17099	165	17962	18	1245	-1893
July 21, 2018	16	62.9	17461	218	18182	18	1586	-2025
July 21, 2018	17	37.71	17818	226	17830	17	1751	-1471
July 21, 2018	18	31.28	17750	258	17519	22	1706	-1099
July 21, 2018	19	12.22	17312	244	17239	17	1505	-1112
July 21, 2018	20	14.34	16909	265	17223	17	1382	-1407
July 21, 2018	21	25.75	16842	253	17595	16	980	-1413
July 21, 2018	22	23.59	16104	252	17138	18	1247	-1955
July 21, 2018	23	14.67	15011	226	16205	21	1487	-2347
July 21, 2018	24	16.38	13890	242	15726	17	595	-2155

July 22, 2018	1	19.56	13048	264	15606	16	200	-2460
July 22, 2018	2	8.53	12505	278	15016	17	200	-2388
July 22, 2018	3	4.06	12138	272	14948	17	200	-2659
July 22, 2018	4	0	11911	252	14981	18	178	-2923
July 22, 2018	5	0	11893	275	15123	17	220	-3188
July 22, 2018	6	0	11975	317	15187	17	229	-3068
July 22, 2018	7	2.31	12453	316	15350	17	211	-2761
July 22, 2018	8	6.07	13104	323	15521	17	159	-2150
July 22, 2018	9	12.84	13636	320	15929	17	159	-2086
July 22, 2018	10	14.35	14044	310	16325	17	159	-2015
July 22, 2018	11	4.12	14465	309	16544	17	441	-2125
July 22, 2018	12	26.53	14360	262	16667	17	324	-2060
July 22, 2018	13	122.66	14631	246	16854	19	159	-2183
July 22, 2018	14	39.07	14953	211	16416	21	1079	-2353
July 22, 2018	15	32.4	15141	254	15839	20	1243	-1697
July 22, 2018	16	38.19	15482	283	16089	20	673	-1013
July 22, 2018	17	34.57	16087	253	16134	20	1160	-998
July 22, 2018	18	35.46	16301	280	15859	18	1694	-1024
July 22, 2018	19	35.45	16291	242	15923	19	1525	-952
July 22, 2018	20	35.04	16216	274	16011	20	1334	-946
July 22, 2018	21	35.13	16328	260	16042	20	1291	-795
July 22, 2018	22	31.4	15640	262	15688	21	1161	-957
July 22, 2018	23	31.72	14611	270	15157	18	741	-1100
July 22, 2018	24	31.85	13666	263	14611	15	200	-918
July 23, 2018	1	15.48	13023	272	13826	17	755	-1297
July 23, 2018	2	16.56	12755	261	13611	17	1032	-1646
July 23, 2018	3	15.08	12588	267	13578	17	753	-1474
July 23, 2018	4	18.54	12703	242	13745	17	1369	-2260
July 23, 2018	5	15.79	13264	211	13556	17	1797	-2022
July 23, 2018	6	21.86	14201	184	14519	17	1397	-1725
July 23, 2018	7	30.37	15708	241	15363	15	1440	-1066
July 23, 2018	8	34.57	16843	277	16131	19	1634	-754
July 23, 2018	9	40.34	17692	201	16734	20	1848	-751
July 23, 2018	10	56.33	18318	271	17475	16	1798	-803
July 23, 2018	11	61.33	18927	261	18505	15	1835	-1276
July 23, 2018	12	45.13	19239	286	18888	15	1698	-1119
July 23, 2018	13	62.11	19580	232	19075	26	1698	-989
July 23, 2018	14	80.91	19909	264	19294	41	1479	-588
July 23, 2018	15	62.2	19866	196	19029	78	1660	-638
July 23, 2018	16	43.94	19974	197	18890	68	1871	-593
July 23, 2018	17	57.03	20157	148	18807	69	2004	-570
July 23, 2018	18	43.94	19983	190	18877	68	1999	-695
July 23, 2018	19	50.14	19855	168	18954	69	1790	-760
July 23, 2018	20	44.5	19673	182	18706	70	2056	-894
July 23, 2018	21	82.65	19454	194	18787	25	1640	-734
July 23, 2018	22	49.65	18371	286	17690	16	1567	-667
July 23, 2018	23	33.26	16883	228	16220	16	1674	-834
July 23, 2018	24	30.06	15555	284	14984	15	1680	-900
July 24, 2018	1	31.86	14697	262	14380	15	1398	-888
July 24, 2018	2	38.55	14182	287	14597	15	738	-928

July 24, 2018	3	31.4	13886	271	14609	14	751	-1241
July 24, 2018	4	32.39	13808	283	14708	13	727	-1406
July 24, 2018	5	22.96	14152	278	14286	14	1308	-1227
July 24, 2018	6	25.25	15082	280	14505	14	1616	-835
July 24, 2018	7	40.88	16637	264	15784	14	1594	-659
July 24, 2018	8	48.59	17814	273	16947	16	1646	-735
July 24, 2018	9	47.62	18495	240	17692	16	1804	-839
July 24, 2018	10	66.89	19083	252	18127	32	1828	-770
July 24, 2018	11	104.67	19646	238	18751	78	1856	-1000
July 24, 2018	12	61.27	20114	277	19099	93	1878	-820
July 24, 2018	13	78.71	20541	241	19377	85	1717	-512
July 24, 2018	14	49.16	20693	211	19245	86	1975	-491
July 24, 2018	15	49.19	20889	194	19129	75	2164	-342
July 24, 2018	16	82.89	21196	175	19259	84	2369	-481
July 24, 2018	17	67.22	21318	113	19290	86	2391	-495
July 24, 2018	18	45.67	20846	136	18680	70	2633	-502
July 24, 2018	19	48.03	20613	134	18627	71	2445	-511
July 24, 2018	20	55.95	20203	195	18634	69	2127	-519
July 24, 2018	21	39.76	19887	262	18303	70	2347	-523
July 24, 2018	22	44.88	18777	275	17793	29	1787	-643
July 24, 2018	23	38.92	17316	234	16587	16	1662	-812
July 24, 2018	24	32.27	15971	271	15280	16	1770	-832
July 25, 2018	1	39.49	15098	255	14929	13	1205	-798
July 25, 2018	2	25.23	14442	213	14543	14	865	-797
July 25, 2018	3	20.14	14058	202	14594	14	481	-874
July 25, 2018	4	19.38	13955	204	14620	14	451	-983
July 25, 2018	5	18.25	14359	191	14473	14	1097	-1127
July 25, 2018	6	23.1	15273	176	14704	14	1624	-954
July 25, 2018	7	29.24	16571	192	15464	16	1688	-520
July 25, 2018	8	31.53	17437	199	16476	15	1689	-542
July 25, 2018	9	32.36	18072	177	17184	41	1645	-775
July 25, 2018	10	35.28	18721	190	17865	66	1809	-945
July 25, 2018	11	43.8	19157	208	18526	69	1709	-1052
July 25, 2018	12	72.71	19311	191	18707	84	1829	-1176
July 25, 2018	13	42.43	19722	180	18575	70	1806	-646
July 25, 2018	14	45.04	19981	205	18929	68	1811	-795
July 25, 2018	15	41.81	20336	192	19433	77	1679	-821
July 25, 2018	16	91.97	20873	145	19917	81	1646	-850
July 25, 2018	17	93.93	21004	114	19788	86	1763	-553
July 25, 2018	18	66.46	21063	124	19540	79	1864	-386
July 25, 2018	19	52.58	20826	139	19209	68	2014	-463
July 25, 2018	20	54.92	20358	157	18921	73	1918	-410
July 25, 2018	21	48.43	19831	199	18585	28	1941	-379
July 25, 2018	22	39.92	18498	210	17430	14	1772	-496
July 25, 2018	23	34.63	16838	229	16040	13	1818	-745
July 25, 2018	24	28.42	15395	237	15298	14	1149	-745
July 26, 2018	1	22.43	14355	200	14457	12	1126	-936
July 26, 2018	2	18.9	13616	191	14405	12	526	-1036
July 26, 2018	3	16.75	13256	116	14363	12	300	-1264
July 26, 2018	4	18.85	13086	203	14501	14	216	-1438

July 26, 2018	5	16.98	13382	191	14685	13	275	-1435
July 26, 2018	6	6.44	14165	197	14818	40	573	-1130
July 26, 2018	7	19.89	15577	159	15405	65	1188	-1045
July 26, 2018	8	28.32	16646	159	16277	65	1143	-790
July 26, 2018	9	32.34	17511	153	17195	65	1519	-1243
July 26, 2018	10	31.72	18122	157	17747	66	1807	-1331
July 26, 2018	11	31.54	18634	139	18192	66	1815	-1394
July 26, 2018	12	30.48	19030	156	18642	66	1692	-1346
July 26, 2018	13	33.07	19504	148	19066	65	1741	-1347
July 26, 2018	14	32.93	19730	160	19505	65	1674	-1415
July 26, 2018	15	34.55	19887	167	19623	66	1762	-1472
July 26, 2018	16	35.01	19554	120	19377	66	1773	-1586
July 26, 2018	17	36.01	19539	118	19125	67	1753	-1406
July 26, 2018	18	38.63	19565	148	18940	67	1753	-1122
July 26, 2018	19	40.87	19298	184	18897	68	1566	-1025
July 26, 2018	20	32.8	18826	206	18021	69	1820	-816
July 26, 2018	21	31.17	18576	195	17628	69	1826	-747
July 26, 2018	22	23.21	17443	223	16998	68	1368	-712
July 26, 2018	23	19.74	15958	213	15673	18	1673	-1089
July 26, 2018	24	16.28	14727	279	15196	12	1538	-1654
July 27, 2018	1	19.73	13817	202	14648	12	881	-1441
July 27, 2018	2	27.43	13218	211	14475	11	400	-1436
July 27, 2018	3	30.88	12895	198	14618	10	209	-1731
July 27, 2018	4	27.23	12860	234	14472	12	393	-1797
July 27, 2018	5	14.35	13186	195	14138	12	1010	-1714
July 27, 2018	6	23.21	13970	191	14840	12	876	-1569
July 27, 2018	7	28.72	15136	164	15355	12	1203	-1196
July 27, 2018	8	28.32	16108	201	15696	11	1746	-1038
July 27, 2018	9	31.57	16840	189	16174	12	1746	-859
July 27, 2018	10	31.88	17294	191	16568	12	1819	-813
July 27, 2018	11	32.19	17550	163	16978	14	1792	-1064
July 27, 2018	12	32.28	17750	202	17705	13	1782	-1553
July 27, 2018	13	33.34	17908	246	18306	13	1780	-1982
July 27, 2018	14	33.35	17974	238	18428	14	1780	-2032
July 27, 2018	15	33.28	17921	209	18414	13	1762	-2104
July 27, 2018	16	33.23	18194	232	18446	12	1762	-1887
July 27, 2018	17	36.78	18496	255	18690	14	1743	-1777
July 27, 2018	18	33.15	18212	273	18147	14	1789	-1447
July 27, 2018	19	33.25	17984	254	17923	15	1799	-1573
July 27, 2018	20	33.27	17598	278	17454	15	1763	-1406
July 27, 2018	21	33.09	17371	249	17145	15	1774	-1305
July 27, 2018	22	30.53	16300	282	16069	15	1775	-1218
July 27, 2018	23	30.81	14890	284	15038	13	1774	-1566
July 27, 2018	24	21.92	13622	291	14151	14	1359	-1540
July 28, 2018	1	23.03	12923	213	13839	15	1244	-1919
July 28, 2018	2	8.73	12372	285	13788	14	1062	-2172
July 28, 2018	3	14.33	12107	281	14054	14	665	-2294
July 28, 2018	4	24.19	11971	264	14260	14	218	-2318
July 28, 2018	5	26.52	11981	233	14459	14	352	-2612
July 28, 2018	6	14.33	12087	233	14728	14	367	-2733

July 28, 2018	7	15.42	12696	208	14451	14	251	-1757
July 28, 2018	8	15.43	13557	239	15021	13	231	-1411
July 28, 2018	9	29.12	14220	232	15846	14	191	-1643
July 28, 2018	10	22.83	14725	256	15997	15	814	-1871
July 28, 2018	11	29.38	15076	230	15917	13	1598	-2251
July 28, 2018	12	29.29	15137	218	15935	13	1670	-2253
July 28, 2018	13	29.29	15139	238	15995	13	1703	-2313
July 28, 2018	14	29.32	15160	259	16156	13	1469	-2219
July 28, 2018	15	29.42	15121	287	15986	13	1764	-2289
July 28, 2018	16	30.65	15256	264	16285	14	1764	-2519
July 28, 2018	17	32.11	15538	178	16325	13	1789	-2358
July 28, 2018	18	31.81	15289	294	16076	14	1763	-2241
July 28, 2018	19	29.7	15176	302	15950	14	1664	-2179
July 28, 2018	20	28.79	15015	281	15511	14	1756	-1956
July 28, 2018	21	41.68	15006	283	15357	15	1789	-1760
July 28, 2018	22	23.15	14316	304	14670	16	1789	-1807
July 28, 2018	23	20.16	13400	253	14210	13	1638	-2139
July 28, 2018	24	22.63	12572	269	13944	14	1282	-2319
July 29, 2018	1	21.34	11950	241	13910	13	916	-2565
July 29, 2018	2	31.87	11510	260	14123	13	526	-2831
July 29, 2018	3	29.07	11267	187	14178	13	354	-3065
July 29, 2018	4	38.49	11132	228	13931	12	371	-2962
July 29, 2018	5	56.01	11217	223	14105	12	376	-3067
July 29, 2018	6	18.91	11217	220	13952	14	331	-2804
July 29, 2018	7	6.42	11629	249	13937	15	347	-2358
July 29, 2018	8	0	12277	230	14062	14	294	-1720
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July 29, 2018	10	22.82	13576	261	15260	13	501	-1941
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July 29, 2018	12	25.4	14794	248	15747	14	1210	-1883
July 29, 2018	13	21.31	15118	247	16100	14	1264	-1983
July 29, 2018	14	27.55	15463	299	16220	14	1637	-2058
July 29, 2018	15	28.94	15588	280	16159	14	1776	-1999
July 29, 2018	16	30.37	15784	264	16232	13	1789	-1874
July 29, 2018	17	32.11	16259	282	16731	14	1783	-2023
July 29, 2018	18	31.62	16449	297	16520	15	1766	-1493
July 29, 2018	19	29.3	16339	268	16479	15	1201	-1043
July 29, 2018	20	28.47	16188	274	15945	14	1788	-1263
July 29, 2018	21	28.57	16206	241	15784	14	1759	-1030
July 29, 2018	22	22.35	15370	258	15038	14	1799	-1133
July 29, 2018	23	19.78	14286	282	14388	14	1837	-1631
July 29, 2018	24	23.11	13366	303	13964	13	1642	-1839
July 30, 2018	1	27.9	12679	258	13934	13	1254	-2151
July 30, 2018	2	27.71	12299	281	14132	14	368	-1845
July 30, 2018	3	20.39	12109	256	14094	14	497	-2144
July 30, 2018	4	16.6	12156	267	14142	14	213	-1938
July 30, 2018	5	23.39	12554	270	14287	14	405	-1895
July 30, 2018	6	22.28	13239	270	14686	14	853	-1835
July 30, 2018	7	25.89	14591	267	15276	14	1438	-1736
July 30, 2018	8	24.52	15463	262	15241	13	1799	-1285

July 30, 2018	9	27.25	16111	258	15786	14	1718	-1174
July 30, 2018	10	29.2	16682	223	16357	17	1718	-1262
July 30, 2018	11	30.68	17120	184	16757	26	1718	-1280
July 30, 2018	12	32.36	17693	227	17492	59	1689	-1444
July 30, 2018	13	32.53	18096	232	18014	73	1690	-1478
July 30, 2018	14	29.92	18216	196	18170	68	1789	-1574
July 30, 2018	15	32.28	18366	291	18317	69	1651	-1571
July 30, 2018	16	38.22	18899	249	18899	70	1585	-1561
July 30, 2018	17	50.6	19250	261	19254	78	1707	-1499
July 30, 2018	18	33.73	19004	268	18740	68	1689	-1237
July 30, 2018	19	33.64	18714	271	18430	67	1740	-1220
July 30, 2018	20	33.01	18468	211	17999	68	1788	-1205
July 30, 2018	21	32.03	18258	213	17789	31	1710	-1021
July 30, 2018	22	26.16	17115	180	16762	14	1717	-1048
July 30, 2018	23	26.66	15556	299	15617	15	1744	-1480
July 30, 2018	24	19.71	14471	312	14592	14	1720	-1444
July 31, 2018	1	21.07	13636	300	14459	13	1167	-1658
July 31, 2018	2	23.13	13136	307	14483	13	652	-1659
July 31, 2018	3	17.99	12836	313	14429	13	205	-1451
July 31, 2018	4	23.42	12807	314	14246	14	608	-1706
July 31, 2018	5	20.45	13170	276	14146	13	922	-1604
July 31, 2018	6	21.58	13749	271	14696	13	929	-1354
July 31, 2018	7	18.8	15232	243	15157	14	1559	-1284
July 31, 2018	8	20.17	16216	250	15685	13	1639	-869
July 31, 2018	9	29.2	16875	181	16443	13	1639	-1033
July 31, 2018	10	28.94	17510	131	17073	14	1639	-1139
July 31, 2018	11	31.99	18004	165	17755	15	1639	-1277
July 31, 2018	12	32.76	18377	167	18325	16	1639	-1501
July 31, 2018	13	33.01	18713	230	18722	43	1639	-1517
July 31, 2018	14	33.01	18934	171	18978	70	1639	-1513
July 31, 2018	15	35.42	19179	175	19116	71	1137	-1013
July 31, 2018	16	38.06	19501	144	19057	70	1742	-1294
July 31, 2018	17	37.12	19845	170	19175	71	1839	-1116
July 31, 2018	18	35.2	19510	150	19248	71	1512	-1165
July 31, 2018	19	33.05	19195	135	18496	72	1693	-974
July 31, 2018	20	32.91	19058	141	18210	25	1738	-819
July 31, 2018	21	32.5	18750	168	17889	14	1639	-553
July 31, 2018	22	26.87	17614	143	16830	14	1639	-657
July 31, 2018	23	21.98	16151	137	15501	13	1639	-769
July 31, 2018	24	12.03	14971	134	14694	14	1688	-1093
August 1, 2018	1	11.2	14259	129	14535	15	1584	-1689
August 1, 2018	2	14.34	13762	134	14418	16	1346	-1846
August 1, 2018	3	23.76	13526	107	14627	15	1085	-2066
August 1, 2018	4	37.78	13506	112	14849	14	715	-2012
August 1, 2018	5	24.03	13894	159	15031	14	964	-1966
August 1, 2018	6	17.3	14857	163	15696	13	1168	-1861
August 1, 2018	7	23.39	16103	155	16199	13	1436	-1429
August 1, 2018	8	27.22	16954	218	16903	12	1679	-1408
August 1, 2018	9	32.28	17545	225	17563	13	1647	-1428
August 1, 2018	10	32.85	18097	281	18121	20	1639	-1467

August 1, 2018	11	35.64	18470	252	18641	14	1706	-1649
August 1, 2018	12	42.66	18740	261	18738	18	1660	-1494
August 1, 2018	13	45.75	18940	277	19358	18	1574	-1864
August 1, 2018	14	39.64	19099	243	19195	50	1723	-1726
August 1, 2018	15	37.66	19197	238	19590	84	1243	-1582
August 1, 2018	16	41.54	19477	287	19707	87	1724	-1865
August 1, 2018	17	40.3	19499	231	19645	87	1725	-1782
August 1, 2018	18	39.4	19195	287	19255	87	1723	-1607
August 1, 2018	19	35.87	18997	258	18943	87	1719	-1543
August 1, 2018	20	48.29	18915	311	19004	97	1746	-1683
August 1, 2018	21	40.26	18705	279	18380	46	1709	-1225
August 1, 2018	22	31.32	17505	303	17358	34	1654	-1169
August 1, 2018	23	27.92	16086	200	15843	33	1654	-1121
August 1, 2018	24	34.18	14862	230	14740	34	1658	-1319
August 2, 2018	1	26.05	14018	225	14239	32	1186	-1061
August 2, 2018	2	10.92	13384	329	13917	33	1410	-1554
August 2, 2018	3	11.07	13094	321	14156	33	873	-1605
August 2, 2018	4	14.35	13110	283	14392	33	430	-1449
August 2, 2018	5	3.52	13474	292	14304	32	1059	-1575
August 2, 2018	6	4.94	14318	332	14638	33	1567	-1555
August 2, 2018	7	6.17	15482	291	15556	33	1652	-1456
August 2, 2018	8	20.5	16441	253	16248	43	1652	-1243
August 2, 2018	9	28.37	17071	218	17063	51	1652	-1513
August 2, 2018	10	31.45	17656	246	17702	49	1652	-1605
August 2, 2018	11	36.73	18264	248	18615	69	1383	-1604
August 2, 2018	12	33.41	18875	244	18976	108	1677	-1602
August 2, 2018	13	33.51	19280	246	19696	89	1321	-1639
August 2, 2018	14	32.05	19499	290	19780	104	1676	-1806
August 2, 2018	15	36.31	19830	278	20126	75	1722	-1964
August 2, 2018	16	59.56	20261	251	20589	76	1727	-1963
August 2, 2018	17	70.34	20407	251	20508	80	1807	-1809
August 2, 2018	18	32.94	20170	269	20038	69	1719	-1391
August 2, 2018	19	40.01	19910	279	19825	68	1320	-1121
August 2, 2018	20	38.59	19843	253	19779	68	1728	-1526
August 2, 2018	21	41.9	19447	353	19515	27	1744	-1466
August 2, 2018	22	35.52	18230	359	18364	18	1644	-1435
August 2, 2018	23	31.52	16624	360	16727	16	1644	-1349
August 2, 2018	24	19.34	15268	378	15528	19	1690	-1453
August 3, 2018	1	18.3	14393	341	14830	19	1559	-1511
August 3, 2018	2	17.08	13735	353	14754	19	979	-1586
August 3, 2018	3	27.4	13345	324	14833	19	571	-1736
August 3, 2018	4	34.8	13282	324	14966	19	297	-1736
August 3, 2018	5	14.82	13613	336	14927	19	1044	-2028
August 3, 2018	6	10.1	14439	342	15027	19	1486	-1770
August 3, 2018	7	23.54	15583	286	15951	17	1293	-1458
August 3, 2018	8	22.47	16560	242	16653	17	1664	-1484
August 3, 2018	9	34.07	17280	262	17453	14	1664	-1638
August 3, 2018	10	42.79	18038	265	18181	16	1649	-1640
August 3, 2018	11	43.1	18678	220	18712	16	1809	-1714
August 3, 2018	12	46.04	19135	263	19295	26	1809	-1848

August 3, 2018	13	47.32	19596	253	19649	68	1809	-1773
August 3, 2018	14	50.68	19957	264	20090	68	1734	-1774
August 3, 2018	15	45.34	20114	288	20332	69	1709	-1774
August 3, 2018	16	49.54	20314	259	20448	75	1709	-1766
August 3, 2018	17	49.47	20675	217	20609	72	1793	-1660
August 3, 2018	18	46.54	20628	249	20091	72	1900	-1209
August 3, 2018	19	41.04	20252	242	20193	73	1442	-1234
August 3, 2018	20	41.66	19805	240	19290	74	1776	-1186
August 3, 2018	21	53.61	19447	213	18978	82	1791	-1234
August 3, 2018	22	37.61	18188	236	17873	24	1717	-1085
August 3, 2018	23	30.76	16621	312	16277	21	1648	-882
August 3, 2018	24	26.6	15328	306	14858	20	1759	-977
August 4, 2018	1	24.39	14478	268	14127	18	1763	-1098
August 4, 2018	2	37.41	13795	278	14119	17	1488	-1523
August 4, 2018	3	29.04	13262	286	14298	18	774	-1482
August 4, 2018	4	28.78	13054	280	14419	21	765	-1834
August 4, 2018	5	27.63	13036	295	14694	19	323	-1657
August 4, 2018	6	20.41	13152	267	14714	21	284	-1537
August 4, 2018	7	15.42	13948	247	14900	18	416	-1119
August 4, 2018	8	20.16	15225	295	15848	17	828	-1179
August 4, 2018	9	24.35	16344	295	16317	17	1450	-1126
August 4, 2018	10	33.05	17238	288	17050	17	1733	-1272
August 4, 2018	11	41.44	17970	282	18160	18	1733	-1747
August 4, 2018	12	40.5	18494	281	18710	18	1727	-1737
August 4, 2018	13	40.29	18707	309	19110	18	1727	-1843
August 4, 2018	14	35.13	18759	302	19154	19	1716	-1883
August 4, 2018	15	38.72	19008	295	19322	20	1886	-1992
August 4, 2018	16	44.89	19508	310	20079	20	1823	-2267
August 4, 2018	17	43.94	20062	293	20499	20	1932	-2121
August 4, 2018	18	41.69	20179	296	20346	21	1928	-1857
August 4, 2018	19	34.96	19796	277	19388	20	2044	-1273
August 4, 2018	20	35.26	19135	257	19108	20	1843	-1559
August 4, 2018	21	35.46	18723	232	18493	17	1846	-1371
August 4, 2018	22	36.04	17654	250	17360	19	1819	-1246
August 4, 2018	23	30.69	16343	227	16310	21	1819	-1435
August 4, 2018	24	18.49	15123	284	15030	20	1865	-1465
August 5, 2018	1	12.94	14271	249	14799	17	973	-1273
August 5, 2018	2	17.31	13573	310	14715	17	767	-1510
August 5, 2018	3	20.23	13097	264	14854	17	639	-2082
August 5, 2018	4	23.91	12813	307	14944	17	820	-2604
August 5, 2018	5	14.38	12715	288	14820	17	725	-2520
August 5, 2018	6	14.33	12664	288	14753	19	372	-2198
August 5, 2018	7	0	13264	252	14658	18	489	-1664
August 5, 2018	8	5.18	14401	242	15359	18	415	-1076
August 5, 2018	9	21.54	15670	239	16088	18	884	-1148
August 5, 2018	10	30.89	16860	250	16794	18	1821	-1583
August 5, 2018	11	34.65	17725	230	17777	18	1821	-1700
August 5, 2018	12	35.9	18430	248	18658	19	1821	-1968
August 5, 2018	13	40.18	18932	263	19342	18	1889	-2063
August 5, 2018	14	39.14	19243	229	19911	30	1949	-2361

August 5, 2018	15	38.83	19650	202	20446	36	1925	-2608
August 5, 2018	16	38.41	20167	241	20661	34	1927	-2309
August 5, 2018	17	38.54	20596	178	20866	33	1926	-2100
August 5, 2018	18	41.48	20683	186	20611	35	2001	-1792
August 5, 2018	19	38.09	20174	188	20395	35	1921	-1789
August 5, 2018	20	35.31	19695	171	19638	35	1935	-1809
August 5, 2018	21	40.39	19502	175	19459	19	1969	-1778
August 5, 2018	22	36.3	18384	264	18683	20	1694	-1686
August 5, 2018	23	19.68	17128	274	17379	18	1923	-1820
August 5, 2018	24	7.91	16027	295	16473	17	1768	-1841
August 6, 2018	1	11.71	15208	277	16185	16	1104	-1752
August 6, 2018	2	19.16	14618	294	16183	16	990	-2152
August 6, 2018	3	18.29	14202	266	16104	19	840	-2425
August 6, 2018	4	14.38	14022	201	16089	17	651	-2515
August 6, 2018	5	14.35	13989	189	16278	17	308	-2346
August 6, 2018	6	7.87	14270	187	15983	20	382	-1918
August 6, 2018	7	14.39	14990	190	16271	21	294	-1363
August 6, 2018	8	29.16	16211	195	16726	20	924	-1293
August 6, 2018	9	35.65	17629	180	17625	19	1799	-1555
August 6, 2018	10	40.37	18864	197	18766	18	1376	-1104
August 6, 2018	11	34.74	19726	183	19477	18	1483	-993
August 6, 2018	12	38.72	20293	188	19711	28	1603	-847
August 6, 2018	13	48	20238	122	19923	35	1592	-1142
August 6, 2018	14	48	19925	113	19749	36	1684	-1267
August 6, 2018	15	46.89	19303	97	19318	35	1932	-1617
August 6, 2018	16	43.79	19375	119	19378	35	1753	-1728
August 6, 2018	17	105.47	19767	125	20191	37	1343	-1719
August 6, 2018	18	35.76	19469	119	19323	27	1840	-1423
August 6, 2018	19	34.13	19113	112	18599	19	2061	-1248
August 6, 2018	20	32.32	19040	181	18410	19	2152	-1232
August 6, 2018	21	39.37	18768	178	17996	17	2232	-1080
August 6, 2018	22	37.75	17835	208	17465	20	1742	-1181
August 6, 2018	23	31.64	16515	248	16321	19	1707	-1267
August 6, 2018	24	22.22	15400	255	15425	18	1807	-1585
August 7, 2018	1	28.08	14640	239	15198	18	983	-1442
August 7, 2018	2	29.29	14091	288	15323	19	934	-1887
August 7, 2018	3	18.49	13771	263	14645	18	1302	-1935
August 7, 2018	4	31.38	13725	254	15089	17	981	-2161
August 7, 2018	5	25.24	14146	172	14958	18	696	-1354
August 7, 2018	6	29.61	15217	179	15466	19	1410	-1585
August 7, 2018	7	37.8	16522	193	16087	22	1634	-1109
August 7, 2018	8	35.22	17517	246	16806	25	1752	-759
August 7, 2018	9	35.59	18304	227	17727	58	1799	-1162
August 7, 2018	10	48	18830	225	18313	72	1756	-1137
August 7, 2018	11	48	19289	279	18820	74	1870	-1237
August 7, 2018	12	54.7	19552	262	19221	96	1943	-1488
August 7, 2018	13	47.03	20052	234	19492	102	1999	-1387
August 7, 2018	14	46.81	20289	274	19763	93	2223	-1529
August 7, 2018	15	41.72	20431	229	19832	91	2287	-1562
August 7, 2018	16	47.53	20758	166	19922	88	2510	-1659

August 7, 2018	17	47	20973	120	19667	90	2532	-1265
August 7, 2018	18	37.67	20698	193	19520	77	2433	-1130
August 7, 2018	19	39.39	20590	193	19275	73	2388	-1029
August 7, 2018	20	39.79	20575	210	19096	76	2288	-679
August 7, 2018	21	39.65	20134	211	18683	76	2388	-775
August 7, 2018	22	34.3	18692	236	17207	78	2266	-629
August 7, 2018	23	34.58	17131	230	16358	29	1859	-912
August 7, 2018	24	27.66	15771	201	15389	21	1815	-1197
August 8, 2018	1	19.9	14852	187	15088	20	1149	-1181
August 8, 2018	2	37.8	14303	174	15066	16	808	-1440
August 8, 2018	3	15.76	13916	170	14897	18	1091	-1825
August 8, 2018	4	14.37	13842	188	15028	21	950	-1883
August 8, 2018	5	16.97	14346	166	14981	18	547	-1160
August 8, 2018	6	37.72	15401	182	15557	17	1302	-1407
August 8, 2018	7	24.48	16510	198	16539	18	1308	-1102
August 8, 2018	8	30.29	17347	169	16869	19	1858	-1165
August 8, 2018	9	33.93	17880	213	17515	16	1861	-1296
August 8, 2018	10	35.4	18263	228	18164	25	1779	-1462
August 8, 2018	11	42.39	18545	243	18928	26	1449	-1650
August 8, 2018	12	37.25	18905	295	19391	53	1570	-1866
August 8, 2018	13	35.69	19206	264	19362	72	1836	-1835
August 8, 2018	14	35.9	19256	276	19566	71	1836	-1835
August 8, 2018	15	35.9	19256	284	19234	72	1836	-1835
August 8, 2018	16	35.14	19530	320	19519	73	1586	-1630
August 8, 2018	17	38.74	19870	287	19758	72	1661	-1528
August 8, 2018	18	35.98	19771	317	20001	71	1736	-1817
August 8, 2018	19	38.04	19535	295	19584	69	1831	-1778
August 8, 2018	20	39.36	19297	294	19382	36	1859	-1615
August 8, 2018	21	38.6	18979	304	18923	18	1817	-1523
August 8, 2018	22	35.06	17701	290	17792	19	1667	-1418
August 8, 2018	23	35.52	16162	307	16198	16	1858	-1593
August 8, 2018	24	24.91	14884	266	14763	19	1843	-1416
August 9, 2018	1	3.72	13959	249	14313	19	1393	-1382
August 9, 2018	2	11.21	13338	314	14505	18	729	-1634
August 9, 2018	3	24.51	12985	323	14888	16	489	-2094
August 9, 2018	4	27.08	12936	330	15015	16	87	-1854
August 9, 2018	5	15.95	13223	315	15287	16	468	-2235
August 9, 2018	6	14.74	13991	319	15662	17	675	-2147
August 9, 2018	7	23.46	15183	246	15930	17	1013	-1747
August 9, 2018	8	21.48	16235	270	16446	17	1726	-1696
August 9, 2018	9	31.48	16982	312	17291	15	1640	-1691
August 9, 2018	10	35.84	17614	279	18461	23	1155	-1887
August 9, 2018	11	36.18	18176	264	18770	26	1538	-2051
August 9, 2018	12	41.09	18795	298	19522	19	1315	-1952
August 9, 2018	13	43.8	19370	273	20085	19	1707	-2238
August 9, 2018	14	42.14	19909	232	20467	19	1301	-1763
August 9, 2018	15	43.47	20150	174	20520	19	1771	-2007
August 9, 2018	16	50.55	20563	336	20636	19	1771	-1711
August 9, 2018	17	37.94	20633	257	20286	20	1904	-1356
August 9, 2018	18	35.13	20184	258	19556	21	1990	-1119

August 9, 2018	19	35.78	19876	248	19317	18	2052	-1347
August 9, 2018	20	43.49	19784	260	19471	14	2082	-1627
August 9, 2018	21	74.64	19451	242	19335	17	2163	-1840
August 9, 2018	22	58.31	18108	344	18466	17	1836	-1837
August 9, 2018	23	31.16	16560	363	16672	18	1736	-1447
August 9, 2018	24	26.99	15320	358	15533	17	1708	-1540
August 10, 2018	1	30.54	14321	358	15105	16	1199	-1556
August 10, 2018	2	15.63	13714	283	14849	18	1160	-1982
August 10, 2018	3	15	13266	260	14955	18	822	-2256
August 10, 2018	4	14.34	13111	303	15005	19	637	-2255
August 10, 2018	5	10.57	13351	296	15150	19	293	-1831
August 10, 2018	6	5.27	14051	326	15630	18	472	-1745
August 10, 2018	7	25.55	15308	257	16042	18	1156	-1729
August 10, 2018	8	23.99	16246	286	16442	18	1651	-1594
August 10, 2018	9	32.92	16746	277	17319	18	1563	-1813
August 10, 2018	10	34.13	17212	284	17738	18	1462	-1648
August 10, 2018	11	35.15	17427	293	17826	27	1637	-1805
August 10, 2018	12	36.12	17653	298	18453	28	1067	-1711
August 10, 2018	13	35.41	18023	228	18139	19	1743	-1719
August 10, 2018	14	41.38	18240	307	18524	20	1843	-1914
August 10, 2018	15	35.44	18467	309	18753	24	1918	-1977
August 10, 2018	16	36.84	18870	330	18944	71	1976	-1989
August 10, 2018	17	54.41	19298	283	19391	78	1971	-1961
August 10, 2018	18	88.42	19344	285	19172	79	1964	-1686
August 10, 2018	19	49.56	19070	312	18919	75	2124	-1783
August 10, 2018	20	36.1	18478	257	18001	75	2025	-1240
August 10, 2018	21	36.86	17962	288	17642	75	1615	-1064
August 10, 2018	22	29.82	16690	314	16689	26	1587	-1153
August 10, 2018	23	21.35	15282	327	15340	19	1971	-1533
August 10, 2018	24	16.19	13973	333	14458	19	1777	-1672
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August 11, 2018	2	14.36	12582	291	14161	19	1138	-2378
August 11, 2018	3	14.37	12258	268	14373	19	476	-2293
August 11, 2018	4	14.38	12050	271	14450	19	368	-2447
August 11, 2018	5	14.34	12089	292	14355	19	489	-2405
August 11, 2018	6	14.33	12249	292	14583	18	287	-2308
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August 11, 2018	8	15.7	13792	283	15347	18	564	-1874
August 11, 2018	9	31.82	14634	264	15542	16	1290	-1893
August 11, 2018	10	34.45	15514	295	15911	18	1773	-1899
August 11, 2018	11	40.42	16071	300	16348	20	1785	-1798
August 11, 2018	12	41.69	16519	314	16703	20	1919	-1851
August 11, 2018	13	42.89	16763	261	16849	21	1964	-1818
August 11, 2018	14	39.22	17049	303	16642	20	2058	-1340
August 11, 2018	15	54.24	17427	294	17288	20	1958	-1580
August 11, 2018	16	77.22	17948	253	18026	20	1849	-1728
August 11, 2018	17	67.07	18392	225	18481	20	1712	-1644
August 11, 2018	18	40.87	18343	248	18154	20	1849	-1311
August 11, 2018	19	38.72	17854	232	17841	20	1618	-1230
August 11, 2018	20	36.95	17412	245	16920	20	1849	-1007

August 11, 2018	21	40.99	17029	225	16713	20	1698	-1142
August 11, 2018	22	31.63	16074	240	15560	22	1907	-1007
August 11, 2018	23	33.28	14919	234	14806	18	1926	-1525
August 11, 2018	24	21.51	13951	262	13797	17	1991	-1539
August 12, 2018	1	26.75	13159	227	13609	15	1639	-1778
August 12, 2018	2	24.81	12654	277	13662	17	1385	-2117
August 12, 2018	3	23.45	12298	264	13838	24	1204	-2420
August 12, 2018	4	14.37	12128	258	13594	16	1262	-2395
August 12, 2018	5	15.62	12087	243	13651	17	985	-2244
August 12, 2018	6	14.37	12137	264	13704	16	770	-2038
August 12, 2018	7	15.92	12618	229	13956	16	814	-1936
August 12, 2018	8	6.36	13467	220	14399	16	1285	-1893
August 12, 2018	9	28.43	14524	238	14908	16	1274	-1403
August 12, 2018	10	32.71	15541	236	15380	16	1909	-1517
August 12, 2018	11	33.32	16404	230	16106	15	1965	-1443
August 12, 2018	12	34.29	16956	167	16815	13	1983	-1698
August 12, 2018	13	39.26	17375	201	17310	14	1983	-1813
August 12, 2018	14	43.83	17638	199	17745	18	1983	-1859
August 12, 2018	15	43.1	18006	208	18276	19	1983	-2100
August 12, 2018	16	49.52	18595	194	18697	19	1945	-1937
August 12, 2018	17	52.08	19194	261	18887	19	2065	-1632
August 12, 2018	18	54.1	19381	236	18993	19	1939	-1367
August 12, 2018	19	39.8	19118	251	18721	19	1983	-1342
August 12, 2018	20	40.19	18727	245	18079	19	2017	-1141
August 12, 2018	21	40.84	18361	212	17814	19	1919	-1159
August 12, 2018	22	37.84	17240	239	16655	19	1916	-1095
August 12, 2018	23	32.26	15883	230	15394	21	1875	-1127
August 12, 2018	24	23.18	14759	302	14507	21	1991	-1419
August 13, 2018	1	19.31	13844	312	14392	17	1482	-1610
August 13, 2018	2	30.49	13373	298	14479	19	1142	-1970
August 13, 2018	3	21.94	13114	303	14398	20	805	-1772
August 13, 2018	4	14.35	13158	214	14315	20	1124	-2076
August 13, 2018	5	6.84	13559	239	14510	19	1325	-2004
August 13, 2018	6	6.44	14459	239	14988	23	1527	-1864
August 13, 2018	7	23.79	15707	213	15624	22	1755	-1443
August 13, 2018	8	32.58	16772	161	16365	21	1896	-1496
August 13, 2018	9	33.09	17778	154	17224	68	1931	-1399
August 13, 2018	10	35.12	18518	241	18060	72	1931	-1411
August 13, 2018	11	44	19048	214	18455	81	1804	-1125
August 13, 2018	12	39.36	19310	267	18386	85	2031	-1015
August 13, 2018	13	38.43	19649	213	18706	78	2183	-1164
August 13, 2018	14	39.41	19857	203	18904	77	2158	-1129
August 13, 2018	15	37.98	19968	266	19095	91	2132	-1103
August 13, 2018	16	44.15	20361	170	19472	90	2340	-1460
August 13, 2018	17	42.21	20613	184	19452	81	2802	-1558
August 13, 2018	18	36.91	20434	219	19343	74	2293	-1117
August 13, 2018	19	38.02	20253	220	19289	74	2163	-1061
August 13, 2018	20	46.61	20248	202	19578	74	1703	-950
August 13, 2018	21	36.8	19862	187	19084	72	1940	-1054
August 13, 2018	22	37.29	18463	315	17764	24	1957	-958

August 13, 2018	23	33.18	16874	292	16301	19	1931	-989
August 13, 2018	24	24.16	15576	362	15411	19	1850	-1222
August 14, 2018	1	17.43	14630	312	14968	18	1249	-1271
August 14, 2018	2	16.75	14022	347	15106	18	539	-1261
August 14, 2018	3	24.32	13665	327	15377	18	304	-1696
August 14, 2018	4	28.65	13520	332	15444	18	308	-1938
August 14, 2018	5	19.9	13958	314	15141	18	1146	-2071
August 14, 2018	6	25.98	14925	300	15366	18	1485	-1711
August 14, 2018	7	29.53	16132	225	15825	21	1678	-1204
August 14, 2018	8	30.65	17134	240	16480	21	1882	-1032
August 14, 2018	9	33	17875	199	17535	66	1646	-1194
August 14, 2018	10	33.49	18585	219	18045	77	1976	-1335
August 14, 2018	11	36.08	19107	216	18596	74	1952	-1373
August 14, 2018	12	40.55	19618	239	18847	76	2080	-1267
August 14, 2018	13	43.9	20197	179	19247	89	2277	-1340
August 14, 2018	14	44.58	20517	151	19706	95	2323	-1521
August 14, 2018	15	38.5	20736	137	20189	91	2283	-1724
August 14, 2018	16	47.13	21079	135	20576	89	2094	-1673
August 14, 2018	17	67.35	21214	103	20582	88	2177	-1671
August 14, 2018	18	37.66	21094	100	19973	87	2731	-1623
August 14, 2018	19	40.28	20929	122	19870	87	2305	-1231
August 14, 2018	20	42.51	20930	170	20080	73	2108	-1251
August 14, 2018	21	36.4	20369	146	19503	73	1898	-895
August 14, 2018	22	33.11	18858	287	17784	25	1852	-504
August 14, 2018	23	21.95	17155	264	16791	20	1738	-1087
August 14, 2018	24	10.07	15795	334	15824	20	1797	-1479
August 15, 2018	1	8.53	14853	262	15532	21	1409	-1795
August 15, 2018	2	13.64	14219	363	15688	21	726	-1812
August 15, 2018	3	15.7	13778	328	15863	20	304	-2090
August 15, 2018	4	30.52	13688	307	15931	20	304	-2322
August 15, 2018	5	9.34	14108	308	15613	18	834	-2071
August 15, 2018	6	12.57	15005	320	15771	18	1316	-1842
August 15, 2018	7	16.37	16303	216	16298	18	1724	-1550
August 15, 2018	8	29.41	17454	261	17236	20	1840	-1424
August 15, 2018	9	32.62	18520	223	18028	18	1769	-1153
August 15, 2018	10	39.23	19377	221	18954	51	1703	-1223
August 15, 2018	11	48.97	20046	228	19391	77	1833	-1108
August 15, 2018	12	40.5	20424	268	19507	75	2352	-1136
August 15, 2018	13	42.37	20708	133	19444	89	2525	-1183
August 15, 2018	14	50.08	20899	106	19496	88	2490	-1031
August 15, 2018	15	37.5	21119	83	19690	90	2533	-1202
August 15, 2018	16	58	21241	75	20529	87	1948	-1317
August 15, 2018	17	55.78	21299	77	20441	85	2057	-1387
August 15, 2018	18	34.58	21020	93	20111	87	2141	-1243
August 15, 2018	19	57.25	20932	149	20259	94	2212	-1582
August 15, 2018	20	54.37	20981	176	19971	76	2205	-1082
August 15, 2018	21	65.48	20563	207	19571	79	2173	-1012
August 15, 2018	22	48.67	19233	214	18928	26	1583	-1087
August 15, 2018	23	28.84	17567	220	17207	20	1905	-1251
August 15, 2018	24	18.07	16179	273	16442	20	1685	-1519

August 16, 2018	1	6.46	15231	203	16001	19	1508	-2042
August 16, 2018	2	8.95	14432	371	16040	19	928	-2162
August 16, 2018	3	14.37	14015	356	16058	19	374	-2148
August 16, 2018	4	15.72	13902	349	15942	19	362	-2103
August 16, 2018	5	10.17	14298	300	15568	19	1124	-2117
August 16, 2018	6	10.76	15169	287	15810	18	1685	-2097
August 16, 2018	7	18.43	16434	242	16359	18	2121	-1787
August 16, 2018	8	32.34	17525	245	17528	18	1888	-1704
August 16, 2018	9	33.96	18428	190	18295	22	1927	-1616
August 16, 2018	10	37.49	19345	236	19080	23	1918	-1683
August 16, 2018	11	45.22	19970	222	19981	55	1890	-1883
August 16, 2018	12	42.35	20244	260	19983	71	1980	-1560
August 16, 2018	13	48.24	20679	173	20461	71	1932	-1733
August 16, 2018	14	41.83	20750	230	20675	71	1873	-1728
August 16, 2018	15	45.63	20835	202	20578	71	2033	-1673
August 16, 2018	16	46.77	20887	201	20538	81	1988	-1582
August 16, 2018	17	49.09	20862	165	20638	80	1965	-1762
August 16, 2018	18	51.14	20708	248	20357	72	2017	-1548
August 16, 2018	19	46.27	20515	246	19993	24	1943	-1281
August 16, 2018	20	40.78	20618	227	19981	19	1889	-1145
August 16, 2018	21	41.96	20245	285	19779	19	1889	-1283
August 16, 2018	22	33.35	18979	240	18521	20	1900	-1313
August 16, 2018	23	31.9	17437	252	17524	19	1875	-1689
August 16, 2018	24	18.29	16176	235	16479	18	1917	-1960
August 17, 2018	1	45.96	15401	264	16358	17	1392	-2105
August 17, 2018	2	23.44	14730	294	16175	19	847	-2057
August 17, 2018	3	22.18	14370	304	16076	19	627	-2033
August 17, 2018	4	32.92	14384	355	16414	18	360	-2155
August 17, 2018	5	20.11	14788	326	16625	18	505	-2105
August 17, 2018	6	29.61	15689	341	16860	18	1234	-2027
August 17, 2018	7	27.06	17056	310	17204	18	1752	-1601
August 17, 2018	8	30.52	18063	294	17952	19	1882	-1535
August 17, 2018	9	34.21	18791	264	18779	18	1882	-1631
August 17, 2018	10	45.23	19360	231	19624	20	1205	-1428
August 17, 2018	11	50.09	19931	230	20006	20	1612	-1614
August 17, 2018	12	51.41	20164	220	20388	20	1428	-1472
August 17, 2018	13	40.05	20335	258	20324	21	1900	-1493
August 17, 2018	14	38.47	20417	252	20184	30	1900	-1348
August 17, 2018	15	46.58	20348	224	20027	42	1900	-1448
August 17, 2018	16	42.22	20281	280	20091	39	1900	-1554
August 17, 2018	17	36.22	20153	285	20024	39	1886	-1594
August 17, 2018	18	35.98	19867	287	19655	22	1900	-1558
August 17, 2018	19	35.69	19471	291	19300	18	1914	-1645
August 17, 2018	20	35.62	19318	337	19165	18	1914	-1462
August 17, 2018	21	39.58	18770	295	18420	19	1914	-1325
August 17, 2018	22	34.44	17583	333	17648	20	1878	-1635
August 17, 2018	23	35.16	16215	363	16316	16	1778	-1615
August 17, 2018	24	62.26	15019	321	15846	15	1758	-2295
August 18, 2018	1	33.02	14213	312	15636	16	1296	-2429
August 18, 2018	2	37.65	13590	302	15640	14	608	-2348

August 18, 2018	3	27.61	13209	286	15424	18	264	-2199
August 18, 2018	4	14.36	13028	285	15421	18	342	-2474
August 18, 2018	5	14.34	13079	260	15332	18	346	-2369
August 18, 2018	6	14.33	13298	295	15593	18	349	-2390
August 18, 2018	7	16.09	13804	276	15545	18	364	-1921
August 18, 2018	8	23.14	14815	248	15781	18	976	-1775
August 18, 2018	9	31.95	15629	238	16457	17	491	-1145
August 18, 2018	10	30.48	16245	220	16740	19	1592	-1920
August 18, 2018	11	33.13	16595	232	17105	18	1827	-2153
August 18, 2018	12	34.05	16747	270	17283	18	1650	-1998
August 18, 2018	13	43.25	16934	254	17385	17	1878	-2130
August 18, 2018	14	35.3	17001	277	17412	18	1910	-2052
August 18, 2018	15	34.37	17088	296	17683	18	1811	-2175
August 18, 2018	16	35.26	17230	267	18107	19	1206	-1904
August 18, 2018	17	35.28	17536	276	18274	18	1506	-2060
August 18, 2018	18	35.27	17485	278	17954	19	1718	-1986
August 18, 2018	19	35.26	17149	255	17530	18	1818	-1986
August 18, 2018	20	35.32	16988	294	17443	19	1263	-1498
August 18, 2018	21	35.22	16634	286	16950	18	1257	-1321
August 18, 2018	22	35.55	15792	300	16227	18	1274	-1461
August 18, 2018	23	28.77	14729	255	15529	18	1134	-1646
August 18, 2018	24	23.79	13801	257	15090	17	1021	-2041
August 19, 2018	1	18.33	13019	228	15008	18	375	-2076
August 19, 2018	2	17.72	12474	196	14951	18	226	-2509
August 19, 2018	3	14.34	12090	199	14685	18	296	-2687
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August 19, 2018	5	14.32	11979	203	14485	18	224	-2567
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August 19, 2018	7	10.08	12368	238	14887	18	14	-2372
August 19, 2018	8	10.54	13112	250	15426	18	14	-2166
August 19, 2018	9	10.54	13963	257	15671	18	329	-1907
August 19, 2018	10	23.92	14727	256	15924	18	840	-1804
August 19, 2018	11	23.05	15404	255	16253	18	1430	-2112
August 19, 2018	12	31.94	15925	238	16529	18	1850	-2235
August 19, 2018	13	30.47	16228	215	16680	18	1703	-1970
August 19, 2018	14	31.94	16480	231	16570	18	2040	-1907
August 19, 2018	15	26.12	16814	162	17026	19	1719	-1796
August 19, 2018	16	28.59	17339	194	17649	19	1231	-1450
August 19, 2018	17	31.79	17919	191	17810	15	1912	-1646
August 19, 2018	18	32.52	17897	241	17723	15	1664	-1256
August 19, 2018	19	23.14	17533	279	17566	15	1412	-1146
August 19, 2018	20	27.49	17462	258	17092	15	1925	-1227
August 19, 2018	21	19.46	17138	297	16535	15	2025	-996
August 19, 2018	22	24.88	15996	287	15402	14	1749	-833
August 19, 2018	23	18.08	14876	275	14672	14	1593	-1058
August 19, 2018	24	13.8	13990	303	14388	14	1775	-1840
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August 20, 2018	2	16.37	12822	289	14466	14	844	-2256
August 20, 2018	3	27.77	12600	300	14635	13	334	-2115
August 20, 2018	4	42.63	12613	281	14746	11	307	-2252

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August 20, 2018	6	18.69	14017	260	15282	12	715	-1732
August 20, 2018	7	21.16	15053	277	15598	13	1182	-1498
August 20, 2018	8	16.42	15976	215	15920	13	1737	-1483
August 20, 2018	9	24.92	16617	243	16898	13	1363	-1578
August 20, 2018	10	28.5	17200	243	17113	14	1818	-1577
August 20, 2018	11	33.88	17780	277	17671	21	1860	-1634
August 20, 2018	12	34.73	18206	308	18230	22	1825	-1606
August 20, 2018	13	35.25	18676	274	18686	47	1743	-1608
August 20, 2018	14	35.37	18937	249	18797	67	1646	-1361
August 20, 2018	15	35.15	19177	282	18964	68	1653	-1324
August 20, 2018	16	34.47	19436	260	19299	69	1658	-1455
August 20, 2018	17	31.33	19643	298	18768	70	2036	-979
August 20, 2018	18	31.66	19487	297	18489	66	2109	-886
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August 21, 2018	9	25.23	17292	186	17662	17	1138	-1406
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August 21, 2018	13	33.89	18389	239	18883	18	1201	-1478
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August 21, 2018	15	35.38	18575	241	19160	21	1173	-1535
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August 21, 2018	17	33.42	19221	213	19181	17	1819	-1508
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August 22, 2018	5	0	13141	185	15535	18	305	-2488
August 22, 2018	6	1.58	14089	189	15873	18	471	-2096

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August 22, 2018	8	29.73	15922	189	17326	17	899	-2198
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August 22, 2018	21	29.18	16208	183	16549	19	1721	-1801
August 22, 2018	22	20.06	15030	162	15539	18	1500	-1818
August 22, 2018	23	6.69	13753	185	14840	18	833	-1677
August 22, 2018	24	3.2	12840	157	14600	21	487	-2031
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August 23, 2018	9	29.37	15122	211	15457	17	1538	-1776
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August 23, 2018	11	15.34	15669	242	15985	20	1561	-1690
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August 23, 2018	17	33.35	17847	271	18272	19	1096	-1335
August 23, 2018	18	32.34	17932	266	18126	18	1587	-1551
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August 24, 2018	3	5.36	12250	232	14843	33	394	-2787
August 24, 2018	4	14.34	12195	262	14797	33	363	-2752
August 24, 2018	5	11.26	12634	262	14695	33	466	-2364
August 24, 2018	6	19.55	13510	243	14942	34	1029	-2315
August 24, 2018	7	17.06	14422	308	15414	33	1195	-1925
August 24, 2018	8	24.95	15204	256	16172	34	832	-1632

August 24, 2018	9	30.02	15854	257	16181	34	1578	-1680
August 24, 2018	10	31.45	16403	270	16562	34	1659	-1562
August 24, 2018	11	31.45	16823	255	17280	34	1347	-1606
August 24, 2018	12	19.89	17233	254	17309	34	1794	-1695
August 24, 2018	13	29.85	17582	292	17605	34	1834	-1642
August 24, 2018	14	31.57	17774	263	18073	34	1293	-1496
August 24, 2018	15	34.18	18020	249	18062	34	1456	-1490
August 24, 2018	16	80.64	18432	260	18663	32	1323	-1480
August 24, 2018	17	93.43	18582	281	18652	35	1773	-1649
August 24, 2018	18	38.69	18309	284	18099	36	1765	-1280
August 24, 2018	19	33.23	17938	298	17534	37	1732	-930
August 24, 2018	20	33.01	17883	330	17509	34	1623	-955
August 24, 2018	21	23.05	17321	342	16794	33	1817	-835
August 24, 2018	22	3.31	16128	335	16211	33	1259	-945
August 24, 2018	23	0	14875	314	15550	33	1665	-1990
August 24, 2018	24	0	13896	333	15355	18	1862	-2941
August 25, 2018	1	-0.04	13216	294	15053	18	1287	-2773
August 25, 2018	2	-0.02	12654	294	15048	18	1089	-3182
August 25, 2018	3	0	12301	295	15180	18	506	-3176
August 25, 2018	4	0	12206	294	15576	17	425	-3495
August 25, 2018	5	7.16	12273	267	15648	17	395	-3490
August 25, 2018	6	0	12564	246	15770	17	275	-3223
August 25, 2018	7	0	13187	206	16159	17	298	-3145
August 25, 2018	8	6.13	14200	200	16767	17	439	-2858
August 25, 2018	9	6.6	15202	168	17125	17	830	-2571
August 25, 2018	10	11.7	15884	271	17268	19	1592	-2730
August 25, 2018	11	25.3	16380	240	17867	22	1676	-2866
August 25, 2018	12	16.12	16607	290	18094	23	1389	-2622
August 25, 2018	13	4.13	16406	277	17619	23	1452	-2289
August 25, 2018	14	0	16019	241	17235	23	970	-1903
August 25, 2018	15	6.54	15893	230	17220	23	720	-1834
August 25, 2018	16	29.25	16160	243	17569	23	904	-2159
August 25, 2018	17	33.74	16482	236	17905	23	898	-2168
August 25, 2018	18	33	16619	242	18186	23	918	-2282
August 25, 2018	19	35.05	16382	276	18252	23	616	-2209
August 25, 2018	20	37.1	16436	274	18495	19	533	-2383
August 25, 2018	21	20.66	16079	293	17524	21	1264	-2331
August 25, 2018	22	27.36	15339	283	16681	22	1380	-2432
August 25, 2018	23	13.55	14429	284	16343	22	876	-2529
August 25, 2018	24	12.23	13580	304	16121	21	335	-2684
August 26, 2018	1	13.14	12970	308	15603	22	411	-2806
August 26, 2018	2	14.37	12554	328	15478	22	314	-2968
August 26, 2018	3	14.38	12320	261	15285	22	314	-3068
August 26, 2018	4	14.38	12198	244	15148	22	340	-3100
August 26, 2018	5	14.37	12257	254	14953	21	297	-2828
August 26, 2018	6	14.36	12437	313	15025	21	374	-2759
August 26, 2018	7	10.77	12937	273	15324	22	418	-2641
August 26, 2018	8	25.46	13935	252	15785	21	387	-2053
August 26, 2018	9	30.35	15116	235	16329	20	1035	-2043
August 26, 2018	10	29.62	15921	227	16428	20	1807	-2097

August 26, 2018	11	31.27	16464	234	16649	19	1506	-1451
August 26, 2018	12	30.61	17039	278	16916	19	1931	-1542
August 26, 2018	13	32.63	17497	229	17419	20	1935	-1636
August 26, 2018	14	34.83	17742	254	17798	20	1957	-1801
August 26, 2018	15	39.79	18145	230	18365	20	1946	-1957
August 26, 2018	16	36.82	18701	246	18814	19	2085	-1972
August 26, 2018	17	39.84	19330	291	19220	18	2046	-1662
August 26, 2018	18	43.97	19402	266	19517	20	2020	-1878
August 26, 2018	19	42.93	19082	289	19193	20	2037	-1828
August 26, 2018	20	44.69	18999	271	19110	20	2027	-1864
August 26, 2018	21	42.54	18400	282	18351	20	1917	-1470
August 26, 2018	22	34.86	17350	304	17521	20	1915	-1726
August 26, 2018	23	30.56	16090	307	16629	19	1876	-2099
August 26, 2018	24	26.42	14988	315	15844	18	1581	-2021
August 27, 2018	1	25.47	14104	294	15250	18	1225	-1973
August 27, 2018	2	20.73	13566	298	15118	19	1111	-2315
August 27, 2018	3	9.57	13284	217	15484	22	512	-2403
August 27, 2018	4	1.2	13222	262	15286	22	284	-2250
August 27, 2018	5	12.2	13822	213	16037	21	317	-2288
August 27, 2018	6	6.1	14879	243	16365	22	1148	-2418
August 27, 2018	7	11.26	16016	226	16751	17	1309	-1842
August 27, 2018	8	17.17	16960	256	17082	15	1890	-1723
August 27, 2018	9	29.8	17624	265	18044	20	1911	-2058
August 27, 2018	10	32.07	18332	264	18675	20	1911	-2058
August 27, 2018	11	33.13	18879	255	19441	28	1846	-2147
August 27, 2018	12	31.41	19114	205	19405	61	1950	-1914
August 27, 2018	13	26.91	19240	171	19606	68	1803	-2005
August 27, 2018	14	23.52	19340	175	20197	74	1344	-2042
August 27, 2018	15	20.2	19626	192	20332	80	1478	-2155
August 27, 2018	16	25.22	20177	191	20739	80	1605	-2186
August 27, 2018	17	29.55	20617	191	20746	81	2013	-2075
August 27, 2018	18	31.09	20773	178	20860	81	2019	-2106
August 27, 2018	19	31.84	20720	192	20943	80	1959	-2126
August 27, 2018	20	33.24	20830	214	21153	79	1974	-2109
August 27, 2018	21	31.11	20214	174	20429	73	1958	-2026
August 27, 2018	22	24.57	19011	178	19302	28	1848	-1909
August 27, 2018	23	20.08	17443	228	17882	20	1918	-2109
August 27, 2018	24	5.16	16108	268	16730	20	1535	-1864
August 28, 2018	1	0	15343	148	16164	20	1514	-2128
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August 28, 2018	3	0	14360	178	16459	19	389	-2291
August 28, 2018	4	0	14327	234	16861	19	404	-2739
August 28, 2018	5	0	14714	278	16683	22	582	-2255
August 28, 2018	6	0	15885	272	17159	23	1215	-2259
August 28, 2018	7	8.13	17290	292	17966	39	1863	-2305
August 28, 2018	8	31.17	18365	260	18989	71	1265	-1807
August 28, 2018	9	31.63	19233	276	19459	70	1838	-2036
August 28, 2018	10	33.74	19937	245	20251	71	1897	-2036
August 28, 2018	11	34.21	20313	182	20495	86	1922	-2131
August 28, 2018	12	33.41	20660	186	20962	86	1897	-2096

August 28, 2018	13	36.17	20912	187	21199	86	1649	-2086
August 28, 2018	14	54.88	21273	159	21746	85	1492	-2061
August 28, 2018	15	52.1	21401	113	21515	85	1849	-2126
August 28, 2018	16	58.84	21724	49	21443	87	1848	-1737
August 28, 2018	17	56.47	22051	47	21523	92	1950	-1591
August 28, 2018	18	45.82	21940	44	20865	87	1974	-1035
August 28, 2018	19	46.96	21607	45	20956	86	2071	-1604
August 28, 2018	20	61.54	21676	63	21144	87	1940	-1608
August 28, 2018	21	58.29	21084	79	20832	75	1984	-1702
August 28, 2018	22	35.17	19749	136	19789	31	1842	-1806
August 28, 2018	23	32.29	18185	272	18426	16	1781	-1731
August 28, 2018	24	29.19	16927	273	17040	16	1974	-1841
August 29, 2018	1	23.97	15994	263	16849	15	1549	-2112
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August 29, 2018	4	42.86	14770	258	16676	18	490	-2230
August 29, 2018	5	4.06	15102	255	16392	17	1183	-2195
August 29, 2018	6	5.97	16119	266	16669	14	1707	-2019
August 29, 2018	7	11.82	17263	252	17639	13	1381	-1575
August 29, 2018	8	42.6	18538	264	18753	12	1425	-1643
August 29, 2018	9	37.49	19354	172	19314	14	1909	-1657
August 29, 2018	10	48.52	19987	189	19683	20	1863	-1451
August 29, 2018	11	57.18	20505	151	20333	20	1959	-1693
August 29, 2018	12	45.73	20589	158	19850	19	2041	-1268
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August 29, 2018	14	50.28	20817	125	19772	30	2080	-902
August 29, 2018	15	33.96	20326	157	19154	29	2330	-1060
August 29, 2018	16	35.06	20666	168	19343	29	2333	-1096
August 29, 2018	17	35.45	20985	153	20229	31	2081	-1265
August 29, 2018	18	34.67	20678	186	20235	24	2013	-1460
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August 29, 2018	20	37.73	20462	172	19905	19	1932	-1280
August 29, 2018	21	34.43	19658	241	19286	20	2043	-1436
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August 29, 2018	23	25.68	16469	330	16910	12	1920	-2000
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August 30, 2018	3	30.44	13143	326	14923	11	672	-2150
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August 30, 2018	5	34.97	13389	356	15283	11	504	-2150
August 30, 2018	6	21.81	14276	313	15532	17	1165	-2150
August 30, 2018	7	26.69	15258	280	15831	14	1787	-2058
August 30, 2018	8	30.83	15859	244	16024	13	1859	-1731
August 30, 2018	9	30.92	16183	233	16028	14	1915	-1561
August 30, 2018	10	30.95	16337	314	16172	28	1889	-1524
August 30, 2018	11	31.45	16291	309	16388	33	1889	-1746
August 30, 2018	12	30.93	16231	304	16266	33	1908	-1662
August 30, 2018	13	31.47	16275	253	16298	32	1608	-1444
August 30, 2018	14	30.48	16263	257	16027	13	1889	-1431

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August 30, 2018	18	34.5	16933	248	16502	16	1908	-1450
August 30, 2018	19	34.48	17021	274	16561	17	1928	-1268
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August 30, 2018	21	32.12	16652	309	15938	21	1954	-844
August 30, 2018	22	24.02	15557	308	14863	21	1908	-898
August 30, 2018	23	16.56	14289	309	14206	17	1804	-1412
August 30, 2018	24	8.84	13259	335	13837	16	1210	-1452
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August 31, 2018	2	14.34	12295	344	13968	17	284	-1671
August 31, 2018	3	14.35	12109	331	14053	17	314	-1984
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August 31, 2018	6	16.26	13364	296	14709	17	760	-1941
August 31, 2018	7	29.05	14327	221	14997	16	1361	-1840
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August 31, 2018	9	30.39	15288	195	15597	16	1587	-1839
August 31, 2018	10	31.62	15624	249	15674	16	1859	-1733
August 31, 2018	11	32.55	15862	216	16042	16	1910	-1931
August 31, 2018	12	38.06	16106	209	16743	17	1910	-2425
August 31, 2018	13	34.59	16373	255	16755	20	1905	-2123
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August 31, 2018	15	43.69	16733	233	17556	21	1198	-1869
August 31, 2018	16	32.84	17114	244	17413	23	1905	-2017
August 31, 2018	17	34.19	17473	246	17535	17	1931	-1883
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August 31, 2018	19	33.22	17132	236	16917	21	1916	-1453
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August 31, 2018	22	25.01	15391	309	15451	19	1167	-1035
August 31, 2018	23	6.45	14122	304	14187	17	1514	-1269
August 31, 2018	24	5.97	13205	288	13907	17	1719	-2174
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September 1, 2018	5	14.33	11803	262	14514	17	199	-2718
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September 1, 2018	7	18.8	12576	240	14699	18	271	-2233
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September 1, 2018	10	27.36	15080	217	15354	18	1810	-1886
September 1, 2018	11	30.46	15670	194	15451	20	1932	-1549
September 1, 2018	12	33.04	16206	177	16206	20	1932	-1719
September 1, 2018	13	33.21	16675	196	16721	21	1932	-1815
September 1, 2018	14	37.45	17163	241	17264	20	1932	-1899
September 1, 2018	15	46.42	17671	257	17857	16	1743	-1875
September 1, 2018	16	53.9	18295	235	18447	18	1944	-1931

September 1, 2018	17	55.62	18740	252	18738	19	1972	-1743
September 1, 2018	18	52.36	18577	240	18131	19	2096	-1460
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September 3, 2018	5	54.22	13463	227	15112	19	737	-2188
September 3, 2018	6	20.59	13728	235	14808	22	658	-1498
September 3, 2018	7	12.5	14191	226	14825	21	518	-981
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September 3, 2018	18	224.78	20504	150	20245	19	1893	-1450

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September 3, 2018	22	33.81	18082	264	17325	21	1887	-771
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September 4, 2018	1	22.31	14523	280	14924	19	1740	-1875
September 4, 2018	2	19.89	13961	286	14459	19	1740	-1965
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September 4, 2018	22	50.02	19007	252	18007	28	1836	-654
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September 5, 2018	1	18.03	15263	254	15470	20	1746	-1747
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September 5, 2018	3	19.18	14219	348	15665	20	623	-1786
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September 5, 2018	6	16.62	15951	317	16393	18	1609	-1828
September 5, 2018	7	27.67	17385	275	17036	18	2058	-1577
September 5, 2018	8	34.98	18510	260	17954	17	1929	-1288
September 5, 2018	9	52.72	19529	255	18925	20	1900	-1214
September 5, 2018	10	70.21	20507	262	19683	22	2005	-1034
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September 5, 2018	12	36.99	21693	124	19453	52	2515	-293
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September 5, 2018	14	34	22125	52	20910	92	2237	-1118
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September 5, 2018	16	48.17	22689	43	21584	93	2358	-1478
September 5, 2018	17	55.92	23005	42	21680	93	2272	-1225
September 5, 2018	18	56.24	22864	41	21727	93	2094	-1075
September 5, 2018	19	48.13	22647	43	21492	89	2259	-1148
September 5, 2018	20	39.37	22722	57	20806	94	2544	-804

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September 6, 2018	2	47.59	15483	200	15769	19	983	-1178
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September 6, 2018	4	33.78	14818	292	15774	16	568	-1327
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September 6, 2018	7	43.92	17526	253	17021	19	1906	-1197
September 6, 2018	8	34.44	17884	284	17366	19	1564	-817
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September 6, 2018	10	36.21	18388	259	17888	21	1932	-1202
September 6, 2018	11	38.29	18542	269	18556	18	1773	-1592
September 6, 2018	12	40.76	18544	279	18662	19	1774	-1643
September 6, 2018	13	42.68	18692	251	19014	27	1773	-1903
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September 6, 2018	19	36.82	19083	253	18974	18	1744	-1405
September 6, 2018	20	32.23	18947	244	18526	19	1809	-1212
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September 8, 2018	2	0	11820	288	14951	17	259	-3233
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September 8, 2018	5	-0.11	11543	296	14186	16	259	-2629
September 8, 2018	6	0	11906	304	14772	17	259	-2840
September 8, 2018	7	0	12276	283	15153	17	259	-2867
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September 8, 2018	10	5.38	13258	246	15749	17	341	-2607
September 8, 2018	11	14.37	13255	229	15939	17	263	-2753
September 8, 2018	12	1.31	13171	253	15934	17	263	-2757
September 8, 2018	13	0.9	13048	224	15771	20	296	-2773
September 8, 2018	14	1.36	12978	187	15590	17	304	-2701
September 8, 2018	15	15.37	13038	259	15797	17	238	-2765
September 8, 2018	16	18.12	13407	210	15720	17	263	-2375
September 8, 2018	17	25.63	13820	238	16091	17	349	-2409
September 8, 2018	18	14.86	14017	223	16041	17	523	-2323
September 8, 2018	19	14.34	14156	219	16054	17	505	-2104
September 8, 2018	20	18.25	14314	246	16515	17	452	-2313
September 8, 2018	21	12.24	13773	208	16322	16	282	-2566
September 8, 2018	22	16.47	13047	251	15840	17	349	-2831
September 8, 2018	23	0	12197	241	15031	17	259	-2806
September 8, 2018	24	-0.29	11538	236	14420	17	259	-2835
September 9, 2018	1	-3	11051	233	13920	17	259	-2751
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September 9, 2018	15	0	12859	188	15849	17	252	-3016
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September 9, 2018	18	0	13956	175	16519	18	266	-2589
September 9, 2018	19	0	14262	169	16387	18	403	-2275
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September 10, 2018	20	26.65	16169	284	16524	17	1750	-1744
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September 11, 2018	9	24.28	15103	254	15792	19	1209	-1669
September 11, 2018	10	28.82	15225	230	15967	18	1120	-1690
September 11, 2018	11	23.66	15256	213	15836	28	1323	-1668
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September 11, 2018	14	29.59	15358	308	16066	19	1643	-1995
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September 12, 2018	18	33.44	17161	253	17196	15	1576	-1433
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September 17, 2018	3	29.79	13187	209	15409	19	706	-2668
September 17, 2018	4	24.58	13205	196	15237	19	326	-2156
September 17, 2018	5	11.73	13727	174	14974	19	1370	-2423
September 17, 2018	6	21.74	15094	183	16003	19	1603	-2403
September 17, 2018	7	17.38	16436	170	16683	18	1798	-1883
September 17, 2018	8	30.38	17171	182	17208	19	1737	-1681
September 17, 2018	9	31.06	17784	166	17663	16	1569	-1253
September 17, 2018	10	37.24	18527	184	18524	20	1710	-1661
September 17, 2018	11	41.73	19207	188	18935	30	1717	-1322
September 17, 2018	12	56.9	19585	193	19551	29	1746	-1567
September 17, 2018	13	56.11	19959	176	19366	21	1833	-1026
September 17, 2018	14	55.9	20183	193	19542	49	2080	-1304
September 17, 2018	15	59.61	20432	169	19661	88	2053	-1251
September 17, 2018	16	60.36	20883	131	19676	89	2451	-1261
September 17, 2018	17	52.28	20993	119	19356	90	2611	-931
September 17, 2018	18	53.08	20798	152	19570	84	2014	-807
September 17, 2018	19	57	20655	136	19489	74	1943	-721
September 17, 2018	20	56.6	20471	196	19477	73	1781	-708
September 17, 2018	21	50.68	19525	195	19217	31	1738	-1212
September 17, 2018	22	36.58	17930	221	17735	19	1742	-1292
September 17, 2018	23	22.51	16246	241	16033	19	1746	-1217
September 17, 2018	24	13.96	14996	231	15335	19	1776	-1808
September 18, 2018	1	7.19	14151	288	15021	19	1406	-1885
September 18, 2018	2	16.7	13629	281	15097	19	1131	-2296
September 18, 2018	3	21.39	13344	268	15051	19	1028	-2421
September 18, 2018	4	14.39	13369	234	15060	19	975	-2433
September 18, 2018	5	8.39	13949	182	15296	19	1247	-2409
September 18, 2018	6	31.7	15204	195	16242	19	1408	-2321
September 18, 2018	7	36.68	16532	234	17123	18	1758	-2298
September 18, 2018	8	41.69	17222	202	17542	19	1666	-1891

September 18, 2018	9	35.33	17641	158	17719	19	1641	-1623
September 18, 2018	10	40.76	17865	155	17577	19	1636	-1280
September 18, 2018	11	35.59	18165	195	17760	21	1649	-1174
September 18, 2018	12	39.73	18458	181	18139	21	1550	-1208
September 18, 2018	13	39.9	18717	204	18602	41	1650	-1342
September 18, 2018	14	46.34	19257	240	18865	71	1838	-1607
September 18, 2018	15	55.18	19429	217	19195	71	2000	-1731
September 18, 2018	16	61.4	19970	221	19525	71	2079	-1681
September 18, 2018	17	69.37	20245	226	19925	70	1919	-1531
September 18, 2018	18	60.59	19750	236	19628	70	2083	-1659
September 18, 2018	19	41.75	19217	228	18891	69	1937	-1443
September 18, 2018	20	35.56	18667	238	18977	72	1710	-1798
September 18, 2018	21	32.86	17416	215	17545	29	1717	-1582
September 18, 2018	22	23.54	15917	233	16481	19	1706	-1965
September 18, 2018	23	26.48	14584	226	15384	18	1704	-2271
September 18, 2018	24	30.54	13480	241	14793	20	1385	-2361
September 19, 2018	1	28.92	12893	226	14582	20	1103	-2510
September 19, 2018	2	44.59	12501	234	14601	19	720	-2565
September 19, 2018	3	16.93	12272	252	14333	20	467	-2242
September 19, 2018	4	14.38	12262	247	14703	20	252	-2446
September 19, 2018	5	0	12634	199	14559	20	925	-2513
September 19, 2018	6	16.54	13861	220	15358	20	1222	-2567
September 19, 2018	7	29.32	15134	194	15908	15	1649	-2269
September 19, 2018	8	30.81	15488	220	16107	15	1721	-2112
September 19, 2018	9	30.81	15571	201	16254	21	1660	-2103
September 19, 2018	10	32.39	15707	208	16592	17	1401	-2053
September 19, 2018	11	32.75	15806	199	16779	15	1181	-1911
September 19, 2018	12	33.03	15983	195	16785	22	1467	-2093
September 19, 2018	13	33.25	16174	172	16860	22	1358	-1896
September 19, 2018	14	32.87	16440	164	16938	21	1456	-1817
September 19, 2018	15	32.77	16748	150	17197	16	1482	-1766
September 19, 2018	16	35.39	17253	190	17368	15	1783	-1789
September 19, 2018	17	35.84	17624	231	17958	13	1822	-2012
September 19, 2018	18	36.03	17459	228	17864	13	1706	-1912
September 19, 2018	19	41.1	17591	203	17705	15	1679	-1571
September 19, 2018	20	34.12	17449	221	17296	15	1714	-1235
September 19, 2018	21	38.28	16509	197	16889	15	1707	-1858
September 19, 2018	22	26.04	15235	219	15388	16	1706	-1522
September 19, 2018	23	11.99	14050	204	14425	15	1679	-1829
September 19, 2018	24	5.46	13088	167	14094	15	1667	-2333
September 20, 2018	1	5.28	12548	185	14151	14	1452	-2817
September 20, 2018	2	8.37	12153	163	14402	15	812	-2762
September 20, 2018	3	0	11919	207	14251	14	416	-2531
September 20, 2018	4	0	11963	225	14624	14	363	-2783
September 20, 2018	5	5.28	12452	231	15127	14	349	-2808
September 20, 2018	6	27.81	13635	223	15350	14	1082	-2546
September 20, 2018	7	29.18	14817	217	15889	14	1346	-2166
September 20, 2018	8	30.9	15337	214	15962	14	1565	-1944
September 20, 2018	9	30.92	15521	170	15995	14	1658	-1842
September 20, 2018	10	33.06	15780	159	16725	11	1209	-2017

September 20, 2018	11	31.63	15937	154	16794	15	1365	-2066
September 20, 2018	12	30.53	15819	157	16455	15	1580	-1966
September 20, 2018	13	30.54	16002	155	16147	14	1789	-1841
September 20, 2018	14	29.27	16006	122	16219	15	1640	-1748
September 20, 2018	15	6.75	15892	125	16128	15	1640	-1665
September 20, 2018	16	0	16072	116	16060	16	1687	-1466
September 20, 2018	17	0	16313	166	16466	16	1655	-1639
September 20, 2018	18	28.1	16313	184	16791	16	1405	-1630
September 20, 2018	19	29.08	16761	125	17116	15	1749	-1782
September 20, 2018	20	24.65	16631	178	16947	16	1808	-1783
September 20, 2018	21	12.89	15852	145	16146	16	1741	-1789
September 20, 2018	22	6.96	14824	148	15822	16	1255	-2003
September 20, 2018	23	2.88	13595	148	15350	16	955	-2401
September 20, 2018	24	-0.01	12759	197	14784	15	301	-2033
September 21, 2018	1	-0.01	12314	239	14746	15	237	-2354
September 21, 2018	2	-0.01	11982	226	14741	16	237	-2635
September 21, 2018	3	-0.03	11835	203	14764	17	237	-2820
September 21, 2018	4	-0.01	11970	232	14725	16	237	-2805
September 21, 2018	5	0	12503	222	15218	16	237	-2897
September 21, 2018	6	3.59	13882	211	16604	17	237	-2849
September 21, 2018	7	9.63	15353	234	17460	17	259	-2221
September 21, 2018	8	13.63	16143	212	18191	17	217	-2027
September 21, 2018	9	11.04	16709	225	18463	16	434	-1964
September 21, 2018	10	11.69	17296	231	19013	16	448	-2034
September 21, 2018	11	17.11	17826	188	19683	16	268	-2021
September 21, 2018	12	29.61	18383	230	20230	16	255	-2027
September 21, 2018	13	30.44	18738	191	20566	17	457	-2135
September 21, 2018	14	29.98	18902	197	20373	29	917	-2166
September 21, 2018	15	30.62	18787	164	20717	18	183	-1952
September 21, 2018	16	27.83	18927	205	20291	19	790	-2080
September 21, 2018	17	21.56	18697	179	19859	19	1016	-1955
September 21, 2018	18	5.55	17808	202	19024	17	1197	-1880
September 21, 2018	19	23.64	17438	164	18595	17	275	-1272
September 21, 2018	20	28.45	17032	182	18547	15	486	-1748
September 21, 2018	21	6.74	15901	223	17652	14	396	-1879
September 21, 2018	22	0.46	14509	249	16757	14	279	-2231
September 21, 2018	23	0	13161	256	15643	14	159	-2324
September 21, 2018	24	-0.98	12020	275	14449	14	246	-2319
September 22, 2018	1	-2.05	11396	235	13843	14	292	-2369
September 22, 2018	2	-3	11040	218	13494	14	349	-2485
September 22, 2018	3	-3.55	10836	226	13288	14	266	-2461
September 22, 2018	4	-4.1	10787	205	13203	14	307	-2495
September 22, 2018	5	-3.64	10961	198	13281	14	298	-2435
September 22, 2018	6	10.83	11427	205	14231	15	260	-2945
September 22, 2018	7	5.77	11958	196	14547	15	218	-2581
September 22, 2018	8	4.05	12534	205	14514	14	549	-2263
September 22, 2018	9	4.17	12817	185	14855	14	346	-2215
September 22, 2018	10	0	12992	192	15072	14	299	-2255
September 22, 2018	11	8.83	13075	199	15157	14	309	-2228
September 22, 2018	12	14.37	12963	197	15088	14	306	-2243

September 22, 2018	13	15.64	12852	184	15019	15	347	-2326
September 22, 2018	14	8.05	12798	182	15008	14	159	-2192
September 22, 2018	15	11.56	12861	180	15052	15	159	-2217
September 22, 2018	16	23.16	13266	208	15468	15	159	-2217
September 22, 2018	17	22.47	13770	189	15840	15	159	-2167
September 22, 2018	18	14.36	14035	208	15976	15	482	-2217
September 22, 2018	19	12.26	14321	190	15648	15	1014	-2192
September 22, 2018	20	19.83	14362	189	15068	14	1581	-2059
September 22, 2018	21	23.43	13793	236	15037	13	959	-1970
September 22, 2018	22	25.67	13059	238	14900	14	646	-2244
September 22, 2018	23	20.94	12201	235	14238	15	316	-2081
September 22, 2018	24	-0.72	11558	241	13595	15	354	-2065
September 23, 2018	1	10.71	11095	220	13662	12	259	-2583
September 23, 2018	2	5.43	10763	237	13363	15	305	-2612
September 23, 2018	3	-4.1	10673	229	13142	15	213	-2446
September 23, 2018	4	1.13	10577	222	13167	14	255	-2602
September 23, 2018	5	-2.75	10679	220	13266	15	288	-2635
September 23, 2018	6	1.44	10954	240	13599	13	314	-2661
September 23, 2018	7	-2.05	11335	195	13861	15	160	-2461
September 23, 2018	8	2.95	11791	198	14136	15	168	-2180
September 23, 2018	9	12.95	12247	205	14359	14	257	-2156
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September 23, 2018	11	17.24	12633	196	14662	15	252	-2078
September 23, 2018	12	24.53	12777	210	14762	15	321	-2075
September 23, 2018	13	17.25	12828	191	14978	14	272	-2246
September 23, 2018	14	14.34	12831	200	14875	14	298	-2094
September 23, 2018	15	16.51	13166	192	15292	14	189	-2234
September 23, 2018	16	20.44	13750	204	15514	14	462	-2052
September 23, 2018	17	63.93	14438	198	16093	11	527	-2026
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September 23, 2018	19	13.67	15000	246	15945	13	1148	-1766
September 23, 2018	20	6.44	14959	223	15926	13	885	-1455
September 23, 2018	21	1.97	14281	209	15759	13	269	-1504
September 23, 2018	22	1.47	13439	289	15677	13	294	-2194
September 23, 2018	23	0.48	12542	309	15418	13	349	-2821
September 23, 2018	24	0	11843	316	14986	13	283	-3058
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September 24, 2018	5	0	11803	273	14633	13	349	-2885
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September 24, 2018	13	0	14369	283	16999	13	317	-2678
September 24, 2018	14	0	14388	238	17141	13	301	-2852

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September 25, 2018	9	82.87	15603	275	17271	14	842	-2213
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September 25, 2018	15	4.8	16133	317	17594	14	1125	-2307
September 25, 2018	16	10.51	16411	307	17585	14	1299	-2199
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September 26, 2018	15	0	15023	253	16805	16	752	-2373
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September 26, 2018	23	15.75	13240	338	15120	14	750	-2414
September 26, 2018	24	17.59	12452	339	15009	13	416	-2555
September 27, 2018	1	15.7	11984	249	14517	13	299	-2561
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September 27, 2018	3	14.35	11568	292	14208	13	228	-2560
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September 27, 2018	11	14.36	14501	244	15918	14	798	-2056
September 27, 2018	12	15.68	14451	284	16135	16	530	-2036
September 27, 2018	13	24.71	14585	309	16448	14	475	-2129
September 27, 2018	14	14.38	14602	282	16166	14	771	-2109
September 27, 2018	15	12.74	14744	286	15953	14	1129	-2189
September 27, 2018	16	29.93	15322	308	16252	13	1527	-2193
September 27, 2018	17	77.34	15625	301	16540	13	1411	-2082
September 27, 2018	18	27.98	15721	306	16140	16	1555	-1744
September 27, 2018	19	19.31	16199	280	16177	14	1708	-1322
September 27, 2018	20	12.96	16052	279	16242	13	1716	-1487
September 27, 2018	21	14.11	15356	292	16041	13	1488	-1879
September 27, 2018	22	10.25	14284	279	15594	30	1071	-2068
September 27, 2018	23	5.46	13195	262	15074	15	510	-2077
September 27, 2018	24	4.84	12381	285	14965	13	334	-2511
September 28, 2018	1	14.37	11836	314	14799	13	303	-2874
September 28, 2018	2	18.77	11541	313	14747	13	304	-3028
September 28, 2018	3	0.49	11416	340	14392	13	271	-2857
September 28, 2018	4	7.15	11447	319	14574	13	269	-2988
September 28, 2018	5	0.46	11920	324	14977	13	276	-2980
September 28, 2018	6	1.43	13114	297	15431	13	301	-2305
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September 28, 2018	9	11.55	14362	238	16475	13	372	-2190
September 28, 2018	10	10.84	14325	246	16805	13	276	-2488
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September 28, 2018	12	5.88	14424	308	16906	13	271	-2427
September 28, 2018	13	0	14524	305	16928	23	259	-2318
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September 28, 2018	15	86.53	14794	239	17061	13	283	-2353
September 28, 2018	16	41.04	15027	345	16925	12	416	-1891
September 28, 2018	17	21.87	15263	309	16925	13	427	-1782
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September 28, 2018	22	9.43	13819	293	16226	13	259	-2347
September 28, 2018	23	21.96	12892	311	15702	13	250	-2765
September 28, 2018	24	8.62	12089	298	14733	13	222	-2484
September 29, 2018	1	0	11594	274	14182	13	222	-2475
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September 29, 2018	3	-4.1	11128	268	13364	13	188	-2107
September 29, 2018	4	-4.1	11053	309	13310	13	188	-2107
September 29, 2018	5	-3.28	11212	300	13481	13	188	-2099
September 29, 2018	6	0.95	11721	298	14514	13	159	-2699
September 29, 2018	7	3.43	12292	305	14966	13	314	-2673
September 29, 2018	8	10.01	12768	235	15369	13	308	-2672
September 29, 2018	9	5.41	13069	249	15118	13	259	-2014
September 29, 2018	10	0	13085	245	15048	13	259	-1921
September 29, 2018	11	0	13148	221	15076	13	259	-1938
September 29, 2018	12	0	13038	251	15113	13	193	-1932
September 29, 2018	13	0	12814	241	14961	13	177	-2031
September 29, 2018	14	0	12695	223	14930	13	64	-2059
September 29, 2018	15	0	12745	236	14922	13	89	-2005
September 29, 2018	16	4.73	13113	189	15182	13	139	-2043
September 29, 2018	17	107.01	13706	216	15717	13	259	-2119
September 29, 2018	18	104.4	14052	235	15727	13	227	-1702
September 29, 2018	19	38.5	14384	215	15387	12	936	-1671
September 29, 2018	20	7.34	14271	231	15051	13	1290	-1737
September 29, 2018	21	58.57	13796	223	15091	13	722	-1760
September 29, 2018	22	19.32	13077	243	15080	13	175	-1848
September 29, 2018	23	8.65	12252	185	14708	13	216	-2344
September 29, 2018	24	4.97	11585	238	14286	13	188	-2593
September 30, 2018	1	2.55	11170	231	14166	14	221	-2951
September 30, 2018	2	0.96	10855	231	13835	14	238	-2919
September 30, 2018	3	-0.07	10701	196	13609	14	188	-2864
September 30, 2018	4	-0.3	10671	221	13523	14	263	-2842
September 30, 2018	5	0.42	10764	258	13698	13	230	-2840
September 30, 2018	6	10.83	11191	237	14311	13	167	-3061
September 30, 2018	7	8.74	11688	212	14529	13	230	-2813
September 30, 2018	8	17.66	12460	230	15159	12	210	-2707
September 30, 2018	9	121.99	13219	246	15724	13	159	-2399
September 30, 2018	10	235.61	13619	216	16036	14	270	-2488
September 30, 2018	11	46.04	13947	260	15891	15	313	-1975
September 30, 2018	12	68.5	13973	242	15818	14	378	-1927
September 30, 2018	13	101.6	13996	237	15641	15	328	-1720
September 30, 2018	14	17.57	14001	246	15360	15	455	-1529
September 30, 2018	15	68.22	14172	232	15457	14	585	-1616
September 30, 2018	16	195.8	14554	253	15889	12	563	-1668
September 30, 2018	17	51.17	14922	242	15613	13	1248	-1607
September 30, 2018	18	15.27	15143	248	15422	13	1528	-1515
September 30, 2018	19	14.36	15371	218	15539	13	1579	-1369
September 30, 2018	20	10.1	15080	236	15313	13	1579	-1479

September 30, 2018	21	7.98	14394	249	15344	13	1046	-1646
September 30, 2018	22	8.43	13545	283	15172	13	495	-1785
September 30, 2018	23	2.8	12637	252	14957	13	253	-2183
September 30, 2018	24	3.73	12000	298	14914	13	263	-2796
October 1, 2018	1	14.31	11609	299	14682	13	136	-2776
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October 1, 2018	3	2.66	11440	261	14499	13	125	-2795
October 1, 2018	4	0	11522	274	14550	13	175	-2834
October 1, 2018	5	-0.31	12072	252	14595	13	177	-2424
October 1, 2018	6	6.05	13374	257	15603	14	218	-2230
October 1, 2018	7	24.22	14920	223	17024	14	266	-2242
October 1, 2018	8	62.04	15341	207	17312	12	327	-2018
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October 1, 2018	10	15.28	15455	324	16795	15	925	-1854
October 1, 2018	11	15.28	15365	273	16876	16	593	-1825
October 1, 2018	12	15.29	15359	301	17048	16	413	-1847
October 1, 2018	13	15.5	15333	306	17394	16	300	-1985
October 1, 2018	14	15.28	15225	328	17330	29	225	-2018
October 1, 2018	15	15.51	15279	290	17508	29	276	-2260
October 1, 2018	16	16.92	15647	319	17583	19	313	-1976
October 1, 2018	17	15.52	15955	298	17785	19	362	-1910
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October 1, 2018	20	14.95	16131	270	17394	19	983	-1911
October 1, 2018	21	15.47	15383	307	17247	19	331	-1893
October 1, 2018	22	14.28	14329	284	16677	19	270	-2348
October 1, 2018	23	8.55	13262	334	15849	19	134	-2413
October 1, 2018	24	10.1	12477	348	14978	19	252	-2427
October 2, 2018	1	14.35	11987	350	14916	19	139	-2699
October 2, 2018	2	0	11739	338	14426	19	125	-2408
October 2, 2018	3	-0.02	11611	343	14234	19	125	-2352
October 2, 2018	4	2.61	11694	337	14439	19	125	-2539
October 2, 2018	5	7.04	12223	311	14786	19	125	-2408
October 2, 2018	6	21.65	13530	295	15961	17	184	-2337
October 2, 2018	7	26.54	14953	291	17242	18	234	-2288
October 2, 2018	8	14.35	15309	324	17161	20	243	-1810
October 2, 2018	9	28.83	15452	237	17145	19	272	-1760
October 2, 2018	10	61.6	15599	173	17245	19	436	-1922
October 2, 2018	11	17.35	15656	195	17238	19	454	-1877
October 2, 2018	12	15.65	15604	222	17075	20	730	-1967
October 2, 2018	13	18.56	15615	245	17135	20	743	-2004
October 2, 2018	14	19.01	15552	251	17253	20	619	-2070
October 2, 2018	15	14.35	15556	254	17094	20	830	-2160
October 2, 2018	16	14.12	15779	251	17429	20	812	-2160
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October 2, 2018	18	12.12	16163	242	17353	19	1083	-2073
October 2, 2018	19	13.89	16532	267	17259	19	1377	-1897
October 2, 2018	20	15.96	16282	253	17254	19	1118	-1897
October 2, 2018	21	21.63	15550	229	17118	20	559	-1912
October 2, 2018	22	17.83	14422	258	16238	19	249	-1839

October 2, 2018	23	17.74	13363	258	15451	19	182	-2050
October 2, 2018	24	5.86	12530	298	14758	19	125	-2054
October 3, 2018	1	3.74	12034	306	14262	19	175	-2072
October 3, 2018	2	-4.1	11767	310	14041	19	125	-2036
October 3, 2018	3	0.21	11636	225	14084	19	125	-2379
October 3, 2018	4	-4.11	11728	231	13938	19	175	-2136
October 3, 2018	5	-3.44	12245	233	14458	19	175	-2153
October 3, 2018	6	9.48	13663	232	15489	19	149	-1730
October 3, 2018	7	20.62	15013	196	16801	19	198	-1754
October 3, 2018	8	26.73	15313	144	16862	18	245	-1655
October 3, 2018	9	14.61	15326	142	16604	19	479	-1652
October 3, 2018	10	15.03	15380	171	16767	20	383	-1618
October 3, 2018	11	14.57	15335	202	16955	19	259	-1639
October 3, 2018	12	11.92	15215	193	16610	19	532	-1724
October 3, 2018	13	16.96	15325	194	17019	19	202	-1742
October 3, 2018	14	13.01	15196	199	17338	19	202	-2157
October 3, 2018	15	9.93	15116	216	17279	19	271	-2214
October 3, 2018	16	7.62	15343	224	17294	19	214	-1942
October 3, 2018	17	10.98	15645	232	17660	20	214	-2131
October 3, 2018	18	9.65	15810	264	17647	20	212	-1836
October 3, 2018	19	9.21	16226	244	18343	20	336	-2256
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October 3, 2018	21	1.84	15211	233	17679	20	250	-2514
October 3, 2018	22	0	14104	246	16708	19	155	-2536
October 3, 2018	23	-0.03	12910	268	15670	19	134	-2603
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October 4, 2018	3	-4.2	11311	258	13660	19	125	-2128
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October 4, 2018	19	12.62	15957	290	18118	21	207	-2163
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October 5, 2018	11	42.06	14871	263	17337	27	253	-2465
October 5, 2018	12	47.61	14727	276	17308	19	175	-2342
October 5, 2018	13	0.39	14707	288	16575	18	251	-1727
October 5, 2018	14	10.01	14778	271	17266	20	144	-2272
October 5, 2018	15	12.57	14730	249	17320	28	84	-2433
October 5, 2018	16	20.3	14907	250	17045	28	97	-2008
October 5, 2018	17	29.16	15256	295	17422	27	133	-2116
October 5, 2018	18	16.33	15507	305	17113	29	760	-2098
October 5, 2018	19	28.76	15893	325	16842	18	1301	-1941
October 5, 2018	20	17.21	15649	299	16773	17	1300	-2075
October 5, 2018	21	15.3	15017	285	16888	19	812	-2287
October 5, 2018	22	18.43	14060	332	16679	21	155	-2297
October 5, 2018	23	9.41	13034	269	15765	20	134	-2534
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October 6, 2018	7	23.55	12519	319	15504	19	133	-2848
October 6, 2018	8	100.89	13325	321	16160	18	94	-2764
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October 6, 2018	12	33.05	14635	339	16532	19	83	-1637
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October 6, 2018	18	17.37	14752	285	16131	21	1220	-2229
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October 6, 2018	20	14.34	14719	325	16282	22	1130	-2301
October 6, 2018	21	33.24	14180	345	16461	16	704	-2574
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October 7, 2018	1	5.32	11362	321	14831	19	125	-3153
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October 11, 2018	6	0.46	13969	328	16786	13	14	-2353

October 11, 2018	7	5.32	15437	271	17771	12	87	-2201
October 11, 2018	8	5.87	15786	262	18113	12	106	-2161
October 11, 2018	9	0	15865	253	18474	12	44	-2262
October 11, 2018	10	2.88	15861	219	18334	26	77	-2325
October 11, 2018	11	3.32	15663	221	18033	17	164	-2281
October 11, 2018	12	2.87	15419	257	17694	12	57	-2006
October 11, 2018	13	4.25	15293	270	17563	13	58	-1996
October 11, 2018	14	1.43	15012	255	17471	13	170	-2259
October 11, 2018	15	0	15025	280	17559	13	85	-2279
October 11, 2018	16	0	15257	297	17804	13	158	-2361
October 11, 2018	17	0	15424	269	18008	13	190	-2437
October 11, 2018	18	0	15591	302	18194	13	117	-2383
October 11, 2018	19	0	15905	328	18632	13	14	-2329
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October 11, 2018	21	0	14925	351	17701	13	25	-2340
October 11, 2018	22	0	13835	354	16554	12	117	-2346
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October 11, 2018	24	-1.74	12019	363	15079	13	14	-2540
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October 12, 2018	3	-3.3	11138	297	14197	13	14	-2653
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October 12, 2018	5	-1.47	11831	347	14959	12	14	-2734
October 12, 2018	6	0.47	13159	363	15931	13	14	-2390
October 12, 2018	7	9.17	14585	314	17081	13	110	-2298
October 12, 2018	8	8.01	14797	259	17197	12	177	-2237
October 12, 2018	9	4.16	14580	248	17080	13	155	-2348
October 12, 2018	10	2.25	14507	244	16914	13	193	-2350
October 12, 2018	11	5.85	14494	274	16938	21	163	-2346
October 12, 2018	12	4.81	14334	227	16711	21	164	-2264
October 12, 2018	13	5.87	14325	244	16727	13	138	-2269
October 12, 2018	14	5.9	14279	304	16771	13	35	-2195
October 12, 2018	15	5.32	14380	295	16685	13	14	-2020
October 12, 2018	16	10.82	14623	296	16738	13	14	-1874
October 12, 2018	17	8.72	15159	310	17037	13	151	-1660
October 12, 2018	18	5.92	15537	279	17179	13	143	-1368
October 12, 2018	19	5.85	15757	276	16802	13	636	-1290
October 12, 2018	20	14.35	15533	288	17145	13	169	-1524
October 12, 2018	21	15.79	14995	295	17030	13	159	-1873
October 12, 2018	22	18.48	14114	245	16453	13	106	-2088
October 12, 2018	23	7.48	13076	290	15805	12	125	-2435
October 12, 2018	24	9.64	12273	371	15129	12	14	-2400
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October 13, 2018	5	-1.81	11452	288	14182	13	14	-2385
October 13, 2018	6	2.94	12022	298	14674	12	14	-2319
October 13, 2018	7	6.85	12834	268	14848	12	162	-1970
October 13, 2018	8	10.8	13459	299	15352	12	120	-1761

October 13, 2018	9	5.88	13729	285	15602	12	49	-1531
October 13, 2018	10	2.4	13753	310	15633	12	139	-1537
October 13, 2018	11	5.87	13807	317	15627	12	134	-1586
October 13, 2018	12	5.9	13733	262	15753	13	167	-1821
October 13, 2018	13	6.54	13407	250	15724	13	205	-2033
October 13, 2018	14	0	13161	274	15423	13	245	-2063
October 13, 2018	15	0	13187	271	15515	13	74	-2060
October 13, 2018	16	5.6	13517	288	15742	13	250	-2128
October 13, 2018	17	9.88	14097	295	16140	13	326	-2114
October 13, 2018	18	17.74	14622	277	16321	13	202	-1603
October 13, 2018	19	16.03	14890	229	16560	13	328	-1688
October 13, 2018	20	14.37	14552	233	16296	13	256	-1631
October 13, 2018	21	12.94	14033	251	15961	13	257	-1808
October 13, 2018	22	6.29	13362	243	15679	13	254	-2183
October 13, 2018	23	6.58	12542	246	14970	13	213	-2196
October 13, 2018	24	0.97	11882	283	14479	13	64	-2286
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October 14, 2018	3	-4.32	10930	250	13379	13	14	-2093
October 14, 2018	4	-4.39	10905	276	13320	12	14	-2100
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October 14, 2018	6	-0.2	11492	262	14114	13	14	-2312
October 14, 2018	7	5.8	12090	296	14725	13	114	-2384
October 14, 2018	8	5.86	12582	284	15107	13	80	-2207
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October 14, 2018	12	5.21	12763	206	15240	13	25	-2165
October 14, 2018	13	0	12594	274	15084	13	24	-2114
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October 14, 2018	15	4.91	12819	344	15387	16	24	-2164
October 14, 2018	16	5.62	13388	230	15615	13	181	-2153
October 14, 2018	17	81.92	14177	280	16395	12	165	-2154
October 14, 2018	18	117.18	14755	293	16559	13	167	-1643
October 14, 2018	19	9.77	15065	257	16133	13	888	-1510
October 14, 2018	20	7.76	14757	194	16079	13	582	-1648
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October 14, 2018	24	0	11778	239	14290	14	14	-2187
October 15, 2018	1	0	11404	269	13947	13	14	-2195
October 15, 2018	2	0	11230	330	13688	13	14	-2103
October 15, 2018	3	0	11210	364	13727	13	14	-2159
October 15, 2018	4	-0.26	11424	345	13845	13	114	-2176
October 15, 2018	5	1.5	12099	275	14350	13	168	-2175
October 15, 2018	6	5.72	13382	265	15179	13	212	-1726
October 15, 2018	7	13.68	14988	238	16709	13	262	-1747
October 15, 2018	8	13	15452	281	17167	13	296	-1689
October 15, 2018	9	5.97	15625	280	17561	13	262	-1898
October 15, 2018	10	5.77	15770	246	17763	12	350	-1973

October 15, 2018	11	5.1	15794	166	18081	12	265	-2285
October 15, 2018	12	3.27	15569	215	17861	13	267	-2311
October 15, 2018	13	0.46	15439	216	18055	12	263	-2547
October 15, 2018	14	0	15212	319	17824	13	193	-2474
October 15, 2018	15	0	15106	301	17708	13	229	-2490
October 15, 2018	16	0	15401	283	17991	13	220	-2472
October 15, 2018	17	0.78	15680	282	18271	13	236	-2511
October 15, 2018	18	0.95	15963	279	18551	13	244	-2511
October 15, 2018	19	5.83	16380	295	18936	13	260	-2511
October 15, 2018	20	5.82	16094	292	18695	13	218	-2500
October 15, 2018	21	0	15380	309	17940	13	232	-2520
October 15, 2018	22	0	14369	303	17034	13	236	-2538
October 15, 2018	23	0	13324	330	16055	13	226	-2532
October 15, 2018	24	-0.02	12596	318	15166	13	226	-2471
October 16, 2018	1	-2.77	12139	304	14494	13	236	-2108
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October 16, 2018	8	8.91	15466	260	17809	13	366	-2355
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October 16, 2018	19	5.71	16219	275	18668	14	129	-2138
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October 17, 2018	3	-3	11644	264	14213	14	191	-2391
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October 17, 2018	13	0	14628	246	17154	20	213	-2447
October 17, 2018	14	0	14573	250	17148	20	161	-2408
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October 18, 2018	4	0	12394	282	15071	14	195	-2512
October 18, 2018	5	0.96	13061	221	15513	14	225	-2414
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October 18, 2018	7	35.4	15965	234	17200	14	671	-1701
October 18, 2018	8	25.81	15996	230	17033	14	671	-1435
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October 23, 2018	11	2.7	15310	241	17399	13	154	-1968
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October 23, 2018	13	0	15115	195	17371	15	24	-1943
October 23, 2018	14	0	15091	200	17335	15	24	-1990
October 23, 2018	15	0.48	15198	257	17357	15	124	-1911
October 23, 2018	16	8.01	15624	297	17865	14	114	-2040
October 23, 2018	17	20.59	16038	280	18156	13	124	-2050
October 23, 2018	18	54.88	16435	233	18399	13	194	-1954

October 23, 2018	19	12.25	16812	197	18274	13	548	-1757
October 23, 2018	20	10.84	16408	250	17995	13	582	-1772
October 23, 2018	21	10.69	15663	217	17844	13	191	-1926
October 23, 2018	22	4.69	14689	313	17031	13	104	-1964
October 23, 2018	23	0.5	13632	304	16139	14	114	-2218
October 23, 2018	24	0	12876	277	15686	14	125	-2591
October 24, 2018	1	0	12444	286	15468	14	125	-2838
October 24, 2018	2	0	12204	289	15207	14	125	-2771
October 24, 2018	3	0	12208	190	15174	14	14	-2736
October 24, 2018	4	3.32	12376	199	15239	14	14	-2715
October 24, 2018	5	7.13	12899	202	15514	13	225	-2631
October 24, 2018	6	8.98	14383	166	15980	13	931	-2427
October 24, 2018	7	138.16	15859	231	17106	13	1069	-2180
October 24, 2018	8	123.95	15989	227	17078	13	1121	-1890
October 24, 2018	9	49.91	15682	230	16833	14	1141	-1905
October 24, 2018	10	14.38	15577	214	16655	13	1304	-2040
October 24, 2018	11	28.52	15544	210	16782	20	1205	-2149
October 24, 2018	12	17.71	15457	211	16899	19	1166	-2311
October 24, 2018	13	14.35	15545	249	17125	14	1233	-2437
October 24, 2018	14	14.35	15668	283	17287	14	1182	-2483
October 24, 2018	15	13.67	15902	226	17457	14	1323	-2579
October 24, 2018	16	36.41	16343	254	17999	13	1304	-2653
October 24, 2018	17	34.78	16803	213	18141	14	1333	-2473
October 24, 2018	18	57.41	17065	213	18352	15	1333	-2343
October 24, 2018	19	103.08	17209	206	18338	15	1333	-2117
October 24, 2018	20	48.27	16951	197	18098	15	1333	-2219
October 24, 2018	21	36.48	16267	210	17373	14	1333	-2137
October 24, 2018	22	22.66	15224	276	16585	14	1333	-2298
October 24, 2018	23	19.9	14100	282	16097	14	944	-2534
October 24, 2018	24	13.67	13431	206	15933	14	375	-2555
October 25, 2018	1	14.98	12896	307	15692	14	229	-2566
October 25, 2018	2	8.05	12655	310	15589	14	241	-2705
October 25, 2018	3	5.94	12570	261	15419	14	203	-2683
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October 25, 2018	5	5.91	13268	130	15796	14	394	-2648
October 25, 2018	6	18.78	14531	143	16453	14	947	-2635
October 25, 2018	7	37.88	16071	134	17472	14	1190	-2407
October 25, 2018	8	183.67	16354	145	17634	14	1369	-2520
October 25, 2018	9	35.86	16204	134	17490	15	1309	-2409
October 25, 2018	10	9.53	15954	120	17169	18	1291	-2351
October 25, 2018	11	-0.05	15654	116	16867	19	1291	-2341
October 25, 2018	12	30.26	15388	102	16731	17	1285	-2354
October 25, 2018	13	34.61	15274	110	16556	17	1323	-2464
October 25, 2018	14	24.34	15160	105	16657	15	1196	-2548
October 25, 2018	15	8.76	15215	133	16550	22	1286	-2428
October 25, 2018	16	29	15725	132	16936	23	1340	-2412
October 25, 2018	17	37.1	16151	139	17349	13	1340	-2415
October 25, 2018	18	56.3	16837	146	17635	10	1426	-2091
October 25, 2018	19	40.71	16955	175	17256	13	1526	-1538
October 25, 2018	20	43.23	16696	179	17293	15	1426	-1807

October 25, 2018	21	37.41	16078	227	16908	14	1476	-2065
October 25, 2018	22	32.7	15058	245	15986	15	1505	-2086
October 25, 2018	23	35.64	14034	227	15373	16	1499	-2479
October 25, 2018	24	26.79	13294	237	15228	15	919	-2505
October 26, 2018	1	35.56	12856	287	15337	13	617	-2717
October 26, 2018	2	30.92	12604	281	15100	14	569	-2694
October 26, 2018	3	16.29	12513	262	15037	14	484	-2653
October 26, 2018	4	33.25	12610	277	15321	13	274	-2682
October 26, 2018	5	17.44	13208	225	15403	17	775	-2660
October 26, 2018	6	22.75	14492	189	15917	15	1466	-2620
October 26, 2018	7	38.04	15930	206	17070	13	1187	-2104
October 26, 2018	8	35.36	16172	200	17251	14	951	-1729
October 26, 2018	9	37.93	16217	182	17527	13	1001	-2107
October 26, 2018	10	35.82	16155	188	17918	27	899	-2382
October 26, 2018	11	35.18	15951	193	17750	16	1083	-2609
October 26, 2018	12	33.97	15782	224	17032	14	1470	-2423
October 26, 2018	13	35.75	15591	185	17091	14	1202	-2469
October 26, 2018	14	34.59	15422	193	17248	14	843	-2418
October 26, 2018	15	14.37	15437	182	17385	14	607	-2302
October 26, 2018	16	23.81	15734	226	17576	14	734	-2311
October 26, 2018	17	32.68	16179	185	17557	14	1285	-2415
October 26, 2018	18	27.7	16549	189	17993	13	1293	-2405
October 26, 2018	19	23.07	16565	213	17887	13	1361	-2279
October 26, 2018	20	12.92	16248	213	17710	14	1157	-2316
October 26, 2018	21	19.66	15524	214	17621	13	727	-2507
October 26, 2018	22	12.68	14720	138	17139	14	318	-2545
October 26, 2018	23	10.87	13709	165	16388	14	250	-2663
October 26, 2018	24	1.45	12821	235	15463	14	272	-2492
October 27, 2018	1	0.49	12238	286	14929	15	254	-2557
October 27, 2018	2	0	11970	312	14714	16	137	-2528
October 27, 2018	3	0	11801	319	14717	15	125	-2591
October 27, 2018	4	0	11839	346	14841	15	125	-2745
October 27, 2018	5	0	12090	353	15112	15	137	-2772
October 27, 2018	6	2.89	12701	330	15471	14	252	-2676
October 27, 2018	7	5.83	13574	345	16335	13	169	-2623
October 27, 2018	8	8.99	14373	341	17117	13	169	-2609
October 27, 2018	9	11.54	14832	320	17603	13	196	-2645
October 27, 2018	10	21.64	15091	357	17686	13	233	-2563
October 27, 2018	11	34.23	15207	361	17885	13	251	-2591
October 27, 2018	12	23.32	15060	284	17713	13	225	-2553
October 27, 2018	13	14.38	14959	268	17566	13	238	-2553
October 27, 2018	14	14.35	14895	281	17528	13	254	-2552
October 27, 2018	15	31.56	15002	289	17584	13	254	-2568
October 27, 2018	16	35.58	15349	291	17923	13	280	-2594
October 27, 2018	17	28.6	15727	250	17711	12	890	-2586
October 27, 2018	18	34.99	15943	226	17331	13	645	-1733
October 27, 2018	19	33.42	15732	253	17000	14	1383	-2288
October 27, 2018	20	13.68	15361	284	16610	14	1379	-2271
October 27, 2018	21	21.98	14838	238	16343	14	1326	-2530
October 27, 2018	22	19.9	14205	295	15823	14	1363	-2628

October 27, 2018	23	18.87	13415	283	15691	13	698	-2633
October 27, 2018	24	30.29	12767	356	15723	12	136	-2679
October 28, 2018	1	17.14	12376	310	15347	15	125	-2709
October 28, 2018	2	14.39	12160	347	15132	15	125	-2697
October 28, 2018	3	14.39	12075	338	15064	14	125	-2693
October 28, 2018	4	17.16	12044	343	15073	13	125	-2741
October 28, 2018	5	14.37	12213	323	14822	13	414	-2652
October 28, 2018	6	17.14	12629	309	14947	13	371	-2320
October 28, 2018	7	21.69	13345	262	15090	13	750	-2229
October 28, 2018	8	17.16	13945	281	15120	13	1129	-1934
October 28, 2018	9	39.87	14573	316	15895	12	1110	-2093
October 28, 2018	10	68.11	14954	276	16276	14	666	-1677
October 28, 2018	11	34.6	15114	273	16144	14	1094	-1762
October 28, 2018	12	34.49	15167	318	16248	12	1097	-1742
October 28, 2018	13	15.76	15025	318	16398	13	602	-1528
October 28, 2018	14	11.56	14894	308	16317	13	823	-1740
October 28, 2018	15	10.85	15069	279	16569	13	550	-1702
October 28, 2018	16	20.48	15508	290	16853	13	808	-1819
October 28, 2018	17	42.28	16004	280	16900	13	1256	-1903
October 28, 2018	18	40.71	16295	250	17068	14	1178	-1615
October 28, 2018	19	36.62	16193	235	16908	15	926	-1369
October 28, 2018	20	34.96	15741	254	16661	14	1075	-1715
October 28, 2018	21	33.55	15098	248	16289	13	1075	-1941
October 28, 2018	22	20.53	14208	238	15709	13	1075	-2227
October 28, 2018	23	7.22	13278	324	15099	13	1075	-2432
October 28, 2018	24	10.11	12619	302	14966	13	509	-2518
October 29, 2018	1	8.42	12273	337	15295	13	152	-2709
October 29, 2018	2	0	12104	356	15117	13	152	-2733
October 29, 2018	3	0	12104	217	14989	13	152	-2726
October 29, 2018	4	0.97	12093	324	15043	13	152	-2714
October 29, 2018	5	1.45	12700	303	15584	13	152	-2678
October 29, 2018	6	2.43	14059	308	16525	13	518	-2637
October 29, 2018	7	15.97	15534	290	17144	13	722	-2087
October 29, 2018	8	34.64	15972	282	17703	12	568	-2006
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October 29, 2018	11	35.01	15860	274	18123	23	260	-2226
October 29, 2018	12	34.98	15630	306	18088	20	325	-2465
October 29, 2018	13	14.35	15427	298	18138	13	225	-2600
October 29, 2018	14	12.25	15135	317	17563	13	614	-2614
October 29, 2018	15	15.59	15187	310	17243	13	615	-2380
October 29, 2018	16	32.23	15667	301	18046	14	125	-2217
October 29, 2018	17	34.16	16230	297	18092	13	262	-1989
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October 29, 2018	22	10.84	14905	295	16352	13	722	-1767
October 29, 2018	23	13.64	13840	270	15955	13	250	-1995
October 29, 2018	24	14.37	13183	274	15939	13	154	-2566

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October 30, 2018	2	14.35	12574	233	15409	13	152	-2675
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October 30, 2018	4	17.11	12640	261	15380	13	152	-2590
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October 30, 2018	8	40.9	16154	199	17272	14	134	-945
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October 30, 2018	11	33.55	15202	235	16704	16	722	-1952
October 30, 2018	12	30.49	14834	253	16711	13	517	-2087
October 30, 2018	13	21.06	14609	225	16813	13	472	-2297
October 30, 2018	14	20.58	14473	221	16692	13	369	-2227
October 30, 2018	15	21.86	14545	206	16300	21	537	-1981
October 30, 2018	16	29.6	15281	317	16495	22	707	-1736
October 30, 2018	17	51.82	16035	299	17475	13	730	-1909
October 30, 2018	18	43.87	16603	331	17942	14	830	-1708
October 30, 2018	19	29.96	16661	309	17883	14	830	-1632
October 30, 2018	20	21.95	16292	322	17586	13	830	-1683
October 30, 2018	21	16.16	15689	269	17568	13	648	-2201
October 30, 2018	22	20.92	14742	256	17188	13	125	-2338
October 30, 2018	23	8.69	13545	318	16772	12	125	-2820
October 30, 2018	24	6.27	12705	329	15886	13	152	-2930
October 31, 2018	1	2.16	12231	320	15663	13	152	-3093
October 31, 2018	2	0	12054	234	15307	13	152	-3084
October 31, 2018	3	0	11886	262	15247	14	152	-3074
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October 31, 2018	5	1.89	12521	290	15750	13	152	-3057
October 31, 2018	6	8.01	13884	286	16607	13	152	-2708
October 31, 2018	7	49.61	15460	302	17600	13	193	-2093
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October 31, 2018	10	32.58	16222	248	17909	12	614	-2019
October 31, 2018	11	25.4	16215	256	18040	16	293	-1825
October 31, 2018	12	14.03	16080	275	17766	17	573	-1855
October 31, 2018	13	6.6	15986	271	18258	16	76	-2018
October 31, 2018	14	22.06	15890	260	18094	18	75	-2164
October 31, 2018	15	24.57	15941	231	18097	15	188	-2139
October 31, 2018	16	33.97	16094	317	18237	13	252	-2087
October 31, 2018	17	33.98	16170	306	17618	14	587	-1747
October 31, 2018	18	35.68	16205	273	17416	14	728	-1645
October 31, 2018	19	32.22	16083	318	17245	14	688	-1508
October 31, 2018	20	35.82	15892	326	17455	13	614	-1834
October 31, 2018	21	30.79	15416	327	17056	13	714	-1939
October 31, 2018	22	14.77	14516	352	16224	13	714	-1887
October 31, 2018	23	13.7	13531	319	15781	13	239	-1982
October 31, 2018	24	14.36	12733	326	15256	13	41	-2105
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November 1, 2018	15	38.15	16101	287	17521	14	824	-1862
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November 2, 2018	4	0.94	12104	295	14877	12	131	-2483
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November 2, 2018	15	43.17	16059	240	17198	18	725	-1632
November 2, 2018	16	48.66	16237	256	17389	17	849	-1787
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November 2, 2018	19	45.37	16659	260	17670	73	954	-1814
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November 2, 2018	21	79.6	15685	307	17045	62	844	-1857
November 2, 2018	22	32.84	14692	301	16097	14	854	-1825
November 2, 2018	23	30.65	13725	282	15252	14	742	-1835
November 2, 2018	24	19.55	12948	287	14472	13	618	-1868
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November 3, 2018	2	29.74	12116	293	14357	13	152	-2104
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November 3, 2018	6	5.85	12775	290	14567	12	580	-1975
November 3, 2018	7	27.97	13671	238	15049	12	371	-1628
November 3, 2018	8	71.4	14482	236	15880	13	717	-1880
November 3, 2018	9	71.24	14968	264	16230	14	625	-1539
November 3, 2018	10	10.13	15021	276	15817	14	775	-1115
November 3, 2018	11	6.49	14987	249	16143	12	403	-1195
November 3, 2018	12	5.93	14892	263	16533	12	625	-1976
November 3, 2018	13	11.53	14757	252	16943	12	625	-2510
November 3, 2018	14	5.93	14661	267	17334	12	125	-2488
November 3, 2018	15	13.65	14545	250	17218	12	174	-2476
November 3, 2018	16	15.93	14818	254	17346	12	187	-2484
November 3, 2018	17	22.07	15455	230	17705	12	125	-2193
November 3, 2018	18	33.87	15903	242	17867	12	390	-2059
November 3, 2018	19	30.17	15717	234	17526	12	614	-2099
November 3, 2018	20	19.5	15339	259	17159	12	466	-1990
November 3, 2018	21	32.96	14835	251	16923	12	125	-1963
November 3, 2018	22	34.4	14212	305	16678	13	89	-2261
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November 3, 2018	24	19.13	12780	233	15262	13	41	-2172
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November 4, 2018	5	13.34	11920	235	14519	12	91	-2388
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November 4, 2018	12	1.34	13124	317	15724	12	125	-2361
November 4, 2018	13	0	13129	309	15870	12	175	-2530
November 4, 2018	14	0	13139	299	15816	12	136	-2475
November 4, 2018	15	0	13436	323	16251	12	101	-2564
November 4, 2018	16	1.23	14039	289	16652	12	178	-2454
November 4, 2018	17	5.18	15120	310	17808	12	147	-2483
November 4, 2018	18	5.92	16095	283	18818	12	160	-2548
November 4, 2018	19	5.85	15857	300	18653	12	60	-2484
November 4, 2018	20	5.15	15539	313	18202	12	194	-2463
November 4, 2018	21	2.15	15059	315	17858	13	116	-2546
November 4, 2018	22	2.11	14405	322	17284	13	14	-2490
November 4, 2018	23	3.45	13564	327	16741	13	83	-2889
November 4, 2018	24	0	12915	306	16083	13	65	-2924
November 5, 2018	1	0	12347	304	15661	12	31	-2896
November 5, 2018	2	0	12012	257	15370	12	31	-3034
November 5, 2018	3	0	11837	280	15161	12	34	-3009
November 5, 2018	4	0	11957	277	14939	12	50	-2743
November 5, 2018	5	0	12084	292	15452	12	50	-3067
November 5, 2018	6	0	12798	278	16136	13	50	-3061

November 5, 2018	7	2.92	14185	201	17262	13	220	-3061
November 5, 2018	8	12.95	15576	166	18420	13	126	-2823
November 5, 2018	9	19.12	15979	187	18601	12	126	-2547
November 5, 2018	10	41.35	16110	221	18197	13	221	-2080
November 5, 2018	11	24.51	16274	219	18600	12	247	-2348
November 5, 2018	12	10.86	16344	182	18508	12	514	-2472
November 5, 2018	13	6.66	16262	258	18898	12	196	-2548
November 5, 2018	14	22.94	16291	205	18728	12	426	-2618
November 5, 2018	15	33.11	16221	247	18772	12	228	-2473
November 5, 2018	16	30.07	16343	220	18784	12	200	-2503
November 5, 2018	17	32.47	16771	248	18767	12	258	-2050
November 5, 2018	18	48.87	17447	268	19098	12	211	-1582
November 5, 2018	19	30.85	17132	283	18741	12	927	-2255
November 5, 2018	20	32.87	16884	281	18796	12	871	-2481
November 5, 2018	21	27.56	16472	290	17917	13	1340	-2388
November 5, 2018	22	21.89	15636	273	17523	12	826	-2360
November 5, 2018	23	16.53	14493	197	16862	12	302	-2324
November 5, 2018	24	11.54	13443	206	16016	12	143	-2431
November 6, 2018	1	4.87	12724	228	15544	13	143	-2586
November 6, 2018	2	0	12276	201	15190	12	143	-2792
November 6, 2018	3	0	11964	212	15000	12	144	-2922
November 6, 2018	4	0	11833	192	14886	12	143	-2977
November 6, 2018	5	0	11940	174	14970	12	144	-2958
November 6, 2018	6	0	12483	165	15460	12	175	-2908
November 6, 2018	7	0.89	13821	194	16485	12	202	-2665
November 6, 2018	8	7.7	15315	159	17411	12	148	-2042
November 6, 2018	9	5.93	15644	177	17704	13	175	-2025
November 6, 2018	10	5.85	15735	183	18052	13	154	-2122
November 6, 2018	11	5.81	15831	177	18199	12	156	-2211
November 6, 2018	12	0	15646	171	17859	23	156	-2148
November 6, 2018	13	0	15229	160	17458	13	170	-2097
November 6, 2018	14	0	15228	153	17418	12	203	-2257
November 6, 2018	15	0	15199	226	17534	12	212	-2271
November 6, 2018	16	0	15449	263	17696	12	173	-2130
November 6, 2018	17	1.38	16116	315	18472	13	155	-2197
November 6, 2018	18	5.85	16893	287	19167	13	198	-2181
November 6, 2018	19	5.89	16705	298	19006	12	197	-2181
November 6, 2018	20	5.84	16452	256	18678	12	197	-2181
November 6, 2018	21	4.42	15999	315	18312	12	197	-2197
November 6, 2018	22	0	15222	309	17574	12	152	-2128
November 6, 2018	23	0	14165	276	16590	13	278	-2396
November 6, 2018	24	0	13153	270	15814	13	143	-2559
November 7, 2018	1	-0.02	12485	282	15381	13	143	-2643
November 7, 2018	2	-0.12	12029	244	14894	13	143	-2665
November 7, 2018	3	-0.31	11789	260	14747	13	143	-2783
November 7, 2018	4	-0.15	11721	293	14709	13	143	-2816
November 7, 2018	5	-0.09	11906	292	14897	13	143	-2832
November 7, 2018	6	-0.02	12469	296	15336	13	143	-2733
November 7, 2018	7	0	13913	266	16461	12	126	-2502
November 7, 2018	8	2.4	15146	178	17646	13	169	-2507

November 7, 2018	9	1.93	15385	194	17732	12	226	-2398
November 7, 2018	10	0	15332	190	17592	12	226	-2291
November 7, 2018	11	0	15324	160	17536	12	242	-2247
November 7, 2018	12	3.53	15472	185	17752	12	155	-2248
November 7, 2018	13	0.96	15511	210	17986	13	231	-2411
November 7, 2018	14	0	15657	255	18137	13	247	-2381
November 7, 2018	15	0	15727	247	17922	12	237	-2137
November 7, 2018	16	0.85	15953	244	18022	12	329	-2108
November 7, 2018	17	4.29	16522	330	18736	12	358	-2255
November 7, 2018	18	5.96	17261	312	19267	12	468	-2209
November 7, 2018	19	26.81	17164	246	19393	12	304	-2308
November 7, 2018	20	48.25	17011	264	19315	12	496	-2775
November 7, 2018	21	54.23	16629	235	19161	13	321	-2775
November 7, 2018	22	20.62	15889	254	18573	12	288	-2678
November 7, 2018	23	12.92	14907	240	17634	12	262	-2667
November 7, 2018	24	4.84	13816	257	16535	12	154	-2537
November 8, 2018	1	5.41	13117	302	15931	12	219	-2633
November 8, 2018	2	5.57	12715	302	15856	12	143	-2912
November 8, 2018	3	2.2	12507	319	15642	12	143	-2867
November 8, 2018	4	4.28	12438	315	15449	13	219	-2777
November 8, 2018	5	0.89	12541	317	15279	12	219	-2517
November 8, 2018	6	2.83	13201	275	15807	12	219	-2512
November 8, 2018	7	6.3	14580	259	16796	12	377	-2383
November 8, 2018	8	19.36	15892	193	17483	12	1128	-2507
November 8, 2018	9	5.95	16093	197	17381	12	1428	-2383
November 8, 2018	10	5.95	15990	168	17514	13	1175	-2472
November 8, 2018	11	19.49	15919	146	17860	13	619	-2450
November 8, 2018	12	15.5	15943	197	17902	12	649	-2438
November 8, 2018	13	27.8	15917	250	17860	12	841	-2488
November 8, 2018	14	36.09	16009	262	17661	12	1133	-2530
November 8, 2018	15	37.45	15994	250	17768	13	985	-2434
November 8, 2018	16	36.82	16192	235	17702	13	1349	-2534
November 8, 2018	17	40.55	16752	290	17787	13	1468	-2195
November 8, 2018	18	45.13	17477	309	18448	13	1561	-2179
November 8, 2018	19	41.03	17333	281	18505	13	1520	-2355
November 8, 2018	20	39.7	17204	294	18406	13	1513	-2373
November 8, 2018	21	37.47	16842	277	18139	13	1421	-2327
November 8, 2018	22	35.26	16124	306	17561	12	1463	-2445
November 8, 2018	23	15.95	15049	289	16666	14	1357	-2437
November 8, 2018	24	10.88	13991	295	16183	12	746	-2534
November 9, 2018	1	14.33	13271	272	15876	12	341	-2574
November 9, 2018	2	9.38	12854	298	15471	12	344	-2550
November 9, 2018	3	5.87	12595	306	15310	12	307	-2603
November 9, 2018	4	5.85	12516	293	15353	12	172	-2645
November 9, 2018	5	5.83	12680	317	15510	12	268	-2678
November 9, 2018	6	5.77	13270	261	15799	12	285	-2469
November 9, 2018	7	7.34	14607	268	16953	13	489	-2570
November 9, 2018	8	14.35	15968	222	18134	12	533	-2499
November 9, 2018	9	121.79	16376	208	17913	12	923	-2278
November 9, 2018	10	365.64	16630	237	18036	12	1177	-2394

November 9, 2018	11	33.74	16897	203	17303	13	1344	-1647
November 9, 2018	12	73.59	17102	215	17460	12	1335	-1515
November 9, 2018	13	42.72	17119	265	17452	13	1335	-1256
November 9, 2018	14	43.95	17121	251	17303	12	1329	-1093
November 9, 2018	15	33.37	17100	274	17623	14	886	-1092
November 9, 2018	16	34.49	17195	240	17717	13	1149	-1393
November 9, 2018	17	28.87	17530	302	18369	13	764	-1257
November 9, 2018	18	13.36	17869	305	18503	13	1335	-1527
November 9, 2018	19	12.85	17533	268	18864	13	688	-1542
November 9, 2018	20	11.27	17174	252	19112	13	94	-1599
November 9, 2018	21	8.64	16761	293	19186	13	175	-2158
November 9, 2018	22	5.42	15957	313	18858	13	235	-2541
November 9, 2018	23	0	14898	328	17554	14	255	-2479
November 9, 2018	24	0	13820	321	16502	14	163	-2426
November 10, 2018	1	0	13179	226	16101	14	142	-2766
November 10, 2018	2	0	12788	206	15964	13	142	-3040
November 10, 2018	3	0	12520	273	15746	13	142	-3040
November 10, 2018	4	0	12423	241	15727	13	142	-3159
November 10, 2018	5	0	12472	246	15907	13	142	-3292
November 10, 2018	6	0	12746	264	16233	13	142	-3327
November 10, 2018	7	0	13365	251	16188	13	125	-2642
November 10, 2018	8	0	13998	239	16683	13	158	-2553
November 10, 2018	9	0	14418	172	17037	13	225	-2648
November 10, 2018	10	0	14742	136	17039	13	215	-2374
November 10, 2018	11	0	15014	148	17622	13	211	-2667
November 10, 2018	12	0	15435	130	17918	13	211	-2549
November 10, 2018	13	0.36	15659	162	17779	13	211	-2067
November 10, 2018	14	0	15578	213	17623	12	211	-1999
November 10, 2018	15	0	15455	211	17355	23	102	-1728
November 10, 2018	16	0	15646	191	17597	14	170	-1893
November 10, 2018	17	5.82	16269	202	18237	13	170	-2004
November 10, 2018	18	17.63	17162	177	19000	13	357	-2024
November 10, 2018	19	12.13	16909	193	18702	13	612	-2086
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November 10, 2018	21	13.35	16043	184	18535	12	89	-2334
November 10, 2018	22	16.33	15499	194	17769	12	225	-2288
November 10, 2018	23	7.77	14783	176	16996	13	223	-2185
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November 11, 2018	3	5.9	12893	145	15469	14	236	-2651
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November 11, 2018	7	12.08	13390	206	15613	13	262	-2231
November 11, 2018	8	13.32	13736	235	15913	13	232	-2132
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November 11, 2018	10	13.32	14268	208	16432	13	232	-2129
November 11, 2018	11	12.76	14245	231	16455	13	274	-2196
November 11, 2018	12	12.7	14305	240	16439	13	306	-2195

November 11, 2018	13	14.88	14579	218	17122	13	101	-2488
November 11, 2018	14	13.36	14754	204	17358	13	70	-2468
November 11, 2018	15	37.69	14987	192	17525	13	125	-2448
November 11, 2018	16	23.15	15488	194	17744	13	125	-2172
November 11, 2018	17	35.68	16419	230	17970	13	361	-1734
November 11, 2018	18	52.66	17279	177	18351	13	631	-1492
November 11, 2018	19	33.51	17067	122	17877	14	632	-1246
November 11, 2018	20	33.28	16794	116	17911	13	632	-1580
November 11, 2018	21	28.02	16368	119	17725	13	632	-1829
November 11, 2018	22	29.1	15746	189	17524	13	433	-2043
November 11, 2018	23	20.91	14849	214	16493	11	722	-2029
November 11, 2018	24	10.22	13948	194	15706	12	684	-2035
November 12, 2018	1	13.32	13351	284	15596	12	132	-2143
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November 12, 2018	6	6.62	13656	265	16111	13	158	-2487
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November 12, 2018	8	40.78	16171	217	18032	13	122	-1763
November 12, 2018	9	40.63	16388	194	17923	13	308	-1598
November 12, 2018	10	39.11	16283	124	17699	21	725	-1944
November 12, 2018	11	40.38	16162	199	17973	19	765	-2363
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November 12, 2018	13	37.84	16160	155	17632	29	804	-2080
November 12, 2018	14	37.24	16388	201	17741	24	804	-2031
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November 12, 2018	16	34.05	16819	133	17925	55	800	-1887
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November 12, 2018	18	43.45	18096	177	18826	78	852	-1419
November 12, 2018	19	43.45	17776	221	18882	76	756	-1680
November 12, 2018	20	41.76	17523	277	18840	77	829	-1841
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November 12, 2018	23	33.12	15396	136	16763	21	778	-1865
November 12, 2018	24	20.51	14393	187	15673	20	817	-1818
November 13, 2018	1	13.34	13769	220	15422	21	130	-1550
November 13, 2018	2	10.39	13439	205	15107	20	130	-1501
November 13, 2018	3	10.3	13265	242	15006	20	130	-1533
November 13, 2018	4	9.02	13130	208	14998	20	130	-1700
November 13, 2018	5	12.7	13284	213	15191	20	130	-1807
November 13, 2018	6	5.91	13814	177	15324	20	445	-1662
November 13, 2018	7	9	15064	224	16117	20	562	-1282
November 13, 2018	8	17.22	16365	191	16796	19	1031	-1228
November 13, 2018	9	45.59	16729	171	17731	19	453	-1292
November 13, 2018	10	99.46	16819	143	18154	13	331	-1619
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November 13, 2018	12	43.8	16850	193	18596	14	518	-1926
November 13, 2018	13	39.54	16834	220	18616	14	768	-2175
November 13, 2018	14	27.58	16847	177	18373	15	774	-2008

November 13, 2018	15	8.68	16837	188	18351	15	828	-2118
November 13, 2018	16	19.25	17016	170	18373	14	819	-2085
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November 13, 2018	18	40.69	18414	233	20379	12	762	-2331
November 13, 2018	19	37.97	18269	249	20191	15	839	-2373
November 13, 2018	20	34.59	18176	245	20093	14	865	-2426
November 13, 2018	21	30.8	17732	249	19623	14	864	-2424
November 13, 2018	22	17.39	16975	240	18729	13	885	-2318
November 13, 2018	23	10.82	15976	237	17776	13	644	-2121
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November 14, 2018	8	86.18	17126	100	18666	13	198	-1694
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November 14, 2018	10	43.6	17056	156	18551	13	588	-1859
November 14, 2018	11	42.24	16789	133	18139	16	739	-1909
November 14, 2018	12	35.47	16584	97	17907	15	739	-1995
November 14, 2018	13	40.63	16514	132	17787	17	752	-1958
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November 14, 2018	21	39.85	18201	195	19588	70	639	-1861
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November 15, 2018	10	49.73	17386	47	19016	13	619	-2208
November 15, 2018	11	50.28	17463	35	19089	12	471	-2094
November 15, 2018	12	50.39	17475	35	19199	13	487	-2169
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November 16, 2018	4	5.91	13641	134	16023	13	157	-2276
November 16, 2018	5	5.9	13819	188	16186	12	157	-2262
November 16, 2018	6	6.73	14320	160	16632	12	201	-2276
November 16, 2018	7	8.5	15554	184	17491	12	566	-2296
November 16, 2018	8	37.18	16678	165	18413	13	440	-1973
November 16, 2018	9	62	17177	204	18722	12	328	-1745
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November 16, 2018	16	8.46	17205	141	19299	13	184	-2064
November 16, 2018	17	43.83	17539	148	19988	12	47	-2335
November 16, 2018	18	52.06	17996	172	20387	13	113	-2248
November 16, 2018	19	41.37	17592	198	20039	17	14	-2179
November 16, 2018	20	42.61	17289	195	19489	13	114	-2049
November 16, 2018	21	33.53	16911	227	19145	12	125	-2036
November 16, 2018	22	16.06	16295	198	18471	12	142	-2036
November 16, 2018	23	2.87	15324	183	17530	12	139	-2036
November 16, 2018	24	1.95	14327	199	16980	12	109	-2512
November 17, 2018	1	0	13455	199	16127	12	130	-2483
November 17, 2018	2	0	13049	207	16097	12	109	-2913
November 17, 2018	3	0	12764	189	15734	12	109	-2825
November 17, 2018	4	0	12606	172	15720	12	109	-2975
November 17, 2018	5	0	12569	217	15654	12	78	-2872
November 17, 2018	6	0	12858	204	15762	12	78	-2773
November 17, 2018	7	0	13546	192	15953	12	70	-2298
November 17, 2018	8	1.59	14374	216	16416	12	70	-1927
November 17, 2018	9	12.3	15142	208	16877	12	125	-1817
November 17, 2018	10	43.94	15634	207	17545	12	130	-1836
November 17, 2018	11	40.14	15808	205	17887	12	110	-1906
November 17, 2018	12	39.35	15906	135	17722	13	239	-1917
November 17, 2018	13	14.34	15905	174	17481	12	489	-1893
November 17, 2018	14	14.38	15768	211	17684	13	221	-1894
November 17, 2018	15	21.69	15749	179	17604	12	245	-1901
November 17, 2018	16	14.34	15919	199	17492	13	520	-1866
November 17, 2018	17	16.24	16547	210	17432	13	984	-1622
November 17, 2018	18	38.35	17294	205	17496	13	1335	-1231

November 17, 2018	19	45.06	17007	159	17558	13	884	-1234
November 17, 2018	20	40.83	16623	180	17477	13	838	-1452
November 17, 2018	21	38.89	16196	133	17002	12	1008	-1673
November 17, 2018	22	40.09	15681	156	16561	14	971	-1643
November 17, 2018	23	51.74	15059	172	16540	15	477	-1762
November 17, 2018	24	23.05	14348	125	16115	15	171	-1739
November 18, 2018	1	37	13771	205	15651	14	130	-1842
November 18, 2018	2	14.35	13314	148	15193	13	109	-1785
November 18, 2018	3	14.33	13114	205	15023	13	109	-1800
November 18, 2018	4	14.3	13017	191	14851	13	109	-1688
November 18, 2018	5	14.31	13046	184	14915	13	109	-1792
November 18, 2018	6	14.36	13210	199	15387	12	109	-2069
November 18, 2018	7	26.73	13650	213	15787	13	101	-2052
November 18, 2018	8	23.38	14164	179	16097	13	157	-1934
November 18, 2018	9	44.14	14772	208	16520	12	160	-1760
November 18, 2018	10	71.62	15237	201	16837	13	207	-1658
November 18, 2018	11	97.27	15490	211	16975	13	203	-1521
November 18, 2018	12	58.15	15639	192	17015	14	239	-1458
November 18, 2018	13	40.55	15827	217	16903	13	574	-1447
November 18, 2018	14	30.22	15908	206	17002	12	500	-1419
November 18, 2018	15	14.36	16011	205	16842	13	642	-1301
November 18, 2018	16	15.96	16270	203	17134	12	592	-1276
November 18, 2018	17	45.33	16989	213	17545	12	480	-865
November 18, 2018	18	52.95	17725	195	18304	13	530	-866
November 18, 2018	19	45.34	17426	216	17972	16	794	-1060
November 18, 2018	20	22.8	17064	195	17441	15	1047	-1255
November 18, 2018	21	12.96	16641	192	16971	12	1026	-1200
November 18, 2018	22	10.85	16033	204	16801	13	771	-1365
November 18, 2018	23	9.41	15154	202	16484	13	489	-1617
November 18, 2018	24	11.5	14353	182	16170	13	130	-1743
November 19, 2018	1	11.35	13700	261	16160	12	125	-2332
November 19, 2018	2	12.21	13340	244	15804	12	125	-2341
November 19, 2018	3	14.34	13118	236	15591	13	101	-2308
November 19, 2018	4	14.35	13172	273	15610	13	101	-2358
November 19, 2018	5	5.2	13313	196	15468	15	201	-2048
November 19, 2018	6	8.58	14065	74	15914	16	115	-1881
November 19, 2018	7	41.67	15436	177	16970	17	506	-1858
November 19, 2018	8	43.72	16616	113	17433	15	1145	-1683
November 19, 2018	9	43.86	16725	130	17589	14	867	-1516
November 19, 2018	10	37.91	16577	105	17226	13	1352	-1791
November 19, 2018	11	35.92	16459	147	17183	13	1243	-1743
November 19, 2018	12	26.49	16339	128	17523	20	678	-1739
November 19, 2018	13	34.57	16249	207	17389	21	954	-1790
November 19, 2018	14	38.65	16448	199	17842	14	659	-1842
November 19, 2018	15	37.44	16569	190	18144	13	383	-1724
November 19, 2018	16	30.9	16922	189	18040	13	778	-1711
November 19, 2018	17	41.05	17746	182	18484	13	1069	-1593
November 19, 2018	18	48.46	18583	191	19538	13	784	-1535
November 19, 2018	19	48.14	18342	190	19809	15	584	-1747
November 19, 2018	20	44.07	18122	127	18893	16	983	-1587

November 19, 2018	21	43.16	17734	150	18778	14	761	-1659
November 19, 2018	22	38.06	17016	138	17998	14	1055	-1856
November 19, 2018	23	22.13	15915	134	16783	14	1265	-1917
November 19, 2018	24	15.17	14852	135	15866	13	1098	-1882
November 20, 2018	1	13.65	14063	135	15379	13	801	-1932
November 20, 2018	2	13.68	13668	117	15605	13	137	-1934
November 20, 2018	3	14.34	13498	136	15484	13	137	-1932
November 20, 2018	4	12.92	13486	138	15533	13	196	-2079
November 20, 2018	5	0.83	13569	144	15238	13	334	-1819
November 20, 2018	6	5.23	14291	124	16155	13	173	-2095
November 20, 2018	7	9.33	15677	113	17586	13	283	-2031
November 20, 2018	8	47.11	17015	111	18501	13	694	-2058
November 20, 2018	9	47.95	17357	131	18980	12	192	-1734
November 20, 2018	10	43.16	17391	146	19056	16	172	-1740
November 20, 2018	11	43.03	17269	119	18853	12	190	-1544
November 20, 2018	12	10.28	16966	107	18200	17	724	-1816
November 20, 2018	13	5.88	16753	121	17853	16	766	-1837
November 20, 2018	14	5.88	16619	133	18199	16	334	-1792
November 20, 2018	15	6.57	16758	132	18267	48	258	-1860
November 20, 2018	16	21.47	17161	141	18149	66	690	-1686
November 20, 2018	17	57.33	18048	128	19610	65	276	-1972
November 20, 2018	18	78.24	18865	130	20325	69	382	-1693
November 20, 2018	19	60.96	18738	132	20333	69	376	-1744
November 20, 2018	20	53.08	18634	129	20009	69	156	-1430
November 20, 2018	21	48.43	18176	111	19409	68	146	-1209
November 20, 2018	22	24.1	17425	138	18132	27	1036	-1459
November 20, 2018	23	7.24	16275	114	17542	15	136	-1259
November 20, 2018	24	2.46	15181	123	17139	14	224	-1969
November 21, 2018	1	1.39	14375	79	16705	14	122	-2386
November 21, 2018	2	0	13951	111	16815	14	122	-2885
November 21, 2018	3	1.39	13702	117	16660	14	122	-2946
November 21, 2018	4	0	13618	115	16720	14	122	-3099
November 21, 2018	5	0	13743	147	16869	14	122	-3099
November 21, 2018	6	0	14328	133	16984	14	122	-2665
November 21, 2018	7	2.6	15643	141	17484	13	472	-2307
November 21, 2018	8	41.19	17005	121	18279	13	727	-1929
November 21, 2018	9	48.43	17216	178	18378	14	958	-1924
November 21, 2018	10	8.92	17162	123	18367	14	1072	-2000
November 21, 2018	11	0	16938	109	18154	16	955	-2065
November 21, 2018	12	0	16737	119	18598	19	315	-2031
November 21, 2018	13	4.22	16548	121	18894	19	398	-2689
November 21, 2018	14	6.43	16622	167	19072	17	219	-2565
November 21, 2018	15	5.89	16794	167	19271	14	272	-2604
November 21, 2018	16	8.98	17360	197	18966	14	760	-2324
November 21, 2018	17	46.67	18450	216	19487	15	972	-1893
November 21, 2018	18	55.38	19419	132	20370	14	1053	-1789
November 21, 2018	19	54.66	19322	144	19968	15	1152	-1700
November 21, 2018	20	58.81	19352	132	20065	13	519	-1193
November 21, 2018	21	53.17	19004	188	19916	14	283	-999
November 21, 2018	22	55.68	18263	157	18864	15	913	-1182

November 21, 2018	23	44.87	17281	168	17326	15	1337	-1066
November 21, 2018	24	42.6	16125	263	16785	14	992	-1297
November 22, 2018	1	43.21	15467	215	16097	15	1072	-1312
November 22, 2018	2	46.23	15037	247	16129	13	715	-1509
November 22, 2018	3	28.53	14917	216	15707	16	1143	-1674
November 22, 2018	4	37.65	14888	178	15891	16	797	-1536
November 22, 2018	5	13.05	15047	203	16011	14	724	-1466
November 22, 2018	6	30.2	15661	133	16323	14	1146	-1658
November 22, 2018	7	53.91	17026	144	17833	13	486	-1244
November 22, 2018	8	67.38	18307	116	19065	14	519	-1204
November 22, 2018	9	59.97	18226	108	18856	14	444	-1000
November 22, 2018	10	56.8	17809	70	18483	15	303	-988
November 22, 2018	11	45.38	17469	134	17630	16	1234	-1206
November 22, 2018	12	44.84	17251	161	17416	14	1377	-1401
November 22, 2018	13	43.4	17092	222	17221	14	1322	-1314
November 22, 2018	14	39.15	17140	190	16986	14	1345	-1064
November 22, 2018	15	42.47	17328	188	17196	14	1345	-1081
November 22, 2018	16	45.54	17822	178	17569	22	1346	-989
November 22, 2018	17	51.39	18796	208	18225	14	1391	-722
November 22, 2018	18	53.54	19714	228	19067	14	1594	-641
November 22, 2018	19	53.82	19482	155	19383	14	1129	-746
November 22, 2018	20	51.31	19298	250	19366	16	994	-769
November 22, 2018	21	45.51	18853	304	19208	16	838	-740
November 22, 2018	22	35.25	18127	246	17765	14	1361	-641
November 22, 2018	23	20.15	17116	253	16909	14	1416	-905
November 22, 2018	24	5.77	16051	272	16459	14	1367	-1327
November 23, 2018	1	5.81	15300	319	16250	14	1033	-1613
November 23, 2018	2	5.87	14890	258	16184	14	1195	-2173
November 23, 2018	3	7.18	14632	293	16305	14	816	-2191
November 23, 2018	4	13.36	14533	266	16507	13	729	-2342
November 23, 2018	5	13.34	14685	241	16975	14	244	-2304
November 23, 2018	6	5.14	15233	213	17342	14	367	-2165
November 23, 2018	7	51.1	16495	247	18354	14	426	-2095
November 23, 2018	8	52.49	17625	217	19232	12	226	-1749
November 23, 2018	9	51.93	17839	156	19118	13	638	-1839
November 23, 2018	10	47.63	17566	93	18844	13	178	-1234
November 23, 2018	11	44.71	17199	148	18645	31	683	-1948
November 23, 2018	12	29.46	17002	134	17767	15	1155	-1773
November 23, 2018	13	50.67	16745	132	17861	12	1179	-2225
November 23, 2018	14	11.5	16580	182	17817	16	1229	-2237
November 23, 2018	15	13.33	16608	194	17464	24	1226	-1910
November 23, 2018	16	11.49	16854	205	17402	14	1337	-1698
November 23, 2018	17	10.88	17437	246	17784	14	1437	-1446
November 23, 2018	18	12.12	18074	237	18610	13	1347	-1570
November 23, 2018	19	6.53	17782	223	18784	13	1291	-2015
November 23, 2018	20	6.57	17508	191	18775	13	1287	-2337
November 23, 2018	21	7.21	17180	263	18737	13	1058	-2409
November 23, 2018	22	6.55	16635	233	18535	13	887	-2551
November 23, 2018	23	3.82	15700	236	18100	13	195	-2351
November 23, 2018	24	0.94	14740	183	17580	13	100	-2704

November 24, 2018	1	3.78	13876	233	16885	13	105	-2879
November 24, 2018	2	1.35	13378	251	16705	13	64	-3132
November 24, 2018	3	0	13036	242	16442	13	49	-3208
November 24, 2018	4	0	12885	232	16226	13	14	-3170
November 24, 2018	5	0	12915	260	16379	13	14	-3295
November 24, 2018	6	0	13172	291	16600	13	14	-3119
November 24, 2018	7	0	13751	246	16790	13	34	-2818
November 24, 2018	8	1.4	14488	270	17371	13	157	-2757
November 24, 2018	9	5.65	15099	236	17797	13	114	-2566
November 24, 2018	10	4.86	15554	214	18242	13	207	-2705
November 24, 2018	11	5.48	15812	207	18360	13	273	-2625
November 24, 2018	12	9.64	16054	248	18684	13	328	-2753
November 24, 2018	13	13.35	16162	274	18616	13	333	-2559
November 24, 2018	14	15.09	16129	241	18582	13	284	-2525
November 24, 2018	15	13.33	16159	205	18241	13	653	-2538
November 24, 2018	16	9.8	16289	216	17840	13	1150	-2514
November 24, 2018	17	3.01	16684	224	17722	13	1284	-2145
November 24, 2018	18	3.99	17082	174	17676	13	1301	-1606
November 24, 2018	19	5.67	16696	194	17784	13	1233	-2029
November 24, 2018	20	10.22	16286	186	17769	13	1072	-2337
November 24, 2018	21	7.15	15830	191	17939	12	801	-2553
November 24, 2018	22	7.67	15237	167	17831	12	301	-2620
November 24, 2018	23	4.74	14493	193	17408	12	170	-2806
November 24, 2018	24	4.47	13711	149	16713	12	44	-2842
November 25, 2018	1	1.38	13040	183	16196	12	14	-2901
November 25, 2018	2	0.47	12595	198	16177	12	14	-3341
November 25, 2018	3	0	12256	239	15915	12	18	-3276
November 25, 2018	4	-0.01	12040	255	15092	12	14	-2710
November 25, 2018	5	0	12001	262	15136	12	14	-2816
November 25, 2018	6	0	12274	235	15400	12	14	-2859
November 25, 2018	7	2.4	12725	268	15836	12	14	-2872
November 25, 2018	8	3.81	13380	311	16028	12	262	-2586
November 25, 2018	9	8.71	14023	281	16707	14	158	-2604
November 25, 2018	10	49.46	14666	236	17208	12	183	-2551
November 25, 2018	11	53.31	15025	154	17490	13	291	-2659
November 25, 2018	12	15.21	15259	235	17213	20	265	-2007
November 25, 2018	13	29.36	15432	230	17355	21	482	-2172
November 25, 2018	14	29.34	15473	227	17381	13	435	-2115
November 25, 2018	15	44.88	15507	236	17554	13	377	-2167
November 25, 2018	16	24.56	15800	241	17202	13	1012	-2167
November 25, 2018	17	47.09	16600	237	17265	12	1357	-1812
November 25, 2018	18	73.23	17189	242	17524	14	1342	-1280
November 25, 2018	19	51.91	16913	254	17240	13	1008	-1015
November 25, 2018	20	43.23	16541	254	17212	13	1317	-1674
November 25, 2018	21	31.45	16096	257	17076	12	1219	-1857
November 25, 2018	22	37.37	15520	219	16894	12	1196	-2278
November 25, 2018	23	22.84	14658	196	16790	13	687	-2419
November 25, 2018	24	17.82	13754	234	16431	13	90	-2468
November 26, 2018	1	13.79	13087	302	16402	13	58	-2883
November 26, 2018	2	12.44	12688	299	15959	13	74	-2933

November 26, 2018	3	7.83	12479	288	15938	13	44	-3149
November 26, 2018	4	4.22	12452	266	15935	13	14	-3199
November 26, 2018	5	0.43	12694	258	16033	13	14	-3085
November 26, 2018	6	0.98	13373	249	16406	13	125	-2915
November 26, 2018	7	4.82	14776	254	17355	13	94	-2494
November 26, 2018	8	9.4	16303	258	18136	12	653	-2206
November 26, 2018	9	7.38	16823	271	18427	12	820	-2143
November 26, 2018	10	13.65	17047	260	18644	12	572	-1905
November 26, 2018	11	14.37	17212	250	18545	12	1172	-2227
November 26, 2018	12	6.6	17252	218	18418	23	1357	-2277
November 26, 2018	13	10.18	17319	208	18685	23	1211	-2318
November 26, 2018	14	12.26	17283	228	18674	14	1240	-2334
November 26, 2018	15	14.37	17260	227	18920	13	601	-2082
November 26, 2018	16	9.51	17385	243	18649	13	1116	-2131
November 26, 2018	17	20.75	18029	262	18865	13	1510	-2059
November 26, 2018	18	14.37	18480	262	19407	13	1503	-2076
November 26, 2018	19	13.03	18085	276	19362	13	1247	-2202
November 26, 2018	20	18.31	17937	242	19744	13	452	-2027
November 26, 2018	21	48.92	17472	265	19624	13	345	-2164
November 26, 2018	22	35.77	16758	215	18967	13	371	-2255
November 26, 2018	23	10.19	15701	148	18299	13	287	-2540
November 26, 2018	24	2.28	14614	195	17083	13	122	-2285
November 27, 2018	1	0	13890	222	16565	13	125	-2533
November 27, 2018	2	0	13463	208	16278	14	125	-2674
November 27, 2018	3	0	13280	195	16244	14	125	-2782
November 27, 2018	4	0	13222	193	16132	14	129	-2793
November 27, 2018	5	0	13436	204	16622	14	129	-3133
November 27, 2018	6	0.49	14078	195	16834	13	125	-2772
November 27, 2018	7	5.75	15351	256	17461	13	268	-2218
November 27, 2018	8	7.87	16743	186	17659	13	1137	-1967
November 27, 2018	9	12.96	17100	198	18218	13	835	-1787
November 27, 2018	10	32.26	17181	147	18895	14	503	-2101
November 27, 2018	11	26.36	17286	197	18877	14	388	-1793
November 27, 2018	12	21.09	17360	152	19087	19	595	-2222
November 27, 2018	13	14.36	17209	204	19338	19	374	-2260
November 27, 2018	14	16.42	17278	205	19450	15	339	-2302
November 27, 2018	15	14.49	17340	258	19493	14	341	-2280
November 27, 2018	16	14.34	17598	265	19269	14	766	-2248
November 27, 2018	17	42.28	18346	280	19818	14	793	-2084
November 27, 2018	18	77.31	18918	263	19917	14	1181	-1854
November 27, 2018	19	14.35	18641	253	19889	14	954	-1843
November 27, 2018	20	25.35	18491	214	19945	14	690	-1961
November 27, 2018	21	13.67	18102	247	19993	14	520	-2189
November 27, 2018	22	12.34	17345	270	19128	13	805	-2237
November 27, 2018	23	18.04	16231	279	18591	14	262	-2236
November 27, 2018	24	7.83	15029	281	17938	14	125	-2562
November 28, 2018	1	1.44	14227	311	17124	14	125	-2629
November 28, 2018	2	0	13851	279	17001	14	125	-2926
November 28, 2018	3	0	13625	274	16836	14	125	-2987
November 28, 2018	4	0	13579	268	16867	14	125	-3031

November 28, 2018	5	0	13718	277	17032	14	125	-3128
November 28, 2018	6	1.29	14391	220	17150	13	125	-2680
November 28, 2018	7	7.96	15675	221	17894	13	188	-2207
November 28, 2018	8	11.55	16916	238	18563	14	648	-2047
November 28, 2018	9	14.39	17196	192	19057	14	671	-2356
November 28, 2018	10	14.39	17256	209	18904	14	896	-2352
November 28, 2018	11	14.36	17160	199	19092	14	673	-2371
November 28, 2018	12	13.65	17072	218	19012	15	668	-2378
November 28, 2018	13	7.36	16877	219	19051	14	336	-2246
November 28, 2018	14	13.65	16880	177	19257	14	369	-2575
November 28, 2018	15	7.39	16956	170	19317	14	353	-2580
November 28, 2018	16	10.14	17212	215	19246	14	467	-2379
November 28, 2018	17	9.68	18022	202	19330	14	1000	-2139
November 28, 2018	18	14.38	18759	217	20029	14	1308	-2280
November 28, 2018	19	19.41	18556	220	19480	14	1525	-2222
November 28, 2018	20	56.52	18399	221	19463	14	1206	-2062
November 28, 2018	21	52.66	18063	262	19176	12	1269	-2062
November 28, 2018	22	63.03	17339	253	18391	12	1451	-2176
November 28, 2018	23	24.38	16201	277	17509	13	1104	-2025
November 28, 2018	24	9.53	15121	266	16837	14	677	-1949
November 29, 2018	1	13.18	14304	299	16343	14	413	-2099
November 29, 2018	2	16.24	13854	286	16172	13	122	-2145
November 29, 2018	3	10.35	13622	284	15912	14	130	-2091
November 29, 2018	4	0	13541	218	15642	14	122	-1971
November 29, 2018	5	0.95	13678	210	15636	14	122	-1903
November 29, 2018	6	4.04	14364	199	15762	14	697	-1920
November 29, 2018	7	20.07	15699	212	16686	13	1334	-2061
November 29, 2018	8	70.13	17035	199	17646	14	1457	-1860
November 29, 2018	9	58.77	17250	208	17649	13	1473	-1571
November 29, 2018	10	50.37	17231	137	17587	14	1560	-1613
November 29, 2018	11	26.23	17220	177	17457	15	1499	-1523
November 29, 2018	12	33.66	17165	133	17501	13	1484	-1655
November 29, 2018	13	31.59	17028	126	17535	14	1166	-1523
November 29, 2018	14	39.37	17160	185	17983	15	988	-1731
November 29, 2018	15	48.04	17238	197	18271	15	1151	-2131
November 29, 2018	16	48.44	17435	189	18041	15	1500	-1868
November 29, 2018	17	50.11	18112	201	18774	13	1334	-1697
November 29, 2018	18	47.75	18718	200	19193	13	1641	-1677
November 29, 2018	19	48	18543	199	18975	14	1310	-1464
November 29, 2018	20	48.02	18353	230	18915	13	1421	-1742
November 29, 2018	21	47.97	18048	254	18595	13	1337	-1690
November 29, 2018	22	48	17314	221	17904	13	1435	-1795
November 29, 2018	23	48.06	16258	222	16865	13	1478	-1811
November 29, 2018	24	25.5	15176	221	15855	13	1423	-1820
November 30, 2018	1	17.49	14329	255	15401	13	979	-1805
November 30, 2018	2	14.36	13820	254	15318	13	761	-1932
November 30, 2018	3	17.51	13540	247	15223	13	615	-1978
November 30, 2018	4	14.38	13467	266	15282	13	368	-1893
November 30, 2018	5	14.34	13646	281	15342	13	574	-1942
November 30, 2018	6	17.49	14227	299	15930	13	532	-1941

November 30, 2018	7	32.42	15577	285	16785	14	1038	-1947
November 30, 2018	8	53.05	16927	204	17767	13	1048	-1765
November 30, 2018	9	48.42	17224	248	17920	13	1118	-1536
November 30, 2018	10	49.35	17268	240	17593	13	1410	-1480
November 30, 2018	11	60.75	17379	251	17604	12	1467	-1491
November 30, 2018	12	68.97	17420	246	17832	11	1459	-1573
November 30, 2018	13	52.05	17322	249	17810	11	1464	-1627
November 30, 2018	14	50.2	17292	188	17735	10	1372	-1504
November 30, 2018	15	47.19	17277	180	17616	11	1372	-1427
November 30, 2018	16	47.29	17331	192	17792	13	1372	-1446
November 30, 2018	17	48.74	17798	259	18379	13	893	-1149
November 30, 2018	18	47.88	18203	266	18443	12	1467	-1249
November 30, 2018	19	46.88	17896	249	18338	12	1424	-1417
November 30, 2018	20	46.18	17692	238	18083	12	1365	-1442
November 30, 2018	21	48.52	17293	197	17790	13	1018	-1235
November 30, 2018	22	44.53	16639	246	17020	13	1264	-1299
November 30, 2018	23	24.42	15717	297	16292	13	987	-1133
November 30, 2018	24	10.12	14656	276	15645	12	961	-1532
December 1, 2018	1	18.89	13861	278	15460	13	524	-1757
December 1, 2018	2	14.37	13413	288	14866	13	1163	-2251
December 1, 2018	3	29.51	13134	284	14951	13	771	-2341
December 1, 2018	4	22.21	12953	251	15054	13	421	-2250
December 1, 2018	5	14.39	12991	249	15197	13	422	-2336
December 1, 2018	6	14.38	13215	232	15600	13	314	-2432
December 1, 2018	7	14.36	13773	254	15950	13	594	-2494
December 1, 2018	8	11.57	14595	209	16251	13	1102	-2486
December 1, 2018	9	14.35	15232	261	16813	13	1055	-2350
December 1, 2018	10	10.85	15547	250	16917	13	1149	-2193
December 1, 2018	11	7.92	15719	270	17111	13	1283	-2345
December 1, 2018	12	24.45	15814	256	17596	13	676	-2205
December 1, 2018	13	10.86	15729	249	17650	13	1110	-2617
December 1, 2018	14	6.63	15679	251	17648	13	1007	-2667
December 1, 2018	15	5.93	15783	263	17679	13	926	-2567
December 1, 2018	16	6.57	15964	240	18060	13	279	-2099
December 1, 2018	17	30.36	16592	275	18659	13	536	-2392
December 1, 2018	18	20.84	17071	242	19367	13	579	-2379
December 1, 2018	19	6.74	16837	258	18926	13	841	-2603
December 1, 2018	20	6.56	16429	174	18694	13	514	-2530
December 1, 2018	21	13.02	16034	224	18989	13	214	-2930
December 1, 2018	22	13.65	15579	192	18630	13	285	-3112
December 1, 2018	23	10.84	14800	195	17812	13	386	-3156
December 1, 2018	24	4.26	13961	147	16893	13	214	-2909
December 2, 2018	1	0	13292	179	16426	13	214	-3108
December 2, 2018	2	0	12802	187	16119	13	214	-3278
December 2, 2018	3	0	12519	159	15988	13	214	-3534
December 2, 2018	4	0	12327	187	15844	13	236	-3532
December 2, 2018	5	0	12320	235	15993	13	237	-3649
December 2, 2018	6	0	12535	258	16066	13	138	-3413
December 2, 2018	7	0	12957	258	16478	13	119	-3354
December 2, 2018	8	2.62	13540	231	16963	13	147	-3266

December 2, 2018	9	6.52	14180	248	17650	13	64	-3173
December 2, 2018	10	10.85	14721	239	17878	13	276	-3179
December 2, 2018	11	13.35	15056	214	18143	13	306	-3156
December 2, 2018	12	13.36	15207	193	18146	13	187	-2929
December 2, 2018	13	14.48	15236	195	18331	13	255	-3169
December 2, 2018	14	13	15076	250	18401	14	302	-3283
December 2, 2018	15	12.12	14925	269	18280	14	211	-3221
December 2, 2018	16	3.15	15102	261	18309	14	139	-3036
December 2, 2018	17	4.63	16018	209	18431	14	550	-2701
December 2, 2018	18	5.93	16998	262	18986	13	986	-2698
December 2, 2018	19	13.34	16796	269	19363	13	384	-2706
December 2, 2018	20	70.05	16460	248	19408	13	144	-2870
December 2, 2018	21	65.9	16028	273	18654	13	534	-2785
December 2, 2018	22	14.75	15400	300	17952	13	511	-2670
December 2, 2018	23	14.14	14498	290	17592	13	170	-2880
December 2, 2018	24	1.44	13589	311	16944	13	14	-2991
December 3, 2018	1	0	12901	315	16121	13	214	-3064
December 3, 2018	2	0	12464	298	15920	13	64	-3149
December 3, 2018	3	0	12355	289	15717	13	14	-3078
December 3, 2018	4	0	12354	241	16056	13	14	-3444
December 3, 2018	5	0.58	12640	238	16401	13	14	-3585
December 3, 2018	6	4.73	13379	249	16632	13	14	-3054
December 3, 2018	7	14.4	14766	265	17342	13	138	-2447
December 3, 2018	8	95.46	16263	246	18110	13	653	-2231
December 3, 2018	9	31.28	16619	264	17838	13	1114	-1973
December 3, 2018	10	13.42	16754	195	17990	13	746	-1672
December 3, 2018	11	67.51	16915	177	18391	13	239	-1617
December 3, 2018	12	45.78	17055	160	18475	21	412	-1696
December 3, 2018	13	12.72	17109	188	18456	20	432	-1701
December 3, 2018	14	13.33	17242	172	18419	13	620	-1602
December 3, 2018	15	27.61	17315	209	18838	13	393	-1823
December 3, 2018	16	33.28	17554	223	18822	13	693	-1722
December 3, 2018	17	41.43	18277	245	18810	14	1323	-1540
December 3, 2018	18	48.61	18876	251	19330	13	1511	-1558
December 3, 2018	19	48.63	18625	196	19445	13	1294	-1733
December 3, 2018	20	45.78	18413	277	19183	13	1182	-1634
December 3, 2018	21	56.19	18093	270	18975	13	1248	-1807
December 3, 2018	22	48.06	17375	307	18630	13	970	-1858
December 3, 2018	23	33.81	16267	268	18099	13	488	-1931
December 3, 2018	24	29.1	15115	239	17348	13	154	-2063
December 4, 2018	1	22.11	14334	250	16872	13	214	-2370
December 4, 2018	2	15.17	13911	216	16439	13	226	-2421
December 4, 2018	3	13.36	13702	255	16260	13	161	-2342
December 4, 2018	4	13.34	13664	248	16210	13	64	-2191
December 4, 2018	5	12.69	13856	261	15963	13	91	-1938
December 4, 2018	6	7.6	14562	220	15896	13	697	-1844
December 4, 2018	7	11.46	16045	93	16805	13	1156	-1843
December 4, 2018	8	25.81	17373	75	17909	13	1189	-1682
December 4, 2018	9	43.59	17494	117	18021	13	1371	-1632
December 4, 2018	10	43.34	17244	119	17960	13	1359	-1765

December 4, 2018	11	26.98	16946	173	17860	13	1244	-1859
December 4, 2018	12	10.15	16615	157	17858	13	1009	-1838
December 4, 2018	13	12.95	16279	183	17791	15	940	-2143
December 4, 2018	14	15.85	16309	132	17828	15	588	-1909
December 4, 2018	15	15.29	16434	164	17295	15	1361	-1909
December 4, 2018	16	40.03	17132	181	17571	31	1418	-1804
December 4, 2018	17	42.72	18077	237	18584	65	1306	-1669
December 4, 2018	18	47.19	19092	248	19081	65	1656	-1390
December 4, 2018	19	52.24	18986	248	19254	65	1465	-1533
December 4, 2018	20	50.98	18823	254	19234	65	1383	-1641
December 4, 2018	21	46.25	18465	292	18969	65	1412	-1654
December 4, 2018	22	44.84	17725	270	18540	65	1387	-1899
December 4, 2018	23	41.28	16618	233	17406	65	1406	-1883
December 4, 2018	24	29.86	15438	265	16528	28	1368	-2070
December 5, 2018	1	35.58	14679	291	16024	13	1111	-2024
December 5, 2018	2	33.52	14234	278	15950	13	927	-2191
December 5, 2018	3	25.07	14017	256	15711	13	828	-2194
December 5, 2018	4	13.35	13967	247	15614	13	673	-1941
December 5, 2018	5	28.94	14147	267	16160	13	432	-2114
December 5, 2018	6	22.05	14742	273	16182	13	859	-1992
December 5, 2018	7	55.23	16034	292	17363	13	549	-1603
December 5, 2018	8	179.64	17364	234	18400	13	261	-1019
December 5, 2018	9	104.48	17543	205	18564	13	507	-1269
December 5, 2018	10	49.62	17394	207	18421	13	924	-1678
December 5, 2018	11	47.63	17189	205	18005	13	1387	-1867
December 5, 2018	12	47.19	16891	220	17740	13	1348	-1867
December 5, 2018	13	47.1	16744	254	17822	13	1193	-1917
December 5, 2018	14	46.8	16929	258	18294	13	796	-1870
December 5, 2018	15	47.05	17111	272	18627	13	699	-1911
December 5, 2018	16	47.21	17429	266	18648	13	815	-1714
December 5, 2018	17	60.74	18250	260	19478	13	463	-1408
December 5, 2018	18	55.55	18940	242	20199	13	342	-1170
December 5, 2018	19	47.96	18724	277	20251	13	321	-1415
December 5, 2018	20	45.99	18533	259	20378	13	433	-1862
December 5, 2018	21	44.52	18128	260	20026	13	403	-1867
December 5, 2018	22	39.96	17396	247	19416	13	368	-2055
December 5, 2018	23	14.51	16181	271	18423	13	229	-2061
December 5, 2018	24	5.47	15017	253	17520	13	214	-2202
December 6, 2018	1	2.38	14257	266	17269	13	340	-2955
December 6, 2018	2	13.35	13844	234	17296	13	259	-3492
December 6, 2018	3	7.92	13599	206	17229	13	226	-3478
December 6, 2018	4	0.3	13535	223	17155	13	122	-3372
December 6, 2018	5	0	13692	233	17039	13	172	-3148
December 6, 2018	6	3.89	14310	193	17359	13	264	-3091
December 6, 2018	7	5.34	15628	206	18162	13	391	-2682
December 6, 2018	8	30.42	17064	197	19027	13	472	-2229
December 6, 2018	9	15.59	17283	186	19195	13	413	-2094
December 6, 2018	10	56.63	17222	199	19083	13	885	-2517
December 6, 2018	11	32.85	17194	160	19125	28	897	-2627
December 6, 2018	12	22.36	17224	156	19325	14	875	-2685

December 6, 2018	13	17.04	17313	158	19479	13	314	-2341
December 6, 2018	14	46.49	17481	152	19694	13	358	-2423
December 6, 2018	15	44.46	17586	130	20244	13	314	-2715
December 6, 2018	16	26.61	17741	138	19618	13	674	-2245
December 6, 2018	17	46.62	18299	172	20134	13	411	-2102
December 6, 2018	18	47.22	18917	253	20684	13	809	-2304
December 6, 2018	19	44.17	18696	247	20470	13	925	-2417
December 6, 2018	20	32.54	18570	212	19954	13	1201	-2332
December 6, 2018	21	30.27	18336	214	19719	13	942	-2058
December 6, 2018	22	33.62	17707	244	18665	13	1316	-1948
December 6, 2018	23	25.82	16721	191	17736	13	1225	-2001
December 6, 2018	24	28.56	15633	202	17005	13	871	-1984
December 7, 2018	1	19.07	14773	308	16742	13	702	-2231
December 7, 2018	2	47.64	14434	285	16766	13	214	-2326
December 7, 2018	3	19.76	14199	300	16586	13	274	-2237
December 7, 2018	4	31.93	14213	291	16331	13	374	-2182
December 7, 2018	5	20.14	14448	277	16643	13	289	-2120
December 7, 2018	6	10.79	15143	325	16727	13	640	-1878
December 7, 2018	7	36.96	16513	269	17648	13	1044	-1877
December 7, 2018	8	46.2	17845	262	18860	13	1136	-1905
December 7, 2018	9	45.84	18076	260	18937	13	1254	-1834
December 7, 2018	10	45.16	17845	246	18896	13	1254	-1924
December 7, 2018	11	45.17	17481	178	18388	18	1271	-1962
December 7, 2018	12	45.13	17284	188	18008	18	1439	-1975
December 7, 2018	13	42.56	17153	194	18424	18	853	-1885
December 7, 2018	14	44.71	17224	173	18570	54	509	-1647
December 7, 2018	15	44.89	17461	207	19037	68	565	-1992
December 7, 2018	16	40.79	17856	134	19025	68	1086	-2045
December 7, 2018	17	51.81	18610	247	20473	70	404	-2045
December 7, 2018	18	55.81	19342	231	20612	70	615	-1685
December 7, 2018	19	61.78	19095	236	20900	70	377	-1956
December 7, 2018	20	49.5	18816	232	20553	68	514	-2007
December 7, 2018	21	44.72	18481	222	19628	27	1182	-1921
December 7, 2018	22	42.72	17841	189	18661	13	1231	-1704
December 7, 2018	23	35.92	16886	199	17820	13	1114	-1643
December 7, 2018	24	23.05	15780	223	16705	13	1114	-1755
December 8, 2018	1	26.09	14969	249	16581	13	967	-2250
December 8, 2018	2	29.59	14384	247	16559	13	214	-2092
December 8, 2018	3	14.35	14181	259	16571	13	369	-2462
December 8, 2018	4	14.34	14139	276	16539	13	440	-2557
December 8, 2018	5	50.6	14129	261	17066	13	14	-2655
December 8, 2018	6	44.76	14382	225	17102	13	14	-2487
December 8, 2018	7	35.16	14992	279	17428	13	14	-2177
December 8, 2018	8	45.74	15825	225	17863	13	240	-1979
December 8, 2018	9	45.71	16456	207	18677	13	29	-1933
December 8, 2018	10	45.87	16828	212	18500	13	264	-1752
December 8, 2018	11	46.12	16825	247	18568	13	614	-2140
December 8, 2018	12	49.31	16754	261	18459	13	614	-2109
December 8, 2018	13	42.52	16532	180	18207	13	894	-2318
December 8, 2018	14	43.2	16336	229	18234	13	701	-2380

December 8, 2018	15	45.82	16298	196	18327	13	232	-2129
December 8, 2018	16	40.19	16543	151	17840	13	740	-1887
December 8, 2018	17	43.52	17434	243	18846	13	329	-1653
December 8, 2018	18	69.46	18165	174	19785	13	198	-1568
December 8, 2018	19	48.52	17915	209	19478	13	609	-1897
December 8, 2018	20	51.67	17564	219	19613	13	483	-2306
December 8, 2018	21	42.75	17159	244	18406	13	1175	-2017
December 8, 2018	22	49.4	16557	224	17911	13	1227	-2261
December 8, 2018	23	43.08	15728	237	16946	13	1229	-2090
December 8, 2018	24	26.56	14853	234	16044	13	1222	-2030
December 9, 2018	1	27.95	14167	261	15858	13	997	-2290
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December 9, 2018	3	32.38	13410	220	15923	13	330	-2504
December 9, 2018	4	9.92	13310	224	15670	13	354	-2397
December 9, 2018	5	10.01	13310	225	15773	13	214	-2358
December 9, 2018	6	10.09	13446	262	15872	13	402	-2394
December 9, 2018	7	9.23	13903	247	15999	13	514	-2230
December 9, 2018	8	11.31	14505	261	16569	13	14	-1733
December 9, 2018	9	47.78	15009	241	17243	13	14	-1919
December 9, 2018	10	5.99	15211	191	17383	14	14	-1852
December 9, 2018	11	9.22	15130	239	17356	23	14	-1919
December 9, 2018	12	13.63	15112	208	17579	23	214	-2456
December 9, 2018	13	35.59	15161	198	17981	23	154	-2760
December 9, 2018	14	40.94	15176	203	17945	15	89	-2687
December 9, 2018	15	45.54	15423	197	17586	13	214	-2206
December 9, 2018	16	42.94	16003	214	17386	13	614	-1790
December 9, 2018	17	46.48	17172	207	18477	13	14	-1266
December 9, 2018	18	50.09	18331	245	19329	13	516	-1342
December 9, 2018	19	52.58	18146	271	19440	13	277	-1219
December 9, 2018	20	45.17	17786	202	18869	13	1135	-1872
December 9, 2018	21	43.22	17342	224	18239	13	1229	-1842
December 9, 2018	22	40.68	16707	242	17642	13	1222	-1917
December 9, 2018	23	45.34	15772	270	16855	13	1229	-2011
December 9, 2018	24	44.44	14827	259	16137	13	1192	-2177
December 10, 2018	1	56.82	14161	220	15358	13	1214	-2116
December 10, 2018	2	49.77	13792	213	14968	14	1148	-2012
December 10, 2018	3	53.59	13611	205	15326	13	214	-1683
December 10, 2018	4	39.68	13612	181	15389	16	76	-1605
December 10, 2018	5	13.04	13702	278	15296	16	144	-1404
December 10, 2018	6	10.66	14376	269	15733	16	430	-1524
December 10, 2018	7	42.82	15849	223	16853	52	714	-1533
December 10, 2018	8	48.33	17333	175	18796	66	314	-1709
December 10, 2018	9	47.29	17560	198	18899	67	348	-1504
December 10, 2018	10	45.11	17384	162	18341	68	595	-1417
December 10, 2018	11	43.93	17277	163	18214	68	738	-1607
December 10, 2018	12	43.88	17317	129	17767	69	1406	-1768
December 10, 2018	13	39.08	17329	141	17819	70	1742	-2149
December 10, 2018	14	39.6	17479	136	18378	70	1096	-1966
December 10, 2018	15	36.72	17491	189	18140	70	1371	-1805
December 10, 2018	16	37.57	17848	185	18485	68	1345	-1784

December 10, 2018	17	50.13	18688	189	19343	66	687	-1190
December 10, 2018	18	72	19345	175	20195	68	654	-1378
December 10, 2018	19	56.56	19077	206	19969	67	714	-1426
December 10, 2018	20	50.69	18798	185	19868	68	625	-1370
December 10, 2018	21	47.55	18326	179	19367	70	660	-1423
December 10, 2018	22	40.24	17557	166	18538	70	1107	-1694
December 10, 2018	23	8.77	16407	196	17825	70	1242	-2351
December 10, 2018	24	0	15255	234	16809	67	980	-2297
December 11, 2018	1	0	14497	186	16320	29	227	-1763
December 11, 2018	2	0	14045	200	16267	14	214	-2171
December 11, 2018	3	0.76	13819	193	16347	15	214	-2459
December 11, 2018	4	10.73	13689	158	16161	14	214	-2369
December 11, 2018	5	0	13873	196	16064	14	214	-2125
December 11, 2018	6	3.13	14493	188	16699	14	137	-2126
December 11, 2018	7	7.33	15832	196	18040	14	14	-2045
December 11, 2018	8	50.53	17255	171	19414	13	73	-2113
December 11, 2018	9	67.78	17767	197	19872	13	14	-2102
December 11, 2018	10	142.46	17846	168	20087	14	198	-2308
December 11, 2018	11	89.24	17993	194	19748	14	177	-1811
December 11, 2018	12	50.8	18090	186	19379	14	304	-1474
December 11, 2018	13	49.29	18000	200	18959	19	54	-885
December 11, 2018	14	47.23	18025	185	18918	25	54	-823
December 11, 2018	15	48.03	18029	192	18793	28	54	-605
December 11, 2018	16	44.77	18154	180	19085	70	54	-729
December 11, 2018	17	67.17	18850	168	20033	70	232	-1317
December 11, 2018	18	70.55	19388	191	20292	70	513	-1169
December 11, 2018	19	65.7	19124	183	20409	74	431	-1458
December 11, 2018	20	55.84	18939	243	20281	70	291	-1420
December 11, 2018	21	51.47	18528	258	19748	70	239	-1150
December 11, 2018	22	52.29	17753	215	19142	21	78	-1181
December 11, 2018	23	44.47	16610	167	17393	14	662	-1171
December 11, 2018	24	31.58	15424	152	15979	14	1011	-1295
December 12, 2018	1	37.1	14600	201	15836	14	416	-1376
December 12, 2018	2	22.26	14149	213	15534	14	225	-1327
December 12, 2018	3	35.19	13957	235	15525	14	232	-1542
December 12, 2018	4	22.39	13901	214	15620	14	264	-1693
December 12, 2018	5	37.14	13952	176	15911	14	14	-1703
December 12, 2018	6	11.46	14542	151	15887	14	102	-1194
December 12, 2018	7	46.03	15858	242	17304	13	14	-1193
December 12, 2018	8	54.66	17257	252	18768	14	14	-1166
December 12, 2018	9	50.58	17483	226	18882	14	14	-1010
December 12, 2018	10	49.58	17465	220	18607	15	214	-1096
December 12, 2018	11	47.76	17426	246	18472	13	714	-1477
December 12, 2018	12	46.48	17364	244	18502	14	714	-1572
December 12, 2018	13	38.52	17210	276	18099	15	964	-1417
December 12, 2018	14	34.42	17267	235	17745	14	1229	-1468
December 12, 2018	15	37.85	17337	213	18206	14	702	-1357
December 12, 2018	16	34.5	17589	242	18844	14	535	-1407
December 12, 2018	17	46.19	18297	230	19811	12	14	-1271
December 12, 2018	18	50.56	18951	195	20555	13	144	-1444

December 12, 2018	19	47.11	18633	219	20360	17	514	-1830
December 12, 2018	20	38.34	18503	224	20192	16	249	-1681
December 12, 2018	21	47.87	17808	260	19813	14	73	-1377
December 12, 2018	22	42.71	17686	224	18933	15	214	-1247
December 12, 2018	23	42.75	16445	287	17737	14	14	-1001
December 12, 2018	24	46.55	15320	293	16518	13	214	-1044
December 13, 2018	1	49.43	14618	234	16305	14	214	-1556
December 13, 2018	2	37.14	14213	254	16251	15	214	-1856
December 13, 2018	3	19.6	14065	336	15931	16	214	-1614
December 13, 2018	4	44.9	13992	251	16089	13	214	-1962
December 13, 2018	5	28.36	14088	268	15984	15	14	-1549
December 13, 2018	6	42.5	14789	242	16540	13	124	-1656
December 13, 2018	7	66.27	16182	207	17589	14	14	-1263
December 13, 2018	8	59.61	17653	174	18987	14	14	-1137
December 13, 2018	9	60.24	17901	181	18941	14	45	-840
December 13, 2018	10	57.15	17904	216	18779	14	314	-946
December 13, 2018	11	60.59	17874	238	18858	17	89	-835
December 13, 2018	12	58.92	17708	239	18569	21	64	-625
December 13, 2018	13	50.46	17556	223	18230	22	492	-879
December 13, 2018	14	47.19	17608	242	18019	54	657	-795
December 13, 2018	15	47.9	17651	253	18286	66	391	-780
December 13, 2018	16	49.17	17875	261	18803	74	231	-950
December 13, 2018	17	60.59	18623	266	19616	79	323	-1169
December 13, 2018	18	50.81	19140	213	19737	73	407	-789
December 13, 2018	19	50.44	18821	240	19746	70	641	-1350
December 13, 2018	20	53.43	18598	203	19742	70	214	-1097
December 13, 2018	21	50.49	18313	266	19327	70	14	-824
December 13, 2018	22	44.17	17587	226	17995	21	894	-1004
December 13, 2018	23	41.45	16415	258	16683	15	1129	-1090
December 13, 2018	24	18.9	15165	226	15868	16	714	-1050
December 14, 2018	1	23.25	14354	267	15728	15	334	-1397
December 14, 2018	2	42.52	13876	229	15529	14	214	-1576
December 14, 2018	3	56.02	13652	254	15725	12	214	-1981
December 14, 2018	4	49	13551	235	15685	13	214	-2048
December 14, 2018	5	19.14	13711	253	16001	15	214	-2185
December 14, 2018	6	38.31	14281	251	15833	16	338	-1609
December 14, 2018	7	39.73	15546	252	16482	15	676	-1332
December 14, 2018	8	44.12	17091	213	17461	14	1160	-1295
December 14, 2018	9	45.65	17562	158	17850	13	1051	-1103
December 14, 2018	10	47.76	17668	163	17883	15	1218	-1207
December 14, 2018	11	63.3	17789	179	18653	15	121	-810
December 14, 2018	12	71.66	17666	149	18879	14	70	-973
December 14, 2018	13	47.3	17294	221	17975	17	659	-1073
December 14, 2018	14	47.42	17205	183	17849	18	875	-1314
December 14, 2018	15	34.02	17038	206	17483	39	1164	-1254
December 14, 2018	16	38.25	17185	213	17519	64	1144	-1328
December 14, 2018	17	38.58	17839	197	17820	68	1437	-1246
December 14, 2018	18	50.11	18270	159	17832	71	1689	-926
December 14, 2018	19	47.13	18054	158	17819	68	1502	-1115
December 14, 2018	20	56.92	17773	129	17861	21	1471	-1350

December 14, 2018	21	55.63	17388	126	17319	14	1471	-1125
December 14, 2018	22	44.03	16838	120	16900	13	1496	-1269
December 14, 2018	23	25.97	15857	131	15919	15	1475	-1225
December 14, 2018	24	14.34	14690	122	15102	15	1275	-1399
December 15, 2018	1	33.4	13857	114	14783	14	714	-1473
December 15, 2018	2	54.42	13342	154	14912	13	466	-1754
December 15, 2018	3	25.51	13049	146	14560	14	837	-2087
December 15, 2018	4	16.8	12886	148	14506	14	888	-2227
December 15, 2018	5	11.35	12899	140	14413	14	530	-1750
December 15, 2018	6	3.38	13079	129	14566	14	565	-1705
December 15, 2018	7	0	13695	156	14726	14	1141	-1891
December 15, 2018	8	1.83	14505	147	15205	14	1115	-1621
December 15, 2018	9	9.98	15185	145	16150	14	904	-1703
December 15, 2018	10	17.41	15637	160	16422	15	1184	-1757
December 15, 2018	11	63.47	15722	173	16550	13	1352	-1909
December 15, 2018	12	21.97	15740	141	16573	14	1313	-1913
December 15, 2018	13	22.28	15688	146	16283	15	1366	-1745
December 15, 2018	14	44.18	15579	146	16577	13	1154	-1950
December 15, 2018	15	23.15	15646	98	16765	13	1053	-1960
December 15, 2018	16	15.65	15881	116	16694	15	1313	-1840
December 15, 2018	17	15.5	16635	145	17117	14	1388	-1564
December 15, 2018	18	28.34	17387	152	17845	14	1388	-1573
December 15, 2018	19	20.85	17078	144	17932	14	1313	-1942
December 15, 2018	20	17.35	16587	99	17586	15	1287	-2039
December 15, 2018	21	14.33	16178	188	17731	15	628	-1967
December 15, 2018	22	14.35	15695	192	17496	15	460	-2003
December 15, 2018	23	14.65	14867	166	16853	14	720	-2387
December 15, 2018	24	12.94	14054	248	16341	15	365	-2296
December 16, 2018	1	14.37	13384	212	15807	15	214	-2340
December 16, 2018	2	16.94	12921	207	15680	15	254	-2634
December 16, 2018	3	14.34	12746	248	15535	15	254	-2672
December 16, 2018	4	60.07	12646	246	15665	13	294	-2981
December 16, 2018	5	14.38	12655	252	15410	14	294	-2646
December 16, 2018	6	13.62	12845	233	15088	15	279	-2152
December 16, 2018	7	12.25	13344	229	15323	15	297	-1936
December 16, 2018	8	17.39	14067	217	15703	14	563	-1892
December 16, 2018	9	52.39	14735	238	16558	13	333	-1862
December 16, 2018	10	43.65	15184	246	16451	14	790	-1749
December 16, 2018	11	14.55	15244	208	16585	14	495	-1561
December 16, 2018	12	13.65	15212	192	16349	15	747	-1564
December 16, 2018	13	14.34	15105	201	16268	14	933	-1681
December 16, 2018	14	14.37	15010	182	16437	14	936	-2089
December 16, 2018	15	34.23	15107	180	16448	15	1154	-2226
December 16, 2018	16	28.9	15526	195	16380	15	1340	-1934
December 16, 2018	17	40.51	16514	200	16973	13	1270	-1508
December 16, 2018	18	39.94	17658	184	17858	12	1776	-1689
December 16, 2018	19	50.18	17462	195	18092	11	1513	-1760
December 16, 2018	20	43.41	17121	168	18247	14	1197	-2013
December 16, 2018	21	29.6	16743	162	17131	15	1352	-1468
December 16, 2018	22	12.14	16062	145	16609	14	1388	-1557

December 16, 2018	23	9.08	15084	186	16111	14	1351	-2004
December 16, 2018	24	6.33	14094	157	15750	14	768	-2071
December 17, 2018	1	3.48	13419	218	15720	14	404	-2333
December 17, 2018	2	14.31	13006	251	15858	14	316	-2871
December 17, 2018	3	13.63	12801	287	16108	14	302	-3177
December 17, 2018	4	2.04	12771	233	16139	14	296	-3227
December 17, 2018	5	1.21	12970	294	16116	14	296	-3049
December 17, 2018	6	3.74	13633	272	16211	14	276	-2533
December 17, 2018	7	9.27	15036	229	16866	14	852	-2410
December 17, 2018	8	10.84	16590	183	17390	14	1342	-1944
December 17, 2018	9	13.36	16967	225	18103	14	996	-1896
December 17, 2018	10	56.87	17150	199	18509	12	776	-1932
December 17, 2018	11	74.51	17210	131	19104	13	427	-2096
December 17, 2018	12	39.75	17319	128	18864	20	590	-2020
December 17, 2018	13	37.5	17287	141	18858	24	681	-2148
December 17, 2018	14	13.37	17348	134	18711	17	814	-1922
December 17, 2018	15	13.34	17251	171	19055	13	814	-2446
December 17, 2018	16	9.64	17570	172	18697	14	1099	-1978
December 17, 2018	17	26.58	18272	180	18874	14	1213	-1626
December 17, 2018	18	39.9	18939	182	19310	14	1389	-1431
December 17, 2018	19	31.59	18726	216	18863	14	1463	-1277
December 17, 2018	20	39.33	18646	199	18928	14	1463	-1581
December 17, 2018	21	37.41	18287	179	18867	14	1388	-1733
December 17, 2018	22	40.65	17660	170	18215	11	1463	-1897
December 17, 2018	23	18.76	16487	218	17138	12	1356	-1656
December 17, 2018	24	48.29	15329	202	16560	13	941	-1903
December 18, 2018	1	20.16	14566	204	16015	15	828	-1945
December 18, 2018	2	13.34	14167	172	15830	14	513	-1887
December 18, 2018	3	13.34	13950	202	15631	14	566	-1978
December 18, 2018	4	18.36	13925	189	15554	14	757	-2141
December 18, 2018	5	15.06	14133	191	15496	14	1051	-2196
December 18, 2018	6	32.14	14816	204	15886	13	1251	-2042
December 18, 2018	7	55.33	16190	160	17095	12	1229	-2010
December 18, 2018	8	81.27	17660	167	17854	14	1521	-1625
December 18, 2018	9	48.29	17739	174	17809	14	1477	-1428
December 18, 2018	10	37.5	17266	157	17008	14	1546	-1010
December 18, 2018	11	36.59	16806	180	16846	13	1419	-1215
December 18, 2018	12	33.39	16390	159	16774	13	1388	-1477
December 18, 2018	13	37.41	16169	189	16854	13	1119	-1672
December 18, 2018	14	37.5	16189	203	16830	13	1413	-1829
December 18, 2018	15	35.83	16480	184	16718	13	1431	-1462
December 18, 2018	16	36.93	17094	145	17247	13	1438	-1450
December 18, 2018	17	40.17	18114	193	18146	13	1466	-1292
December 18, 2018	18	42.01	19164	169	19024	13	1711	-1316
December 18, 2018	19	42.32	19053	175	19264	14	1481	-1550
December 18, 2018	20	41.35	18902	173	19113	14	1481	-1488
December 18, 2018	21	38.99	18601	104	18684	14	1444	-1402
December 18, 2018	22	38.76	17912	120	18206	14	1463	-1577
December 18, 2018	23	28.64	16715	139	17202	15	1280	-1530
December 18, 2018	24	13.16	15464	120	16051	13	1035	-1411

December 19, 2018	1	16.35	14614	126	15851	13	737	-1763
December 19, 2018	2	10.91	14059	183	15784	13	661	-2110
December 19, 2018	3	4.42	13797	237	15758	13	333	-2001
December 19, 2018	4	8.43	13696	144	15820	13	414	-2368
December 19, 2018	5	5.54	13845	163	15920	13	196	-2113
December 19, 2018	6	2.26	14358	155	16545	13	392	-2371
December 19, 2018	7	13.26	15680	145	17394	13	496	-2082
December 19, 2018	8	30.64	17086	111	18599	13	672	-2053
December 19, 2018	9	34.71	17246	146	18756	13	617	-1941
December 19, 2018	10	37.36	16994	120	18387	13	604	-1840
December 19, 2018	11	22.19	16778	88	18302	13	391	-1821
December 19, 2018	12	21.96	16523	74	18332	13	214	-1923
December 19, 2018	13	6.54	16273	94	17774	14	471	-1844
December 19, 2018	14	38.26	16281	74	17927	13	214	-1835
December 19, 2018	15	27.29	16452	86	17442	13	900	-1794
December 19, 2018	16	37.16	16855	77	17311	13	1239	-1675
December 19, 2018	17	46.62	17643	72	18215	14	914	-1357
December 19, 2018	18	38.36	18492	76	18887	14	1400	-1654
December 19, 2018	19	35.8	18275	68	18789	14	1389	-1789
December 19, 2018	20	24.73	18106	83	18770	14	1055	-1651
December 19, 2018	21	17.18	17801	83	18599	14	1181	-1858
December 19, 2018	22	34.86	17145	77	18153	15	914	-1782
December 19, 2018	23	15.21	16105	79	17093	13	870	-1692
December 19, 2018	24	10.88	14868	106	16277	13	912	-2059
December 20, 2018	1	14.35	14042	93	16121	13	346	-2193
December 20, 2018	2	14.35	13563	90	15692	13	316	-2248
December 20, 2018	3	25.09	13387	78	15752	13	266	-2494
December 20, 2018	4	40.51	13356	89	15864	13	202	-2603
December 20, 2018	5	30.16	13486	145	15625	13	246	-2221
December 20, 2018	6	10.83	14088	133	15905	13	385	-2086
December 20, 2018	7	19.36	15377	134	17022	13	462	-2059
December 20, 2018	8	34.94	16762	125	17964	13	772	-1859
December 20, 2018	9	36.22	17051	141	17616	14	1398	-1785
December 20, 2018	10	36.87	16922	115	17145	13	1473	-1603
December 20, 2018	11	37.12	16898	116	17556	24	911	-1573
December 20, 2018	12	37.14	16860	122	17355	14	1167	-1644
December 20, 2018	13	37.16	16829	159	17063	14	1512	-1568
December 20, 2018	14	42.39	16947	73	17211	15	1512	-1649
December 20, 2018	15	38.31	16889	61	16873	15	1512	-1496
December 20, 2018	16	31.52	17089	76	17140	13	1513	-1491
December 20, 2018	17	34.91	17718	111	17791	12	1175	-1168
December 20, 2018	18	37.18	18334	130	18678	12	1199	-1472
December 20, 2018	19	36.27	18147	140	18631	16	1404	-1785
December 20, 2018	20	35.1	17964	132	18335	16	1513	-1653
December 20, 2018	21	33.41	17693	139	18049	13	1509	-1656
December 20, 2018	22	34.98	17090	137	17482	12	1524	-1797
December 20, 2018	23	31.69	16050	133	16339	13	1599	-1765
December 20, 2018	24	30.13	14873	138	15618	15	1274	-1786
December 21, 2018	1	9.84	14099	143	15549	14	929	-2141
December 21, 2018	2	10.23	13551	158	15561	13	316	-2136

December 21, 2018	3	7.96	13204	180	15359	13	176	-2039
December 21, 2018	4	9.49	13070	169	15279	13	236	-2186
December 21, 2018	5	12.69	13180	155	15468	13	260	-2290
December 21, 2018	6	10.21	13756	163	15645	13	136	-1775
December 21, 2018	7	17.05	14951	141	16140	13	1045	-1995
December 21, 2018	8	31.03	16330	131	17365	13	781	-1691
December 21, 2018	9	16.48	16896	118	17640	13	1163	-1783
December 21, 2018	10	34.13	16994	123	17674	13	1223	-1769
December 21, 2018	11	24.7	17000	123	17512	13	1443	-1768
December 21, 2018	12	13.35	16926	104	17306	13	1543	-1711
December 21, 2018	13	6.55	16619	111	17048	13	1505	-1643
December 21, 2018	14	5.13	16483	104	16976	13	1548	-1829
December 21, 2018	15	6.58	16409	163	17474	13	1120	-1949
December 21, 2018	16	8.06	16509	175	17294	13	1448	-1995
December 21, 2018	17	12.95	17103	183	18167	13	1138	-1995
December 21, 2018	18	15.58	17683	173	18992	13	840	-1949
December 21, 2018	19	14.36	17462	176	18999	13	1192	-2481
December 21, 2018	20	14.35	17222	174	18661	12	1256	-2493
December 21, 2018	21	13.65	16929	171	18587	13	1029	-2458
December 21, 2018	22	13.64	16331	204	17620	13	1356	-2295
December 21, 2018	23	10.11	15441	205	17361	13	757	-2352
December 21, 2018	24	6.09	14378	187	16954	13	306	-2555
December 22, 2018	1	3.78	13684	205	16258	13	136	-2392
December 22, 2018	2	0	13203	186	15743	13	136	-2351
December 22, 2018	3	0	12879	169	15546	13	210	-2487
December 22, 2018	4	0	12844	118	15475	13	166	-2582
December 22, 2018	5	0	12914	104	15429	13	210	-2541
December 22, 2018	6	5.55	13247	101	15821	13	166	-2584
December 22, 2018	7	11.49	13780	152	16740	13	107	-2897
December 22, 2018	8	16.33	14576	153	17441	13	267	-2974
December 22, 2018	9	34.5	15361	140	17845	13	300	-2634
December 22, 2018	10	60.03	15956	173	18440	12	198	-2525
December 22, 2018	11	35.31	16356	122	18474	14	234	-2268
December 22, 2018	12	17.78	16486	157	17974	19	354	-1598
December 22, 2018	13	24.27	16415	177	18017	22	380	-1802
December 22, 2018	14	14.55	16261	158	18214	18	354	-2063
December 22, 2018	15	13.34	16321	166	18328	13	454	-2305
December 22, 2018	16	12.2	16518	136	18172	11	347	-1766
December 22, 2018	17	22.7	17185	170	18539	11	679	-1789
December 22, 2018	18	31.26	17830	134	19127	13	620	-1739
December 22, 2018	19	40.14	17588	156	18950	12	392	-1552
December 22, 2018	20	38.65	17291	155	18198	13	852	-1504
December 22, 2018	21	38.27	16936	166	17634	11	1080	-1507
December 22, 2018	22	33.34	16428	158	16767	14	1348	-1329
December 22, 2018	23	47.2	15636	162	16075	15	1237	-1346
December 22, 2018	24	33.59	14794	155	15606	16	1109	-1600
December 23, 2018	1	24.84	14082	174	15404	14	711	-1725
December 23, 2018	2	19.44	13604	113	15156	12	609	-1907
December 23, 2018	3	25.7	13277	199	15068	13	331	-1825
December 23, 2018	4	26.72	13167	203	15068	13	241	-1828

December 23, 2018	5	13.38	13199	210	14996	13	259	-1757
December 23, 2018	6	13.36	13352	194	15059	13	432	-1832
December 23, 2018	7	13.33	13758	157	15101	13	689	-1798
December 23, 2018	8	23.17	14464	150	15562	13	750	-1676
December 23, 2018	9	29.27	15051	171	15976	12	923	-1620
December 23, 2018	10	16.32	15596	137	16638	14	904	-1759
December 23, 2018	11	18.8	15910	148	17231	13	812	-1943
December 23, 2018	12	29.21	16028	145	17955	12	214	-1991
December 23, 2018	13	28.21	16082	159	17643	13	619	-1965
December 23, 2018	14	36.01	16030	175	17473	13	553	-1778
December 23, 2018	15	36.02	16127	163	17362	14	723	-1813
December 23, 2018	16	36.04	16388	150	16991	14	1312	-1702
December 23, 2018	17	34.46	17108	106	17333	14	1422	-1486
December 23, 2018	18	33.15	17764	121	18154	13	1486	-1658
December 23, 2018	19	29.09	17557	119	18362	14	1070	-1743
December 23, 2018	20	31.53	17225	119	17991	14	1259	-1825
December 23, 2018	21	13.35	16839	99	17731	14	1126	-1831
December 23, 2018	22	20.48	16348	90	17112	14	1264	-1856
December 23, 2018	23	16.23	15547	120	16965	14	632	-1843
December 23, 2018	24	17.91	14657	91	16662	14	327	-2147
December 24, 2018	1	29.26	13838	132	16370	13	143	-2386
December 24, 2018	2	13.35	13373	108	15872	13	118	-2368
December 24, 2018	3	13.33	12954	161	15945	13	166	-2812
December 24, 2018	4	13.32	12909	67	15959	13	182	-3027
December 24, 2018	5	11.45	12887	172	15953	14	162	-2925
December 24, 2018	6	12.69	13229	176	16237	13	82	-2859
December 24, 2018	7	4.24	13871	193	16205	13	468	-2499
December 24, 2018	8	11.49	14756	138	16885	14	578	-2626
December 24, 2018	9	15.6	15418	142	16991	14	1010	-2438
December 24, 2018	10	39	15979	140	17886	14	647	-2480
December 24, 2018	11	15.61	16223	130	18339	14	493	-2363
December 24, 2018	12	14.33	16263	124	18088	14	458	-2136
December 24, 2018	13	14.33	16201	129	18303	14	379	-2352
December 24, 2018	14	14.34	16078	149	18511	14	380	-2632
December 24, 2018	15	15.38	15806	164	18481	14	342	-2791
December 24, 2018	16	9.45	15773	169	18157	14	408	-2651
December 24, 2018	17	5.61	16209	165	18174	13	481	-2218
December 24, 2018	18	5.93	16711	137	18539	13	256	-1810
December 24, 2018	19	10.9	16246	154	18463	13	297	-2245
December 24, 2018	20	14.36	15836	130	18244	14	252	-2339
December 24, 2018	21	16.84	15526	152	17742	13	357	-2323
December 24, 2018	22	35.79	15266	101	17463	14	190	-2261
December 24, 2018	23	23.76	14746	140	16788	14	270	-2200
December 24, 2018	24	15.39	14083	135	16518	14	337	-2501
December 25, 2018	1	14.35	13428	126	15782	14	237	-2327
December 25, 2018	2	24.19	13008	180	15317	14	248	-2260
December 25, 2018	3	14.39	12723	204	15190	13	248	-2350
December 25, 2018	4	14.39	12572	207	15159	13	287	-2539
December 25, 2018	5	23.4	12662	142	15167	14	193	-2457
December 25, 2018	6	14.38	12872	137	14989	14	273	-2147

December 25, 2018	7	19.52	13360	136	15379	13	214	-2019
December 25, 2018	8	26.42	13991	150	15522	14	788	-2074
December 25, 2018	9	27.61	14513	166	15874	13	786	-1873
December 25, 2018	10	14.38	14772	163	16070	14	863	-1973
December 25, 2018	11	14.36	14728	181	15990	13	995	-1959
December 25, 2018	12	14.37	14633	161	16045	13	941	-2057
December 25, 2018	13	14.33	14577	155	15911	13	1024	-2124
December 25, 2018	14	14.34	14627	113	16221	13	830	-2119
December 25, 2018	15	60.83	14808	169	16805	13	413	-2210
December 25, 2018	16	19.92	15183	153	16521	14	887	-1984
December 25, 2018	17	39.91	15523	104	16976	13	624	-1696
December 25, 2018	18	14.34	15779	97	16813	14	1129	-1647
December 25, 2018	19	14.35	15346	160	16722	13	995	-1890
December 25, 2018	20	25.18	15080	170	17009	13	388	-1835
December 25, 2018	21	26.37	14938	163	16963	13	216	-1786
December 25, 2018	22	23.22	14942	169	16476	13	809	-2041
December 25, 2018	23	18.54	14441	155	16231	13	458	-1984
December 25, 2018	24	19.6	13776	132	15680	13	460	-2063
December 26, 2018	1	19.76	13169	216	15394	13	491	-2342
December 26, 2018	2	9.55	12714	174	15294	13	323	-2576
December 26, 2018	3	9.49	12463	183	15212	13	323	-2761
December 26, 2018	4	11.35	12392	205	15080	13	323	-2672
December 26, 2018	5	9.42	12452	167	15220	13	223	-2701
December 26, 2018	6	10.91	12717	187	15361	13	193	-2540
December 26, 2018	7	9.55	13169	202	15504	13	366	-2423
December 26, 2018	8	11.35	13761	190	15976	13	564	-2428
December 26, 2018	9	26.17	14140	220	16464	13	276	-2309
December 26, 2018	10	48.64	14619	206	16585	13	641	-2411
December 26, 2018	11	63.36	14876	174	16605	14	828	-2322
December 26, 2018	12	26.73	14960	152	16273	16	1009	-2094
December 26, 2018	13	13.33	15046	147	16074	13	1260	-2064
December 26, 2018	14	13.35	14958	180	16570	13	835	-2202
December 26, 2018	15	13.36	15025	176	17132	13	296	-2212
December 26, 2018	16	9.03	15202	128	16926	13	841	-2271
December 26, 2018	17	13.72	15722	177	17075	13	1296	-2224
December 26, 2018	18	35.82	16409	167	17765	13	1213	-2132
December 26, 2018	19	34.69	16251	184	17786	13	1296	-2383
December 26, 2018	20	32.44	16065	150	17772	13	1065	-2339
December 26, 2018	21	13.38	15859	157	17320	13	1122	-2160
December 26, 2018	22	23.62	15603	142	16722	13	1407	-2258
December 26, 2018	23	19.48	14985	196	16530	13	1082	-2419
December 26, 2018	24	9.64	14138	189	16231	13	467	-2291
December 27, 2018	1	8.1	13542	200	16189	13	303	-2615
December 27, 2018	2	6.47	13203	211	16086	13	263	-2854
December 27, 2018	3	9.31	13019	199	16153	13	154	-3007
December 27, 2018	4	0	12962	216	15977	13	163	-2870
December 27, 2018	5	0	13096	242	16206	13	206	-2976
December 27, 2018	6	0	13487	201	16623	13	243	-3106
December 27, 2018	7	0	14348	165	16994	13	214	-2616
December 27, 2018	8	11.53	15349	118	18570	13	324	-3422

December 27, 2018	9	14.35	15872	129	19102	13	353	-3393
December 27, 2018	10	14.37	16122	145	19276	13	396	-3333
December 27, 2018	11	15.3	16331	155	19304	13	370	-3154
December 27, 2018	12	38.68	16397	127	19399	13	411	-3230
December 27, 2018	13	14.33	16353	148	18877	14	588	-2827
December 27, 2018	14	8.15	16303	141	19217	14	267	-2956
December 27, 2018	15	7.46	16264	152	19246	13	250	-3025
December 27, 2018	16	5.95	16514	156	19430	13	224	-2938
December 27, 2018	17	8.67	17129	146	19708	15	320	-2653
December 27, 2018	18	14.36	17853	180	20711	13	182	-2764
December 27, 2018	19	14.37	17607	184	20546	13	242	-2943
December 27, 2018	20	41.83	17512	128	20315	13	240	-2906
December 27, 2018	21	14.36	17047	221	20103	13	243	-3012
December 27, 2018	22	27.71	16335	219	19607	13	325	-3299
December 27, 2018	23	3.76	15413	231	18637	13	214	-3125
December 27, 2018	24	0	14463	212	17862	13	143	-3257
December 28, 2018	1	0	13628	216	17147	13	143	-3380
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December 28, 2018	4	0	12498	173	16093	13	226	-3573
December 28, 2018	5	0	12490	183	16023	13	208	-3467
December 28, 2018	6	0	12786	173	16300	13	211	-3505
December 28, 2018	7	0	13434	174	16932	13	233	-3419
December 28, 2018	8	0	14332	179	18153	13	266	-3841
December 28, 2018	9	0	14851	168	18428	13	314	-3638
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December 28, 2018	11	1.2	15487	182	19028	13	233	-3479
December 28, 2018	12	5.84	15607	169	19317	13	245	-3727
December 28, 2018	13	1.56	15598	182	18926	13	139	-3196
December 28, 2018	14	5.16	15403	170	19198	13	143	-3611
December 28, 2018	15	5.22	15209	189	19108	13	143	-3789
December 28, 2018	16	0	15190	168	18629	13	201	-3372
December 28, 2018	17	0	15654	189	18634	13	265	-2988
December 28, 2018	18	4.54	16342	158	19500	13	244	-3168
December 28, 2018	19	4.22	16134	168	19710	13	218	-3555
December 28, 2018	20	5.57	15965	167	19690	13	39	-3540
December 28, 2018	21	0.38	15706	165	19390	13	167	-3572
December 28, 2018	22	2.68	15211	193	18988	13	230	-3661
December 28, 2018	23	0	14387	221	17657	13	264	-3126
December 28, 2018	24	0	13543	197	17163	13	155	-3449
December 29, 2018	1	0	12874	222	16537	13	112	-3410
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December 29, 2018	3	0	12214	186	15880	13	148	-3426
December 29, 2018	4	0	12196	112	15691	13	173	-3417
December 29, 2018	5	0	12212	158	15855	13	143	-3527
December 29, 2018	6	0	12487	152	15922	13	198	-3408
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December 29, 2018	15	9.25	15295	146	17248	13	314	-2039
December 29, 2018	16	13.54	15671	137	17070	14	416	-1576
December 29, 2018	17	18	16609	149	17350	13	1124	-1644
December 29, 2018	18	33	17640	148	18060	13	1418	-1589
December 29, 2018	19	31.57	17480	146	18101	14	1240	-1588
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December 29, 2018	22	22.79	16364	173	17378	13	788	-1499
December 29, 2018	23	22.81	15629	173	16951	13	511	-1508
December 29, 2018	24	25.14	14770	170	16288	13	421	-1699
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December 30, 2018	3	29.3	13548	161	16162	11	332	-2669
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December 30, 2018	5	14.21	13378	157	16182	13	174	-2657
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December 30, 2018	9	13.32	14681	174	16788	13	314	-2173
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December 30, 2018	22	13.36	15793	142	18071	14	259	-2290
December 30, 2018	23	21.98	15057	161	17606	14	278	-2559
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December 31, 2018	1	20.44	13436	161	16279	14	391	-2854
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December 31, 2018	7	9.74	13836	160	15975	14	758	-2595
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December 31, 2018	9	5.95	14982	150	17364	13	214	-2221
December 31, 2018	10	13.32	15309	149	17760	13	239	-2461
December 31, 2018	11	13.34	15470	154	17935	13	277	-2437
December 31, 2018	12	13.34	15461	162	17810	13	643	-2718

December 31, 2018	13	9.04	15487	169	17369	13	693	-2242
December 31, 2018	14	5.33	15373	159	17376	13	781	-2430
December 31, 2018	15	19.09	15642	139	17749	13	570	-2534
December 31, 2018	16	14.23	15962	137	18098	13	602	-2474
December 31, 2018	17	5.83	16523	133	18259	15	818	-2290
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January 2, 2019	10	19.29	17233	147	18420	13	899	-1857
January 2, 2019	11	25.5	17182	182	18757	12	470	-1813
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January 2, 2019	13	32.35	17397	206	18872	13	690	-1953
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January 3, 2019	22	8.53	16846	245	19099	14	309	-2200
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January 3, 2019	24	0	14835	231	17781	14	418	-3007
January 4, 2019	1	0	14030	277	17669	14	446	-3675
January 4, 2019	2	0	13536	278	17070	14	392	-3479
January 4, 2019	3	0	13231	301	16783	14	313	-3401
January 4, 2019	4	0	13163	279	16736	14	389	-3554
January 4, 2019	5	-0.01	13222	285	16076	14	408	-2788
January 4, 2019	6	0	13706	272	16729	14	426	-3086
January 4, 2019	7	0	14655	269	17121	14	333	-2358
January 4, 2019	8	2.32	15773	254	18288	14	382	-2575
January 4, 2019	9	0	16124	248	18354	14	309	-2204
January 4, 2019	10	1.81	16145	222	18558	14	398	-2524
January 4, 2019	11	10.97	16025	147	18606	15	224	-2581
January 4, 2019	12	13.34	15813	186	18154	14	412	-2406
January 4, 2019	13	5.91	15541	171	18098	15	309	-2540
January 4, 2019	14	8.38	15400	186	18126	15	392	-2772
January 4, 2019	15	5.56	15379	197	17705	14	397	-2466
January 4, 2019	16	6.67	15759	165	17745	14	398	-2156

January 4, 2019	17	11.39	16470	207	18311	14	316	-2012
January 4, 2019	18	22.05	17531	185	19127	14	798	-2160
January 4, 2019	19	22.27	17390	175	19025	14	781	-2126
January 4, 2019	20	13.35	17206	149	18670	14	916	-2136
January 4, 2019	21	26.72	16975	183	18551	14	723	-2114
January 4, 2019	22	29.3	16519	96	17804	13	941	-2029
January 4, 2019	23	24.98	15579	84	16960	13	811	-1956
January 4, 2019	24	23	14551	86	16384	13	434	-1970
January 5, 2019	1	13.16	13727	92	16073	14	267	-2328
January 5, 2019	2	1.43	13166	176	15549	14	259	-2301
January 5, 2019	3	5.81	12893	188	15694	13	159	-2706
January 5, 2019	4	5.75	12777	179	15467	14	209	-2659
January 5, 2019	5	5.91	12765	217	15604	14	309	-2850
January 5, 2019	6	5.95	12947	201	15719	14	259	-2706
January 5, 2019	7	10.25	13490	170	15930	14	349	-2631
January 5, 2019	8	10.3	14196	185	16448	14	649	-2643
January 5, 2019	9	33.92	14822	200	16835	14	388	-2160
January 5, 2019	10	17.63	15305	140	16640	13	1160	-2254
January 5, 2019	11	49.6	15605	156	16889	13	1301	-2372
January 5, 2019	12	65.43	15719	221	17190	13	1306	-2469
January 5, 2019	13	15.71	15660	236	16794	14	1418	-2129
January 5, 2019	14	15.38	15544	207	16842	13	1272	-2194
January 5, 2019	15	14.03	15457	227	17008	14	614	-1817
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January 5, 2019	17	5.67	16109	247	17117	14	1663	-2257
January 5, 2019	18	5.83	16983	254	18306	13	1475	-2392
January 5, 2019	19	5.31	16704	221	18583	13	893	-2444
January 5, 2019	20	10.34	16271	196	18661	13	493	-2557
January 5, 2019	21	5.36	15797	209	18219	13	415	-2431
January 5, 2019	22	5.7	15295	180	18003	13	360	-2759
January 5, 2019	23	0	14508	175	17067	13	259	-2453
January 5, 2019	24	0	13708	180	16713	13	288	-2985
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January 6, 2019	7	0	12893	183	16229	13	364	-3461
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January 6, 2019	10	5.72	14413	222	17121	14	248	-2759
January 6, 2019	11	3.35	14500	243	17020	14	223	-2399
January 6, 2019	12	0	14531	265	16713	13	239	-2121
January 6, 2019	13	6.63	14841	261	17322	14	163	-2384
January 6, 2019	14	12.24	15003	219	17303	13	381	-2449
January 6, 2019	15	23.93	15186	242	17896	15	379	-2829
January 6, 2019	16	12.25	15664	219	17743	15	801	-2603
January 6, 2019	17	15.41	16718	186	17995	15	947	-2086
January 6, 2019	18	47.46	17949	237	18698	15	1341	-1793

January 6, 2019	19	16.97	17847	244	18725	16	1341	-1784
January 6, 2019	20	17.79	17533	238	18595	14	1322	-2047
January 6, 2019	21	15.88	17064	271	18530	14	801	-1893
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January 6, 2019	23	17.8	15598	205	17537	13	359	-1928
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January 7, 2019	1	11.49	14174	210	16901	13	363	-2675
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January 7, 2019	3	0	13613	222	16588	12	234	-2802
January 7, 2019	4	0	13597	191	16383	12	233	-2692
January 7, 2019	5	0	13830	222	16814	13	203	-2805
January 7, 2019	6	0.49	14473	235	17201	13	388	-2751
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January 7, 2019	8	14.83	17331	169	19798	13	515	-2691
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January 7, 2019	12	93.64	17901	210	20622	14	455	-2830
January 7, 2019	13	27.94	17959	215	20276	17	495	-2450
January 7, 2019	14	13.34	18016	186	20035	18	524	-2200
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January 7, 2019	16	38.73	18173	189	20343	18	209	-2169
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January 7, 2019	22	23.49	17510	250	19862	15	209	-2217
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January 8, 2019	6	12.74	14043	165	16777	13	109	-2729
January 8, 2019	7	66.11	15225	143	17249	13	698	-2641
January 8, 2019	8	192.45	16662	175	18373	15	563	-2107
January 8, 2019	9	13.37	16811	80	17765	18	1154	-1880
January 8, 2019	10	8.45	16779	67	17249	19	1122	-1372
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January 8, 2019	12	17.82	16800	83	17836	36	832	-1695
January 8, 2019	13	6.62	16789	65	17568	28	1443	-2102
January 8, 2019	14	13.3	16875	104	18162	19	499	-1692
January 8, 2019	15	13.37	16935	132	18192	16	908	-1984
January 8, 2019	16	6.05	17046	169	18379	15	1272	-2316
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January 8, 2019	19	7.09	17896	207	19029	16	1459	-2141
January 8, 2019	20	6.39	17665	217	19332	16	694	-2055

January 8, 2019	21	10.14	17265	155	19436	16	309	-2227
January 8, 2019	22	5.66	16536	143	18667	15	309	-2171
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January 8, 2019	24	0	14423	144	17442	15	210	-2852
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January 9, 2019	12	5.71	16887	104	19324	14	216	-2501
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January 9, 2019	14	5.96	16690	136	19147	13	184	-2464
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January 10, 2019	8	57.72	17668	46	19962	13	295	-2544
January 10, 2019	9	27.49	17896	15	20138	13	273	-2407
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January 10, 2019	16	14.83	17617	88	20177	15	318	-2812
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January 11, 2019	10	33.42	18718	131	19011	20	1471	-1515
January 11, 2019	11	30.24	18286	123	18779	20	1471	-1730
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January 13, 2019	11	13.32	16011	159	18162	20	345	-2266
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January 27, 2019	24	42.19	16693	239	17161	14	1380	-1591
January 28, 2019	1	48.88	16176	235	16894	14	1336	-1734
January 28, 2019	2	26.43	15878	226	16294	18	1419	-1458
January 28, 2019	3	29.54	15817	245	16062	19	1382	-1280
January 28, 2019	4	84.2	15748	230	17075	14	192	-1205
January 28, 2019	5	28.88	15968	146	16931	18	365	-1081
January 28, 2019	6	32.97	16670	141	17428	19	1076	-1689
January 28, 2019	7	33.07	18047	151	18955	15	993	-1663
January 28, 2019	8	33.78	19441	129	20262	18	1154	-1718
January 28, 2019	9	33.79	19510	135	20348	18	1164	-1824
January 28, 2019	10	32.01	19263	149	20382	18	1239	-2118
January 28, 2019	11	33.05	19262	136	20865	15	1428	-2860
January 28, 2019	12	33.35	19356	132	20861	22	1485	-2887
January 28, 2019	13	32.52	19422	147	20629	24	1708	-2793
January 28, 2019	14	30.08	19513	151	20561	21	1808	-2602
January 28, 2019	15	26.33	19582	122	20671	21	1542	-2474
January 28, 2019	16	30.89	19694	87	20808	19	1193	-2207
January 28, 2019	17	32.97	20180	28	21540	19	213	-1617
January 28, 2019	18	48.85	20983	75	22707	18	474	-2143
January 28, 2019	19	33.86	20862	81	22552	18	995	-2609
January 28, 2019	20	41.88	20564	63	22343	18	682	-2371
January 28, 2019	21	33.93	20173	90	21579	19	521	-1789
January 28, 2019	22	33.96	19277	138	20945	20	729	-2222
January 28, 2019	23	32.6	18160	101	19606	18	580	-1820
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January 29, 2019	1	15.19	16317	134	18080	19	1306	-2829
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January 29, 2019	3	14.38	15668	138	18107	19	1375	-3644
January 29, 2019	4	14.35	15526	98	17956	19	1249	-3536
January 29, 2019	5	14.38	15647	108	18249	19	1259	-3716
January 29, 2019	6	18.15	16171	90	18811	19	462	-3028
January 29, 2019	7	14.86	17305	80	19588	19	343	-2584
January 29, 2019	8	34.43	18536	97	21119	17	109	-2691
January 29, 2019	9	35.05	18882	78	21205	19	309	-2626
January 29, 2019	10	34.25	18938	91	21243	20	909	-3135
January 29, 2019	11	33.81	18810	92	20883	29	1009	-2963
January 29, 2019	12	32.7	18609	94	19932	21	1643	-2855
January 29, 2019	13	32.73	18525	87	19853	21	1495	-2826
January 29, 2019	14	17.67	18384	84	19740	22	1270	-2386
January 29, 2019	15	21.97	18385	89	19963	22	827	-2326
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January 29, 2019	17	27.57	19062	148	20914	22	993	-2593
January 29, 2019	18	32.2	19869	141	21692	22	1193	-2932
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January 29, 2019	24	3.78	16903	88	18538	20	1293	-2809
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January 31, 2019	1	63.78	17278	194	19247	19	792	-2723
January 31, 2019	2	53.24	16864	144	18884	21	792	-2568
January 31, 2019	3	50.95	16607	198	19162	20	292	-2685
January 31, 2019	4	50.6	16606	186	18956	20	92	-2251
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January 31, 2019	13	37.93	18888	127	19995	23	1797	-2647
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January 31, 2019	15	35.72	18770	143	19609	53	1697	-2317
January 31, 2019	16	32.96	19042	177	19931	75	1572	-2325
January 31, 2019	17	25.24	19710	167	20107	80	1794	-2077
January 31, 2019	18	50.18	20703	150	21704	75	1482	-2465

January 31, 2019	19	51.21	20975	106	22583	74	1483	-3110
January 31, 2019	20	51.48	20906	96	22559	76	1641	-3336
January 31, 2019	21	58.15	20756	93	22221	76	1468	-3090
January 31, 2019	22	51.29	20268	127	21207	74	1716	-2654
January 31, 2019	23	41.7	19069	198	19832	74	1736	-2313
January 31, 2019	24	37.91	18000	200	18673	75	1802	-2250
February 1, 2019	1	41.63	17326	246	18237	74	1305	-2007
February 1, 2019	2	43.09	16914	220	18186	75	656	-1779
February 1, 2019	3	39.42	16731	250	17865	73	995	-1967
February 1, 2019	4	38.37	16644	227	17991	72	625	-1728
February 1, 2019	5	39.38	16849	241	18179	74	922	-2104
February 1, 2019	6	34.21	17378	124	18548	73	1168	-2315
February 1, 2019	7	37.67	18624	153	19795	73	604	-1795
February 1, 2019	8	74.96	19817	126	20995	74	926	-2085
February 1, 2019	9	75	19883	139	20917	75	1337	-2218
February 1, 2019	10	68.84	19421	138	20502	75	1579	-2585
February 1, 2019	11	37.82	19016	149	20268	75	1193	-2351
February 1, 2019	12	41.55	18672	139	20332	76	423	-2000
February 1, 2019	13	35.12	18329	158	19216	74	1329	-2065
February 1, 2019	14	39.69	18191	153	19535	72	1295	-2564
February 1, 2019	15	36.13	18135	122	19385	72	1232	-2437
February 1, 2019	16	67.46	18257	143	20516	26	443	-2669
February 1, 2019	17	36.81	19008	166	20359	20	1310	-2589
February 1, 2019	18	110.99	19909	157	21238	19	1429	-2692
February 1, 2019	19	44.16	20224	200	21362	20	1435	-2261
February 1, 2019	20	38.47	20109	194	21420	20	1258	-2371
February 1, 2019	21	35.07	19808	189	20588	20	1417	-1906
February 1, 2019	22	38.69	19132	188	20066	19	1499	-2129
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February 1, 2019	24	32.12	17053	226	18248	19	1666	-2550
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February 2, 2019	3	27.39	15439	260	17160	19	1495	-2949
February 2, 2019	4	24.96	15280	259	17661	16	801	-2892
February 2, 2019	5	21.75	15247	260	17691	20	812	-2898
February 2, 2019	6	20.23	15396	255	18018	20	979	-3310
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February 2, 2019	15	70.28	17161	146	19393	18	265	-2341
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February 2, 2019	17	21.45	17476	158	19184	22	781	-2260
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February 3, 2019	11	14.36	16155	165	18776	21	866	-3236
February 3, 2019	12	14.36	16158	159	18911	21	502	-3071
February 3, 2019	13	12.99	16118	250	18530	22	943	-3076
February 3, 2019	14	10.17	16053	253	18407	22	1217	-3331
February 3, 2019	15	14.34	16037	226	18573	22	1278	-3515
February 3, 2019	16	27.55	16259	249	18920	22	1149	-3597
February 3, 2019	17	28.85	16782	256	19704	21	359	-3048
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February 3, 2019	24	12.99	14382	263	17557	21	364	-3225
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February 4, 2019	4	5.87	13202	241	16183	21	94	-2733
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February 4, 2019	6	11.55	13945	256	16889	21	114	-2793
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February 5, 2019	3	3.11	13023	314	16013	19	294	-2912
February 5, 2019	4	14.33	13048	302	16062	19	369	-3052
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February 5, 2019	6	6.3	13893	292	16634	20	449	-2913
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February 8, 2019	21	27.94	18837	191	20145	20	1345	-2533
February 8, 2019	22	27.78	18205	195	19684	19	1424	-2765
February 8, 2019	23	22.5	17246	242	18380	16	1427	-2358
February 8, 2019	24	19.29	16209	245	18016	18	860	-2425
February 9, 2019	1	16.57	15494	268	17586	19	690	-2483
February 9, 2019	2	14.03	15053	224	17333	19	405	-2451

February 9, 2019	3	13.33	14804	232	17065	19	359	-2396
February 9, 2019	4	13.33	14696	161	16774	19	452	-2369
February 9, 2019	5	13.99	14780	115	16881	19	352	-2397
February 9, 2019	6	13.33	14983	121	17016	19	421	-2381
February 9, 2019	7	20.43	15607	165	17104	19	1270	-2634
February 9, 2019	8	28.28	16270	158	17982	19	1048	-2758
February 9, 2019	9	28.08	16656	126	18267	20	1383	-2879
February 9, 2019	10	27.16	16660	213	18109	19	1356	-2682
February 9, 2019	11	29.92	16575	150	18096	19	1380	-2880
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February 9, 2019	13	29.76	16283	208	17518	19	1354	-2385
February 9, 2019	14	29.4	16121	194	17283	19	1438	-2377
February 9, 2019	15	29.33	16066	250	17438	20	1285	-2403
February 9, 2019	16	26.59	16324	239	17311	20	1309	-2082
February 9, 2019	17	27.37	17134	287	17771	19	1494	-1914
February 9, 2019	18	29.2	18159	250	18624	18	1618	-1830
February 9, 2019	19	30.55	18501	238	19353	19	1589	-2114
February 9, 2019	20	29.43	18221	260	19067	21	1612	-2154
February 9, 2019	21	28.87	17841	244	18570	22	1562	-2037
February 9, 2019	22	28.79	17311	276	18165	22	1562	-2088
February 9, 2019	23	28.36	16560	275	17266	21	1553	-1938
February 9, 2019	24	29.3	15744	263	16742	21	1438	-2119
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February 10, 2019	2	25.93	14794	259	15466	20	1435	-1825
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February 10, 2019	4	25.15	14386	227	15030	19	1553	-1947
February 10, 2019	5	26.02	14396	246	15257	19	1553	-2191
February 10, 2019	6	26.86	14574	258	15521	18	1560	-2279
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February 10, 2019	8	27.07	15537	169	16071	23	1391	-1737
February 10, 2019	9	26.79	15916	203	16280	23	1516	-1694
February 10, 2019	10	27.14	16158	171	16441	22	1596	-1671
February 10, 2019	11	28.19	16286	189	16856	19	1610	-1978
February 10, 2019	12	27.9	16202	182	16453	23	1663	-1756
February 10, 2019	13	26.37	16225	218	16374	24	1558	-1497
February 10, 2019	14	25.43	16236	200	16284	24	1507	-1348
February 10, 2019	15	27.64	16344	164	16629	23	1375	-1535
February 10, 2019	16	27.7	16694	188	16726	24	1418	-1266
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February 10, 2019	18	28.74	18311	193	18168	16	1656	-1449
February 10, 2019	19	28.9	18607	178	18741	18	1647	-1602
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February 10, 2019	22	28.47	17456	198	18124	20	1633	-2042
February 10, 2019	23	29.28	16580	176	17355	20	1635	-2156
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February 11, 2019	1	26.67	15132	155	15849	21	1384	-1884
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February 11, 2019	4	20.9	14522	240	15304	20	1739	-2255

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February 11, 2019	7	28.04	16727	251	17616	17	1307	-2101
February 11, 2019	8	30.87	17989	148	18890	17	1403	-2219
February 11, 2019	9	29.36	18059	133	18681	19	1425	-1964
February 11, 2019	10	28.91	17923	92	18209	22	1611	-1788
February 11, 2019	11	29.31	17815	114	18708	20	1767	-2589
February 11, 2019	12	29.02	17637	151	18810	29	1767	-2791
February 11, 2019	13	28.62	17420	152	18546	32	1789	-2768
February 11, 2019	14	25.27	17228	133	18344	23	1824	-2747
February 11, 2019	15	21.49	17038	155	18069	21	1840	-2718
February 11, 2019	16	21.34	17350	159	18043	24	1771	-2382
February 11, 2019	17	27.42	18027	143	18685	23	1648	-2263
February 11, 2019	18	29.12	18857	169	19801	19	1505	-2384
February 11, 2019	19	29.33	19245	159	20185	19	1428	-2073
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February 11, 2019	23	19.73	16972	245	17891	19	1715	-2429
February 11, 2019	24	15.1	15923	267	17268	19	1477	-2495
February 12, 2019	1	12.16	15289	304	17175	19	1202	-2811
February 12, 2019	2	13.98	14863	247	17232	19	1059	-3168
February 12, 2019	3	13.32	14794	299	16887	19	1477	-3230
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February 12, 2019	5	34.99	14840	276	17799	17	650	-3455
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February 12, 2019	12	87.32	18999	185	20586	20	306	-1698
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February 12, 2019	14	46.44	19046	231	20187	22	331	-1395
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February 12, 2019	23	21.34	16845	216	17748	21	1460	-2109
February 12, 2019	24	19.33	15879	170	17263	19	1162	-2458
February 13, 2019	1	24.83	15229	235	17100	19	1237	-2944
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February 13, 2019	5	14.32	14680	222	16908	19	1055	-3097
February 13, 2019	6	12.94	15228	231	17381	19	1051	-3056

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February 13, 2019	8	19.76	17401	190	18800	19	1438	-2732
February 13, 2019	9	27.84	17691	204	19582	19	1296	-3101
February 13, 2019	10	28.29	17773	177	19945	18	638	-2927
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February 13, 2019	15	22.73	17651	238	19273	19	890	-2291
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February 13, 2019	23	25.89	16886	201	18185	29	1436	-2523
February 13, 2019	24	21.15	15963	194	17304	21	1379	-2543
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February 14, 2019	22	25.92	17259	288	18375	20	1508	-2329
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February 20, 2019	14	28.47	17494	166	18907	20	1621	-2938
February 20, 2019	15	28.55	17640	161	19123	21	1443	-2871
February 20, 2019	16	29.45	17879	197	18890	24	1403	-2273
February 20, 2019	17	27.84	18346	251	18963	21	1548	-1985
February 20, 2019	18	38.2	18948	206	19225	20	1347	-1423
February 20, 2019	19	28.54	19182	251	19362	20	1585	-1510
February 20, 2019	20	31.38	19097	259	19226	21	1719	-1626
February 20, 2019	21	32.56	18739	262	19086	18	1397	-1561
February 20, 2019	22	61.02	18062	299	19137	20	1480	-2171
February 20, 2019	23	25.72	16854	284	17941	22	1472	-2102
February 20, 2019	24	7.01	15749	261	16547	22	1537	-1931
February 21, 2019	1	4.1	14980	322	16376	21	817	-1886
February 21, 2019	2	7.51	14522	296	16522	19	299	-1918
February 21, 2019	3	13.7	14217	289	16804	18	647	-2906
February 21, 2019	4	13.63	14138	277	16635	20	750	-2893
February 21, 2019	5	10.21	14166	269	16659	19	625	-2817
February 21, 2019	6	10.32	14747	232	16819	20	1047	-2866
February 21, 2019	7	12.21	15884	235	17290	19	1601	-2744
February 21, 2019	8	19.87	17006	231	18086	19	1462	-2279
February 21, 2019	9	37.09	17283	213	18763	21	1040	-2353
February 21, 2019	10	31.56	17251	215	19090	19	969	-2647
February 21, 2019	11	26.2	17150	213	19177	19	500	-2347
February 21, 2019	12	21.34	16971	198	18931	22	415	-2113
February 21, 2019	13	21.98	16801	194	18616	20	509	-2164
February 21, 2019	14	14.52	16591	135	18444	20	597	-2263

February 21, 2019	15	14.36	16458	206	18293	20	441	-2176
February 21, 2019	16	18.57	16674	208	18151	28	866	-2210
February 21, 2019	17	25.69	17210	185	18173	20	1382	-2208
February 21, 2019	18	23.1	17770	266	18396	20	1684	-2043
February 21, 2019	19	29.13	18329	276	18684	19	1824	-1979
February 21, 2019	20	29.95	18295	284	18978	18	1691	-2027
February 21, 2019	21	28.4	18030	256	18347	22	1664	-1644
February 21, 2019	22	29.96	17460	269	17783	20	1664	-1653
February 21, 2019	23	26.37	16463	310	16573	22	1631	-1346
February 21, 2019	24	29.58	15423	292	16129	21	1267	-1604
February 22, 2019	1	21.84	14715	269	15582	22	1110	-1652
February 22, 2019	2	27.57	14391	277	15663	20	870	-1834
February 22, 2019	3	24.01	14171	259	15535	19	892	-1934
February 22, 2019	4	22.34	14111	233	15401	20	1081	-2061
February 22, 2019	5	16.95	14279	245	15376	20	1282	-2049
February 22, 2019	6	18.13	14841	267	15538	21	1467	-1872
February 22, 2019	7	28.81	16090	241	16785	19	1499	-1949
February 22, 2019	8	31.23	17233	250	17808	17	1530	-1970
February 22, 2019	9	30.86	17230	198	17694	18	1418	-1735
February 22, 2019	10	28.93	16887	210	17256	19	1401	-1543
February 22, 2019	11	30.5	16631	220	17229	20	1375	-1764
February 22, 2019	12	28.55	16450	258	16714	23	1484	-1512
February 22, 2019	13	28.51	16327	253	16566	21	1483	-1449
February 22, 2019	14	28.58	16408	234	16836	18	1538	-1773
February 22, 2019	15	27.47	16449	190	16979	18	1360	-1747
February 22, 2019	16	24.51	16409	273	16948	25	1313	-1597
February 22, 2019	17	28.06	16857	247	17336	25	1464	-1734
February 22, 2019	18	29.83	17435	249	17639	19	1451	-1436
February 22, 2019	19	39.23	17985	271	18280	19	1461	-1580
February 22, 2019	20	30.26	17950	238	17908	20	1451	-1139
February 22, 2019	21	27.47	17654	249	17491	20	1451	-982
February 22, 2019	22	28.41	17132	243	17302	20	1451	-1393
February 22, 2019	23	28.54	16224	232	16102	19	1451	-1084
February 22, 2019	24	26.01	15232	269	15624	19	1373	-1427
February 23, 2019	1	27.5	14516	261	15428	19	1373	-2044
February 23, 2019	2	41.18	14083	223	15247	19	1319	-2219
February 23, 2019	3	29.8	13801	241	15136	22	1298	-2375
February 23, 2019	4	25.79	13729	258	15201	22	1319	-2508
February 23, 2019	5	46.86	13739	261	15570	19	901	-2517
February 23, 2019	6	19.16	14003	265	15622	20	1068	-2469
February 23, 2019	7	20.09	14549	293	16021	19	912	-2151
February 23, 2019	8	19.05	15175	260	16749	19	464	-1951
February 23, 2019	9	21.97	15617	189	17026	19	942	-2240
February 23, 2019	10	22.13	15840	242	17233	20	1229	-2428
February 23, 2019	11	22.52	15695	240	17130	19	1293	-2474
February 23, 2019	12	17.66	15397	228	16803	18	1432	-2435
February 23, 2019	13	16.28	15058	243	16654	19	1251	-2614
February 23, 2019	14	14.34	14702	235	16277	20	1144	-2457
February 23, 2019	15	14.32	14491	244	16541	19	762	-2541
February 23, 2019	16	13	14759	202	16272	20	1180	-2521

February 23, 2019	17	17.2	15572	221	17104	20	1357	-2795
February 23, 2019	18	21.96	16407	196	17417	21	1379	-2264
February 23, 2019	19	14.36	16928	234	17719	22	1345	-1971
February 23, 2019	20	12.65	16653	214	17426	21	1333	-1893
February 23, 2019	21	12.37	16243	250	17469	21	1269	-2288
February 23, 2019	22	19.69	15611	202	17417	17	753	-2331
February 23, 2019	23	15.9	14860	189	16609	18	967	-2563
February 23, 2019	24	10.14	14042	178	16461	18	532	-2778
February 24, 2019	1	10.3	13439	209	16286	18	310	-2965
February 24, 2019	2	5.86	13088	200	16110	18	318	-3092
February 24, 2019	3	5.8	12940	243	16056	18	266	-3129
February 24, 2019	4	5.93	12777	199	16047	18	311	-3328
February 24, 2019	5	5.87	12735	226	16010	18	345	-3388
February 24, 2019	6	4.29	12866	235	16405	18	352	-3652
February 24, 2019	7	2.44	13485	244	16416	18	337	-3120
February 24, 2019	8	12.62	14074	241	16898	18	281	-2987
February 24, 2019	9	5.93	14572	256	17463	18	159	-2715
February 24, 2019	10	5.27	15011	244	17404	18	282	-2436
February 24, 2019	11	17.27	15299	225	17729	18	209	-2440
February 24, 2019	12	26.59	15691	237	18031	19	274	-2475
February 24, 2019	13	25.73	15979	242	17990	18	715	-2474
February 24, 2019	14	26.6	15977	231	17990	17	654	-2503
February 24, 2019	15	25.66	16111	253	18075	17	640	-2420
February 24, 2019	16	24.47	16375	240	18705	18	256	-2436
February 24, 2019	17	25.25	16922	214	18994	19	300	-2242
February 24, 2019	18	30.14	17338	209	19105	18	667	-2228
February 24, 2019	19	26.51	17614	224	19277	19	721	-2197
February 24, 2019	20	25.69	17382	221	18928	18	628	-1960
February 24, 2019	21	45.03	17010	262	18961	18	628	-2423
February 24, 2019	22	44.67	16373	286	18238	19	883	-2485
February 24, 2019	23	27.78	15564	243	17426	19	718	-2319
February 24, 2019	24	11.4	14827	270	16930	19	703	-2544
February 25, 2019	1	12.38	14263	267	16485	19	582	-2545
February 25, 2019	2	24.71	13963	191	16655	19	255	-2840
February 25, 2019	3	8.95	13887	143	16626	19	300	-2961
February 25, 2019	4	12.49	14006	156	16798	19	346	-3058
February 25, 2019	5	0	14203	121	16781	19	425	-2945
February 25, 2019	6	0.48	14858	48	16965	19	862	-3008
February 25, 2019	7	26.17	16128	56	17505	19	1493	-2883
February 25, 2019	8	29.41	17111	106	18398	19	1662	-2851
February 25, 2019	9	31.37	17442	109	18658	19	1603	-2778
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February 25, 2019	12	13.91	17333	101	18829	26	824	-2221
February 25, 2019	13	12	17230	130	18440	19	1668	-2747
February 25, 2019	14	14.61	17253	146	18517	19	1597	-2808
February 25, 2019	15	15.73	17227	114	18459	19	1794	-3001
February 25, 2019	16	22.31	17412	123	18348	19	1745	-2594
February 25, 2019	17	31.49	18020	160	19236	19	1732	-2923
February 25, 2019	18	39.05	18738	162	20007	18	1634	-2813

February 25, 2019	19	37.9	19261	153	19771	19	2033	-2431
February 25, 2019	20	40.55	19285	178	19789	19	1564	-1961
February 25, 2019	21	40.54	18987	207	19767	19	1322	-1986
February 25, 2019	22	31.59	18247	205	19054	20	1451	-2004
February 25, 2019	23	27.88	17077	228	17768	18	1599	-2016
February 25, 2019	24	22.39	16065	219	17077	17	1544	-2207
February 26, 2019	1	29.45	15454	215	16922	18	1281	-2469
February 26, 2019	2	28.96	15191	183	16986	19	778	-2465
February 26, 2019	3	28.97	15062	213	16715	18	1077	-2542
February 26, 2019	4	28.98	14983	192	16621	21	1103	-2484
February 26, 2019	5	29.98	15176	168	16443	20	1466	-2575
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February 26, 2019	7	35.81	17171	125	17868	19	1429	-2055
February 26, 2019	8	87.76	18222	185	19011	19	1541	-2223
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February 26, 2019	10	33.24	17761	165	18534	19	1398	-2034
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February 26, 2019	12	33.16	17405	124	18159	19	1529	-2217
February 26, 2019	13	32.43	17164	115	17894	19	1642	-2284
February 26, 2019	14	32.21	17075	155	17548	22	1735	-2108
February 26, 2019	15	29.09	16953	172	17804	31	1499	-2279
February 26, 2019	16	30.59	17299	151	17652	25	1502	-1819
February 26, 2019	17	30.47	18194	179	18911	57	1477	-2104
February 26, 2019	18	46.63	18985	181	19765	74	1020	-1649
February 26, 2019	19	63.99	19650	195	19924	80	1375	-1494
February 26, 2019	20	57.36	19613	181	19930	81	1456	-1531
February 26, 2019	21	40.3	19332	213	19758	78	1128	-1363
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February 26, 2019	23	31.42	17623	181	17903	26	1673	-1745
February 26, 2019	24	30.45	16612	203	16930	20	1682	-1724
February 27, 2019	1	39.51	15978	202	16927	20	1431	-2113
February 27, 2019	2	32.43	15653	213	16633	20	1603	-2281
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February 27, 2019	4	24.17	15360	195	16287	23	1079	-1811
February 27, 2019	5	24.71	15554	184	16777	21	778	-1808
February 27, 2019	6	32.3	16220	142	17605	19	728	-2031
February 27, 2019	7	33.25	17528	108	18735	20	1026	-2215
February 27, 2019	8	36.95	18600	142	19961	20	497	-1818
February 27, 2019	9	34.93	18827	160	20221	20	625	-1952
February 27, 2019	10	33.57	18926	139	19559	20	1374	-1995
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February 27, 2019	18	63.96	19655	174	19818	80	1129	-1168
February 27, 2019	19	62.65	20185	191	20051	79	1377	-1178
February 27, 2019	20	60.25	20159	179	20097	82	1548	-1377

February 27, 2019	21	37.26	19721	152	19990	79	1050	-1144
February 27, 2019	22	35.47	18941	186	19386	79	1010	-1349
February 27, 2019	23	33.03	17892	159	18159	26	1333	-1454
February 27, 2019	24	32.22	16865	177	17043	20	1597	-1529
February 28, 2019	1	30.85	16177	116	16537	19	1400	-1636
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February 28, 2019	3	29.74	15698	175	16367	22	1322	-1852
February 28, 2019	4	30.21	15693	158	16372	21	1654	-2174
February 28, 2019	5	31.72	15870	162	16533	21	1712	-2202
February 28, 2019	6	33.14	16607	125	17558	19	861	-1984
February 28, 2019	7	63.13	17898	153	18952	19	669	-1638
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February 28, 2019	17	31.97	17804	158	18343	23	1720	-2139
February 28, 2019	18	42.27	18624	234	19469	52	1125	-1876
February 28, 2019	19	44.12	19290	233	19916	76	1720	-2210
February 28, 2019	20	39.1	19352	200	19966	78	2107	-2450
February 28, 2019	21	33.93	19032	182	19823	79	1842	-2471
February 28, 2019	22	33.48	18397	243	19290	76	1886	-2635
February 28, 2019	23	40.42	17321	244	18646	24	1093	-2238
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March 1, 2019	3	30.44	15046	245	16044	16	1872	-2638
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March 1, 2019	13	31	16219	189	16733	17	1640	-1983
March 1, 2019	14	28.88	16047	194	16164	17	1656	-1535
March 1, 2019	15	29.29	15915	126	16066	16	1680	-1725
March 1, 2019	16	27.19	16165	184	16079	15	1685	-1500
March 1, 2019	17	31.98	16767	250	16856	14	1779	-1721
March 1, 2019	18	33.52	17548	245	17905	14	1619	-1779
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March 1, 2019	23	31.26	16515	202	16463	16	1617	-1325
March 1, 2019	24	29.18	15492	244	15597	14	1714	-1621
March 2, 2019	1	34.02	14741	235	14347	12	1785	-1221
March 2, 2019	2	34.91	14301	173	14146	11	1721	-1347
March 2, 2019	3	37.62	14046	252	14003	11	1794	-1507
March 2, 2019	4	43.07	13889	293	13980	11	1791	-1517
March 2, 2019	5	49.18	13968	265	14295	11	1782	-1798
March 2, 2019	6	74.86	14257	274	14913	13	1732	-2181
March 2, 2019	7	44.33	14764	273	14901	14	1723	-1559
March 2, 2019	8	46.69	15378	277	15345	15	1507	-1161
March 2, 2019	9	36.03	15979	272	15933	17	1487	-1233
March 2, 2019	10	46.93	16415	221	16282	16	1487	-1257
March 2, 2019	11	48.75	16723	238	16251	15	1657	-1069
March 2, 2019	12	48.81	16798	223	16520	16	1808	-1276
March 2, 2019	13	48.58	16516	230	16334	15	1703	-1152
March 2, 2019	14	48.19	16226	237	15736	16	1603	-770
March 2, 2019	15	41.7	16146	239	15842	16	1503	-1006
March 2, 2019	16	40.23	16318	200	15984	14	1503	-955
March 2, 2019	17	39.64	16652	162	16026	15	1505	-680
March 2, 2019	18	35.49	17123	124	16564	14	1507	-845
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March 2, 2019	20	43.11	17355	154	16843	14	1659	-989
March 2, 2019	21	41.05	16957	244	16324	14	1598	-727
March 2, 2019	22	40.01	16418	229	15821	15	1598	-765
March 2, 2019	23	40.52	15764	257	15355	13	1598	-925
March 2, 2019	24	46.42	15009	247	14771	14	1597	-1115
March 3, 2019	1	38.62	14437	224	14356	13	1587	-1221
March 3, 2019	2	26.62	14013	241	14282	14	1587	-1491
March 3, 2019	3	14.86	13806	252	14080	14	1632	-1601
March 3, 2019	4	47.3	13697	249	14466	13	773	-1316
March 3, 2019	5	41.17	13679	236	14669	14	467	-1206
March 3, 2019	6	43.32	13933	283	14976	13	467	-1272
March 3, 2019	7	42.21	14338	245	15356	15	461	-1154
March 3, 2019	8	39.34	14835	235	15032	16	1100	-1036
March 3, 2019	9	31.71	15194	260	15166	14	1592	-1275
March 3, 2019	10	14.42	15170	250	15208	15	1780	-1506
March 3, 2019	11	14.36	15053	265	15063	14	1745	-1410
March 3, 2019	12	17.38	15171	280	15461	14	1478	-1577
March 3, 2019	13	15.36	15256	298	15443	14	1743	-1722
March 3, 2019	14	37.93	15284	267	15572	14	1744	-1756
March 3, 2019	15	42.62	15528	279	15757	15	1735	-1797
March 3, 2019	16	40.27	16019	274	15716	15	1785	-1241
March 3, 2019	17	41.82	16782	221	16179	15	1784	-982
March 3, 2019	18	43.97	17532	255	16799	13	1809	-891
March 3, 2019	19	50.44	17989	216	17789	12	1815	-1287
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March 3, 2019	21	40.01	17454	196	17094	15	1735	-1079
March 3, 2019	22	37.74	16939	165	16341	15	1634	-795
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March 3, 2019	24	42.76	15303	196	15518	12	1714	-1539

March 4, 2019	1	26.44	14775	217	14866	15	1643	-1378
March 4, 2019	2	14.01	14532	248	14750	16	1654	-1472
March 4, 2019	3	14.33	14474	197	14880	14	1173	-1332
March 4, 2019	4	14.38	14572	197	15085	15	1426	-1733
March 4, 2019	5	14.35	14932	169	15314	15	1710	-1820
March 4, 2019	6	37.73	15570	147	16113	14	1447	-1842
March 4, 2019	7	46.36	16955	153	17282	14	1468	-1656
March 4, 2019	8	53.61	18007	151	18584	14	1511	-2023
March 4, 2019	9	49.3	17938	203	18294	15	1537	-1729
March 4, 2019	10	54.89	17630	171	18136	15	1513	-1870
March 4, 2019	11	48.65	17163	241	17698	16	1474	-1735
March 4, 2019	12	45.67	16856	248	17526	21	1448	-1805
March 4, 2019	13	33.96	16655	239	17424	21	1363	-1909
March 4, 2019	14	13.35	16741	195	17226	15	1239	-1661
March 4, 2019	15	31.55	16713	190	17478	15	903	-1542
March 4, 2019	16	24.53	17026	165	17630	16	1164	-1632
March 4, 2019	17	36.91	17833	206	17987	15	1512	-1565
March 4, 2019	18	36.41	18651	195	18481	16	1804	-1498
March 4, 2019	19	44.5	19305	226	19275	16	1757	-1591
March 4, 2019	20	38.62	19462	245	19201	16	1738	-1159
March 4, 2019	21	39.45	19154	278	18903	16	1588	-1202
March 4, 2019	22	36.4	18457	282	18358	16	1508	-1207
March 4, 2019	23	33.64	17434	296	17602	16	1544	-1552
March 4, 2019	24	27.88	16371	300	16539	14	1708	-1600
March 5, 2019	1	29.65	15759	286	15839	15	1690	-1470
March 5, 2019	2	22.46	15461	258	16068	15	1278	-1620
March 5, 2019	3	14.35	15324	269	15856	15	1443	-1682
March 5, 2019	4	14.36	15353	299	16094	15	1162	-1678
March 5, 2019	5	12.96	15519	288	15881	15	1440	-1577
March 5, 2019	6	14.36	16063	301	16514	15	1702	-1883
March 5, 2019	7	18.25	17302	187	17538	15	1610	-1693
March 5, 2019	8	43.35	18244	152	18656	14	1610	-1984
March 5, 2019	9	43.23	18190	222	18918	14	1612	-2168
March 5, 2019	10	24.33	17845	199	19067	14	1180	-2203
March 5, 2019	11	13.73	17561	150	18521	14	1154	-2035
March 5, 2019	12	12.33	17441	158	18202	14	1169	-1874
March 5, 2019	13	13.73	17309	176	17996	14	1610	-2179
March 5, 2019	14	18.28	17421	167	18258	22	1610	-2347
March 5, 2019	15	31.55	17564	160	18628	27	1443	-2494
March 5, 2019	16	39.7	17696	217	18572	14	1610	-2267
March 5, 2019	17	40.06	18251	244	18845	13	1610	-2005
March 5, 2019	18	40.45	18925	214	19202	15	1493	-1589
March 5, 2019	19	47.63	19578	237	19814	12	1466	-1547
March 5, 2019	20	47.6	19776	284	20104	12	1393	-1374
March 5, 2019	21	46.83	19449	279	20015	13	1193	-1480
March 5, 2019	22	43.42	18750	286	19075	16	1493	-1557
March 5, 2019	23	31.99	17667	275	17876	17	1660	-1466
March 5, 2019	24	12.89	16602	263	16918	16	1669	-1652
March 6, 2019	1	26	16013	223	16723	15	1666	-2174
March 6, 2019	2	31.91	15657	221	16772	16	1666	-2488

March 6, 2019	3	30.72	15453	289	17020	15	1702	-2957
March 6, 2019	4	28.81	15450	302	16801	15	1666	-2693
March 6, 2019	5	30.48	15679	305	16928	15	1667	-2595
March 6, 2019	6	36.67	16359	243	17914	14	801	-2225
March 6, 2019	7	38.21	17562	237	19235	14	993	-2487
March 6, 2019	8	69.16	18488	199	20132	14	578	-2100
March 6, 2019	9	57.04	18259	206	20055	14	623	-2126
March 6, 2019	10	37.19	17797	157	18979	15	1173	-2109
March 6, 2019	11	35.59	17372	178	18423	17	1513	-2278
March 6, 2019	12	30.78	17244	201	17849	18	1870	-2221
March 6, 2019	13	32.53	17095	226	17685	18	1861	-2216
March 6, 2019	14	35.59	17069	223	17917	19	1512	-2188
March 6, 2019	15	35.02	17039	231	17840	20	1628	-2201
March 6, 2019	16	28.45	17323	245	17546	20	1660	-1645
March 6, 2019	17	31.92	18033	231	18241	66	1502	-1567
March 6, 2019	18	35.82	18887	262	19038	68	1660	-1691
March 6, 2019	19	43.32	19560	259	19937	70	1660	-1870
March 6, 2019	20	44.19	19778	247	20204	72	1660	-1783
March 6, 2019	21	38.56	19436	240	19881	71	1660	-1899
March 6, 2019	22	37.27	18747	225	19126	24	1682	-1835
March 6, 2019	23	38.55	17606	225	18251	15	1687	-2089
March 6, 2019	24	35.35	16551	282	17446	16	1752	-2322
March 7, 2019	1	31.55	15782	275	16793	16	1666	-2388
March 7, 2019	2	30.18	15449	255	16530	18	1616	-2461
March 7, 2019	3	30.32	15322	293	16751	13	1416	-2535
March 7, 2019	4	27.45	15336	246	16673	16	1539	-2492
March 7, 2019	5	32.8	15553	226	17001	13	1216	-2514
March 7, 2019	6	32.39	16228	210	17603	14	1285	-2512
March 7, 2019	7	38.03	17538	167	18838	14	993	-2272
March 7, 2019	8	79.56	18333	179	19355	15	1093	-1942
March 7, 2019	9	57.2	18063	196	18947	15	1128	-1859
March 7, 2019	10	35.87	17552	209	18522	15	1540	-2236
March 7, 2019	11	33.47	17197	220	17935	15	1621	-2136
March 7, 2019	12	33.3	17004	156	17889	15	1559	-2313
March 7, 2019	13	33.61	16760	180	17796	15	1560	-2462
March 7, 2019	14	33.27	16709	210	17747	15	1559	-2418
March 7, 2019	15	31.1	16624	154	17626	17	1472	-2342
March 7, 2019	16	32.95	16901	165	17594	17	1639	-2324
March 7, 2019	17	33.48	17597	187	18416	40	1639	-2317
March 7, 2019	18	37.11	18426	223	19071	71	1198	-1758
March 7, 2019	19	44.84	19255	229	19723	71	1665	-1957
March 7, 2019	20	34.93	19466	235	19519	70	1786	-1598
March 7, 2019	21	34.13	19165	238	19268	70	1665	-1494
March 7, 2019	22	36.86	18508	220	18916	69	1665	-1939
March 7, 2019	23	35.7	17430	272	18111	24	1598	-1926
March 7, 2019	24	29.92	16362	318	17049	16	1790	-2098
March 8, 2019	1	29.49	15710	290	16184	17	1621	-1765
March 8, 2019	2	29.05	15406	260	15720	15	1615	-1604
March 8, 2019	3	29.17	15255	311	15833	14	1621	-1848
March 8, 2019	4	29.01	15198	290	15824	14	1621	-1900

March 8, 2019	5	32.63	15394	287	16512	12	1285	-2152
March 8, 2019	6	32.21	16035	237	16904	13	1585	-2198
March 8, 2019	7	36.9	17229	250	18077	14	1293	-1933
March 8, 2019	8	34.69	18021	152	18415	15	1193	-1436
March 8, 2019	9	33.37	17688	168	18168	15	1393	-1699
March 8, 2019	10	43.99	17170	181	18123	15	1565	-2388
March 8, 2019	11	42.4	16769	169	17921	15	1638	-2635
March 8, 2019	12	34.4	16553	194	17515	15	1488	-2248
March 8, 2019	13	33.29	16253	252	17136	15	1494	-2125
March 8, 2019	14	32.7	16048	243	16742	15	1506	-1946
March 8, 2019	15	32.53	15830	229	16485	16	1445	-1885
March 8, 2019	16	29.64	15901	219	16265	17	1528	-1643
March 8, 2019	17	29.92	16513	215	16441	17	1528	-1262
March 8, 2019	18	35.18	17319	245	17131	15	1528	-1101
March 8, 2019	19	48	18095	220	18225	14	1528	-1479
March 8, 2019	20	54.01	18338	208	18681	15	1258	-1367
March 8, 2019	21	43.36	18060	199	18085	16	1528	-1296
March 8, 2019	22	34.47	17522	211	17293	16	1528	-1088
March 8, 2019	23	35.54	16571	245	16520	16	1528	-1184
March 8, 2019	24	31.96	15617	244	15440	17	1560	-1031
March 9, 2019	1	33.3	14936	267	15176	16	1611	-1510
March 9, 2019	2	31.73	14552	243	14845	16	1560	-1546
March 9, 2019	3	31.92	14368	275	14722	16	1559	-1597
March 9, 2019	4	30.51	14358	274	14744	16	1442	-1500
March 9, 2019	5	30.29	14453	237	14898	17	1476	-1645
March 9, 2019	6	29.37	14738	184	15565	16	400	-1030
March 9, 2019	7	30.21	15225	194	16293	16	299	-1043
March 9, 2019	8	27.8	15411	204	16480	18	299	-1050
March 9, 2019	9	26.21	15264	196	16212	17	299	-986
March 9, 2019	10	17.58	15027	140	16296	17	299	-1329
March 9, 2019	11	14.77	14804	232	16417	16	299	-1678
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March 9, 2019	14	25.53	14327	208	16644	16	258	-2411
March 9, 2019	15	28.33	14245	175	16707	16	50	-2390
March 9, 2019	16	23.61	14470	187	16624	16	361	-2282
March 9, 2019	17	27.22	15190	151	17192	16	420	-2296
March 9, 2019	18	24.48	16150	154	17699	16	350	-1795
March 9, 2019	19	26.39	16795	194	18594	16	299	-1910
March 9, 2019	20	23.88	16675	185	18666	17	199	-1992
March 9, 2019	21	25.39	16326	180	18314	16	71	-1884
March 9, 2019	22	24.34	15845	168	17758	17	71	-1877
March 9, 2019	23	20.26	15137	185	17107	15	67	-1819
March 9, 2019	24	15.12	14434	207	16809	16	92	-2238
March 10, 2019	1	16.09	13960	219	16448	16	163	-2381
March 10, 2019	2	56.66	13624	179	16477	12	120	-2775
March 10, 2019	3	47.54	13420	220	16250	12	100	-2682
March 10, 2019	4	5.21	13321	238	15516	15	111	-1966
March 10, 2019	5	13.33	13247	243	15804	16	172	-2490
March 10, 2019	6	9.77	13473	199	16058	16	232	-2604

March 10, 2019	7	15.27	13980	206	16518	16	244	-2636
March 10, 2019	8	38.23	14522	229	17059	14	222	-2511
March 10, 2019	9	54.4	15054	208	17693	15	405	-2806
March 10, 2019	10	59.61	15477	234	17647	15	802	-2705
March 10, 2019	11	156.03	15758	227	17865	15	353	-2233
March 10, 2019	12	64.58	15879	182	17790	16	293	-1911
March 10, 2019	13	15.21	16021	98	17449	16	407	-1633
March 10, 2019	14	20.74	16010	165	17379	14	201	-1392
March 10, 2019	15	31.84	16168	197	17519	14	109	-1273
March 10, 2019	16	45	16423	235	17559	15	623	-1515
March 10, 2019	17	27.34	16695	173	17624	17	685	-1255
March 10, 2019	18	20.9	16747	152	17654	18	685	-1332
March 10, 2019	19	13.36	16820	134	17664	18	379	-985
March 10, 2019	20	10.97	16599	119	17286	18	1022	-1538
March 10, 2019	21	13.36	16087	176	17518	16	580	-1796
March 10, 2019	22	24.45	15353	209	17145	14	259	-1805
March 10, 2019	23	54.94	14612	119	16824	14	339	-2387
March 10, 2019	24	16.62	13876	247	16301	16	362	-2483
March 11, 2019	1	13.37	13507	225	16143	15	305	-2671
March 11, 2019	2	7.02	13318	236	15685	15	302	-2375
March 11, 2019	3	12.23	13263	261	15947	15	301	-2656
March 11, 2019	4	13.56	13372	269	16116	15	358	-2833
March 11, 2019	5	5.15	14008	125	16072	15	513	-2385
March 11, 2019	6	4.95	15052	177	16795	15	877	-2424
March 11, 2019	7	29.04	16226	175	17554	16	921	-2147
March 11, 2019	8	31.11	16743	245	18093	14	793	-2025
March 11, 2019	9	30.83	16778	217	18436	15	743	-2084
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March 11, 2019	12	31.79	16613	203	17876	21	1077	-2156
March 11, 2019	13	30.64	16598	183	17739	17	1151	-2043
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March 11, 2019	15	25.82	16379	186	17595	15	1015	-2026
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March 11, 2019	17	27.3	16955	212	17922	15	1108	-1773
March 11, 2019	18	30	17169	191	18015	13	1030	-1718
March 11, 2019	19	59.42	17755	156	17978	14	1085	-1202
March 11, 2019	20	41.34	17813	173	17985	16	1255	-1129
March 11, 2019	21	27.13	17086	151	17117	17	1133	-940
March 11, 2019	22	19.25	16166	167	16534	18	1033	-1147
March 11, 2019	23	18.35	15130	229	15720	15	1108	-1372
March 11, 2019	24	17.71	14381	189	15478	15	851	-1660
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March 12, 2019	3	19.49	13778	200	15579	14	764	-2325
March 12, 2019	4	18	13886	199	15589	15	569	-2057
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March 12, 2019	10	35.36	16188	165	17668	15	875	-2132
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March 12, 2019	13	27.39	15113	91	16171	16	769	-1678
March 12, 2019	14	26.17	14865	125	16095	15	624	-1786
March 12, 2019	15	23.43	14760	115	16218	15	624	-1813
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March 12, 2019	17	24.84	15628	136	16483	15	926	-1652
March 12, 2019	18	25.96	16266	129	16885	16	929	-1457
March 12, 2019	19	25.63	17130	131	17748	16	930	-1428
March 12, 2019	20	26.89	17376	160	18057	15	930	-1371
March 12, 2019	21	27.29	16792	107	17688	15	808	-1511
March 12, 2019	22	26.93	15953	135	16768	15	752	-1376
March 12, 2019	23	26.04	14892	177	15822	15	925	-1642
March 12, 2019	24	24.65	14154	230	15447	15	881	-1907
March 13, 2019	1	16.22	13739	222	14887	15	517	-1357
March 13, 2019	2	13.35	13468	237	14888	15	197	-1320
March 13, 2019	3	12.08	13426	205	14895	15	109	-1288
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March 13, 2019	5	16.65	14068	237	15461	14	194	-1378
March 13, 2019	6	13.77	15191	236	15997	15	805	-1331
March 13, 2019	7	28.86	16427	247	17279	15	1166	-1745
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March 13, 2019	10	28.7	16925	200	17663	16	1031	-1634
March 13, 2019	11	31.45	16850	179	17626	15	995	-1552
March 13, 2019	12	28.71	16672	209	17362	16	995	-1469
March 13, 2019	13	28.69	16592	225	17210	15	991	-1334
March 13, 2019	14	28.6	16552	229	16969	16	952	-1149
March 13, 2019	15	29.96	16533	182	17110	15	993	-1418
March 13, 2019	16	80.93	16723	233	17541	16	995	-1587
March 13, 2019	17	42.19	16964	210	17532	16	995	-1271
March 13, 2019	18	28.88	17022	236	17380	16	986	-1071
March 13, 2019	19	27.24	17447	211	17698	16	1005	-940
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March 13, 2019	23	14.26	14596	258	16202	16	624	-1901
March 13, 2019	24	10.97	13833	264	15660	15	534	-2019
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March 14, 2019	4	1.84	13073	275	15401	13	301	-2355
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March 14, 2019	6	2.34	14595	266	16393	13	888	-2379
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March 14, 2019	10	15.14	15927	187	18173	22	209	-2245

March 14, 2019	11	19.83	15919	221	18233	13	209	-2334
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March 16, 2019	8	41.67	14958	133	16152	12	1479	-2700
March 16, 2019	9	23.58	15127	180	16521	14	1514	-2671
March 16, 2019	10	10.13	14942	163	16470	15	1305	-2551
March 16, 2019	11	3.58	14736	117	16045	14	1401	-2575
March 16, 2019	12	10.9	14687	134	16461	13	1250	-2863

March 16, 2019	13	15.36	14526	146	16631	13	919	-2891
March 16, 2019	14	26.45	14445	176	16646	12	936	-2922
March 16, 2019	15	19.42	14574	179	17210	14	373	-2894
March 16, 2019	16	22.76	14989	174	17396	13	770	-3018
March 16, 2019	17	25.93	15554	158	17705	13	450	-2471
March 16, 2019	18	28.99	15973	169	17833	13	672	-2427
March 16, 2019	19	25.76	16339	159	17674	13	1570	-2625
March 16, 2019	20	27.15	16394	186	17632	13	1507	-2453
March 16, 2019	21	27.06	15975	174	17695	12	1243	-2771
March 16, 2019	22	25.19	15293	189	17167	12	1393	-2884
March 16, 2019	23	26.3	14566	184	16792	12	1241	-3252
March 16, 2019	24	18.88	13944	177	16276	13	449	-2575
March 17, 2019	1	24.82	13580	213	15340	13	1290	-2785
March 17, 2019	2	22.06	13356	236	15194	13	1120	-2682
March 17, 2019	3	22.94	13218	204	14894	10	1526	-2946
March 17, 2019	4	25.86	13273	229	14528	12	1372	-2424
March 17, 2019	5	57.99	13443	205	14820	14	1526	-2650
March 17, 2019	6	58.43	13862	187	14755	14	1526	-2174
March 17, 2019	7	40.68	14266	126	14687	14	1527	-1687
March 17, 2019	8	28.23	14584	199	14973	14	1527	-1614
March 17, 2019	9	23.4	14539	187	14864	15	1184	-1200
March 17, 2019	10	24.27	14375	225	15158	14	676	-1205
March 17, 2019	11	21.25	14331	209	14995	13	1095	-1466
March 17, 2019	12	19.67	14178	217	14958	13	1264	-1740
March 17, 2019	13	13.99	13989	230	15268	13	761	-1770
March 17, 2019	14	19.04	13975	238	15327	13	620	-1765
March 17, 2019	15	26.26	14251	208	15735	12	674	-2037
March 17, 2019	16	28.37	14741	202	15704	12	1360	-2023
March 17, 2019	17	27.67	15438	200	16157	15	1360	-1839
March 17, 2019	18	24.42	15864	187	15905	14	1577	-1356
March 17, 2019	19	27.08	16467	206	16641	14	1627	-1551
March 17, 2019	20	28.18	16705	169	17074	15	1627	-1737
March 17, 2019	21	26.79	16200	207	16602	15	1677	-1711
March 17, 2019	22	27.73	15388	250	16193	15	1460	-1956
March 17, 2019	23	27.63	14533	261	15895	15	1366	-2407
March 17, 2019	24	27.66	13968	224	15277	14	1524	-2593
March 18, 2019	1	26.38	13612	231	14854	13	1336	-2274
March 18, 2019	2	33.04	13545	248	15088	15	935	-2175
March 18, 2019	3	31.69	13587	238	15292	15	770	-2196
March 18, 2019	4	21.08	13805	213	15175	14	1046	-2146
March 18, 2019	5	26.13	14391	201	15237	13	1555	-2118
March 18, 2019	6	33.62	15854	197	17190	12	1527	-2760
March 18, 2019	7	82.28	17136	123	18381	14	1253	-2374
March 18, 2019	8	30.88	17012	136	17936	14	1296	-2056
March 18, 2019	9	31.32	16427	179	17789	14	1229	-2436
March 18, 2019	10	30.75	15976	195	17568	14	1402	-2818
March 18, 2019	11	30.74	15774	235	17413	15	1479	-2960
March 18, 2019	12	30.27	15762	257	17136	15	1522	-2591
March 18, 2019	13	29.95	15684	216	16849	15	1621	-2523
March 18, 2019	14	27.18	15427	249	16528	16	1578	-2400

March 18, 2019	15	24.18	15355	252	16321	15	1550	-2262
March 18, 2019	16	25.37	15577	262	16300	16	1539	-2023
March 18, 2019	17	26.86	16165	229	16698	16	1550	-1898
March 18, 2019	18	26.68	16628	223	17196	14	1539	-1955
March 18, 2019	19	31.32	17444	197	18402	13	1639	-2477
March 18, 2019	20	39.59	17672	217	18518	14	1770	-2324
March 18, 2019	21	29.84	16935	225	18266	15	1539	-2532
March 18, 2019	22	27.34	15931	278	17431	15	1529	-2700
March 18, 2019	23	18.46	14918	275	16308	17	1529	-2554
March 18, 2019	24	18.54	14232	267	15466	17	1534	-2430
March 19, 2019	1	28.68	13850	272	15656	14	1261	-2736
March 19, 2019	2	29.53	13754	225	15667	14	1307	-2931
March 19, 2019	3	26.77	13700	160	15577	15	1307	-2982
March 19, 2019	4	30.51	13857	166	15721	15	1140	-2824
March 19, 2019	5	25.76	14457	185	15442	15	1307	-2038
March 19, 2019	6	32.07	15908	112	17320	13	749	-2180
March 19, 2019	7	62.47	17116	98	18507	14	824	-2067
March 19, 2019	8	35.65	16968	138	18430	16	819	-2064
March 19, 2019	9	30.87	16300	130	17817	16	1206	-2638
March 19, 2019	10	29.6	15726	135	17142	16	1456	-2663
March 19, 2019	11	29.23	15386	128	16475	15	1556	-2523
March 19, 2019	12	28.43	15174	133	15982	17	1639	-2285
March 19, 2019	13	24.27	15146	156	15816	18	1591	-2067
March 19, 2019	14	20.75	14965	237	15555	18	1586	-1787
March 19, 2019	15	24.05	15028	224	16193	18	975	-1876
March 19, 2019	16	24.21	15354	250	16500	17	729	-1681
March 19, 2019	17	24.5	15813	227	16576	17	1355	-1872
March 19, 2019	18	26.19	16236	246	16622	15	1628	-1732
March 19, 2019	19	32.73	16890	236	17375	14	1943	-2123
March 19, 2019	20	30.74	17224	235	17525	15	1818	-1772
March 19, 2019	21	28.63	16663	270	17667	15	1628	-2249
March 19, 2019	22	13.43	15597	285	16476	15	1578	-1954
March 19, 2019	23	16.86	14475	271	15723	14	1556	-2455
March 19, 2019	24	15.2	13775	283	15341	14	1486	-2697
March 20, 2019	1	27.01	13353	254	15293	13	1282	-2972
March 20, 2019	2	30.58	13199	277	15235	12	1161	-2935
March 20, 2019	3	32.02	13157	235	15519	14	1162	-3197
March 20, 2019	4	11.59	13330	257	15043	16	1656	-3075
March 20, 2019	5	7.35	13905	235	15475	14	1629	-2984
March 20, 2019	6	22.17	15220	235	16433	13	1656	-2696
March 20, 2019	7	29.45	16388	156	17554	14	1578	-2521
March 20, 2019	8	29.33	16278	183	17551	16	1578	-2621
March 20, 2019	9	29.25	15735	211	17034	17	1593	-2734
March 20, 2019	10	27.68	15302	173	17053	17	1214	-2793
March 20, 2019	11	20.3	14927	218	16701	17	1093	-2521
March 20, 2019	12	14.38	14702	248	16380	16	1077	-2587
March 20, 2019	13	24.45	14727	222	16804	16	492	-2546
March 20, 2019	14	26.33	14629	222	16489	28	1062	-2765
March 20, 2019	15	25.53	14708	243	16364	33	1328	-2781
March 20, 2019	16	22.48	15261	220	16371	33	1462	-2492

March 20, 2019	17	29.3	15862	198	16613	34	1831	-2375
March 20, 2019	18	29.99	16237	120	16849	31	1831	-2431
March 20, 2019	19	31.41	16795	123	17374	30	1831	-2245
March 20, 2019	20	31.89	16951	179	17169	32	1997	-1935
March 20, 2019	21	32.07	16345	198	17095	33	1809	-2344
March 20, 2019	22	28.86	15316	166	16220	34	1809	-2518
March 20, 2019	23	24.57	14204	233	15038	33	1641	-2230
March 20, 2019	24	38.62	13430	223	14957	31	948	-2237
March 21, 2019	1	39.58	12956	216	15140	30	287	-2265
March 21, 2019	2	35.4	12744	222	15173	31	287	-2451
March 21, 2019	3	22.93	12783	225	14827	32	287	-2145
March 21, 2019	4	20.27	12932	238	14950	32	287	-2042
March 21, 2019	5	16.24	13527	179	14869	32	1120	-2308
March 21, 2019	6	28.89	14852	189	15752	31	1745	-2567
March 21, 2019	7	30.25	16210	173	17093	32	1667	-2480
March 21, 2019	8	30.59	16522	177	17193	32	1667	-2226
March 21, 2019	9	30.67	16468	171	17256	32	1741	-2404
March 21, 2019	10	30.78	16348	175	17300	32	1741	-2451
March 21, 2019	11	30.59	16271	172	17003	32	1766	-2317
March 21, 2019	12	30.68	16197	178	16881	23	1839	-2402
March 21, 2019	13	32.44	16238	122	16555	16	1839	-2037
March 21, 2019	14	31.1	16053	134	16305	16	1939	-2030
March 21, 2019	15	29.19	16001	105	16368	16	1829	-2083
March 21, 2019	16	29.32	16281	118	16633	16	1829	-2061
March 21, 2019	17	38.13	16461	235	17032	16	1829	-2189
March 21, 2019	18	31.28	16529	167	16984	15	1829	-2085
March 21, 2019	19	35.82	16889	221	17038	15	1847	-1749
March 21, 2019	20	35.15	16912	227	17289	15	1945	-1973
March 21, 2019	21	29.09	16314	212	16988	16	1829	-2293
March 21, 2019	22	27.68	15302	207	16018	15	1830	-2269
March 21, 2019	23	29.28	14256	219	15327	14	1670	-2495
March 21, 2019	24	36.04	13489	213	15133	16	1363	-2743
March 22, 2019	1	27.1	13092	183	15031	15	933	-2704
March 22, 2019	2	21.71	12798	222	14853	13	640	-2515
March 22, 2019	3	29.71	12726	233	15052	14	627	-2778
March 22, 2019	4	34.34	12839	269	15319	13	509	-2801
March 22, 2019	5	15.23	13475	274	15293	13	1165	-2757
March 22, 2019	6	8.19	14808	221	15751	13	1756	-2521
March 22, 2019	7	23.31	16081	224	16932	12	1549	-2198
March 22, 2019	8	17.29	16329	245	17449	12	1317	-2126
March 22, 2019	9	4.49	16171	201	17346	12	1136	-1985
March 22, 2019	10	5.2	16042	240	17249	12	1171	-2178
March 22, 2019	11	12.2	15761	194	17501	22	641	-2227
March 22, 2019	12	4.04	15510	203	17060	22	873	-2240
March 22, 2019	13	13.73	15440	220	17687	12	466	-2501
March 22, 2019	14	14.99	15229	240	17660	12	345	-2539
March 22, 2019	15	14.36	15197	184	17069	12	891	-2541
March 22, 2019	16	14.99	15400	204	17414	13	749	-2538
March 22, 2019	17	25.5	15836	138	17749	12	800	-2540
March 22, 2019	18	14.37	16089	168	17863	12	1016	-2538

March 22, 2019	19	12.93	16665	191	17750	12	1710	-2488
March 22, 2019	20	14.38	16925	180	17734	13	1798	-2237
March 22, 2019	21	20.37	16450	171	17717	13	1742	-2724
March 22, 2019	22	19.13	15576	168	17089	11	1615	-2803
March 22, 2019	23	15.72	14585	164	16596	14	1338	-3059
March 22, 2019	24	20.57	13874	169	16438	14	598	-2949
March 23, 2019	1	15.33	13513	193	16037	13	620	-2931
March 23, 2019	2	17.41	13246	221	15962	12	503	-2978
March 23, 2019	3	21.09	13293	199	16197	13	287	-3046
March 23, 2019	4	19.26	13372	207	15919	13	854	-3257
March 23, 2019	5	19.08	13653	203	15821	12	1011	-3048
March 23, 2019	6	15.99	14291	209	15739	13	1316	-2685
March 23, 2019	7	16.77	14843	152	16044	13	1193	-2274
March 23, 2019	8	14.78	15004	160	16000	13	1328	-2109
March 23, 2019	9	4.94	14750	149	15507	14	1328	-1895
March 23, 2019	10	18.53	14554	139	15599	13	1332	-2261
March 23, 2019	11	29.38	14420	163	16029	14	1012	-2455
March 23, 2019	12	27.15	14189	173	15733	14	1580	-2923
March 23, 2019	13	19.36	13862	123	15449	15	1580	-2961
March 23, 2019	14	15.02	13516	119	15192	13	1420	-2760
March 23, 2019	15	14.35	13335	96	15501	13	624	-2587
March 23, 2019	16	10.19	13585	117	15199	13	1492	-2923
March 23, 2019	17	15.27	14294	131	15628	13	1636	-2831
March 23, 2019	18	24.16	14884	145	15986	13	1681	-2657
March 23, 2019	19	28.11	15559	161	16531	14	1681	-2494
March 23, 2019	20	26.36	15876	169	16964	13	1651	-2461
March 23, 2019	21	10.25	15330	177	16505	12	1661	-2565
March 23, 2019	22	0	14561	219	15910	12	864	-1966
March 23, 2019	23	0	13818	226	15429	12	683	-2055
March 23, 2019	24	0.87	13137	225	15481	12	725	-2797
March 24, 2019	1	7.85	12691	312	15704	12	476	-3230
March 24, 2019	2	14.31	12466	333	15782	13	287	-3277
March 24, 2019	3	14.35	12350	318	15761	13	309	-3444
March 24, 2019	4	14.37	12375	305	15797	12	345	-3485
March 24, 2019	5	20.19	12564	315	15732	12	287	-3218
March 24, 2019	6	23.82	12997	299	15801	14	588	-3103
March 24, 2019	7	14.36	13436	247	15854	15	499	-2681
March 24, 2019	8	8.7	13691	246	15757	13	634	-2499
March 24, 2019	9	14.32	13889	259	15627	12	833	-2280
March 24, 2019	10	36.6	13950	280	16136	13	255	-2212
March 24, 2019	11	29.78	14093	229	15822	21	812	-2309
March 24, 2019	12	14.36	14075	260	15603	21	1318	-2479
March 24, 2019	13	5.88	13774	253	15224	13	1151	-2195
March 24, 2019	14	13.64	13654	222	15356	13	867	-2308
March 24, 2019	15	20.86	13714	244	15683	14	436	-2103
March 24, 2019	16	21.02	13999	238	15873	12	646	-2123
March 24, 2019	17	25.44	14814	206	15985	13	1526	-2374
March 24, 2019	18	26.16	15237	238	16233	14	1673	-2261
March 24, 2019	19	31.89	15748	221	16411	14	1689	-2060
March 24, 2019	20	28.36	16038	275	16699	13	1647	-1941

March 24, 2019	21	28.65	15620	272	16134	14	1627	-1719
March 24, 2019	22	26.78	14831	248	15638	15	1580	-1851
March 24, 2019	23	24.24	13919	252	15087	16	1644	-2372
March 24, 2019	24	16.87	13277	266	14601	16	1171	-2144
March 25, 2019	1	19.14	12951	309	14960	15	245	-1918
March 25, 2019	2	24.73	12810	312	14763	15	339	-1898
March 25, 2019	3	23.58	12795	307	15067	17	296	-2127
March 25, 2019	4	20.51	13142	328	15052	20	369	-1908
March 25, 2019	5	7.22	13860	315	15260	20	766	-1778
March 25, 2019	6	17.86	15230	267	16118	56	1111	-1570
March 25, 2019	7	29.37	16442	198	17819	71	1097	-2308
March 25, 2019	8	27.45	16318	223	17691	73	1118	-2278
March 25, 2019	9	27.09	15751	208	16979	73	805	-1865
March 25, 2019	10	27.03	15329	185	16401	70	285	-1264
March 25, 2019	11	27.19	14885	174	16439	20	286	-1623
March 25, 2019	12	27.3	14887	195	16570	14	206	-1671
March 25, 2019	13	28.05	14773	190	16792	15	268	-2115
March 25, 2019	14	27.24	14524	244	16841	15	268	-2346
March 25, 2019	15	22.83	14459	228	16788	16	300	-2390
March 25, 2019	16	8.21	14866	266	16669	15	260	-1880
March 25, 2019	17	22.49	15391	247	17441	14	360	-2198
March 25, 2019	18	25.82	15898	195	18062	14	320	-2346
March 25, 2019	19	37.43	16659	202	18656	12	327	-2259
March 25, 2019	20	30.81	17201	252	18548	14	1457	-2519
March 25, 2019	21	28.38	16710	312	17648	14	1456	-2026
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March 25, 2019	23	18.95	14708	302	15310	14	1663	-1994
March 25, 2019	24	18.37	13987	311	14960	14	1374	-2101
March 26, 2019	1	29.55	13622	293	15295	11	1056	-2476
March 26, 2019	2	26.61	13459	311	15262	11	1008	-2515
March 26, 2019	3	26.65	13490	291	15166	13	1075	-2435
March 26, 2019	4	25.19	13697	260	15365	15	1093	-2503
March 26, 2019	5	29.22	14341	213	16046	13	1166	-2774
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March 26, 2019	7	32.95	16879	253	18213	14	1093	-2195
March 26, 2019	8	30.63	16568	258	17453	15	1456	-2040
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March 26, 2019	14	25.31	14585	213	15509	15	1488	-2247
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March 26, 2019	16	25.65	15027	282	15715	13	1518	-2034
March 26, 2019	17	26.66	15588	241	16528	12	1322	-2132
March 26, 2019	18	26.76	16032	232	16719	13	1548	-2036
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March 26, 2019	21	29.99	16825	248	17172	14	1706	-1855
March 26, 2019	22	28.24	15820	253	16388	15	1548	-1779

March 26, 2019	23	25	14703	250	15043	13	1548	-1636
March 26, 2019	24	23.81	14058	244	14459	14	1635	-1828
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March 27, 2019	2	27.23	13590	265	14798	11	1560	-2487
March 27, 2019	3	26.83	13519	207	14811	13	1560	-2676
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March 27, 2019	5	25.89	14223	188	15814	14	1398	-2888
March 27, 2019	6	31.82	15544	168	17356	15	813	-2558
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March 27, 2019	11	25.6	14954	185	16189	16	1071	-2248
March 27, 2019	12	24.25	14724	176	15818	14	1304	-2315
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March 27, 2019	16	22.57	14759	164	15553	21	1338	-2032
March 27, 2019	17	24	15353	172	15972	14	1538	-2032
March 27, 2019	18	27.62	15870	194	16337	14	1538	-1939
March 27, 2019	19	28.47	16500	173	16874	14	1639	-1887
March 27, 2019	20	28.1	16742	178	17076	15	1639	-1586
March 27, 2019	21	26.66	16156	183	16826	14	1638	-2005
March 27, 2019	22	12.5	15128	191	16241	14	1638	-2490
March 27, 2019	23	11.99	14057	182	15846	14	1303	-2855
March 27, 2019	24	7.32	13237	180	15736	14	681	-2933
March 28, 2019	1	10.73	12832	181	15967	14	216	-3155
March 28, 2019	2	14.31	12649	198	15954	14	91	-3199
March 28, 2019	3	11.59	12587	190	15981	14	97	-3286
March 28, 2019	4	6.47	12729	190	16031	14	146	-3220
March 28, 2019	5	3.08	13246	143	16197	14	547	-3303
March 28, 2019	6	7.54	14581	117	16732	14	1236	-3292
March 28, 2019	7	26.52	15925	109	17327	13	1756	-3117
March 28, 2019	8	24.84	16297	162	17576	15	1656	-2836
March 28, 2019	9	26.1	16330	150	17857	15	1518	-2986
March 28, 2019	10	25.05	16279	137	17811	29	1252	-2674
March 28, 2019	11	26.6	16199	103	17401	14	1680	-2741
March 28, 2019	12	13.64	15698	144	16812	16	1656	-2434
March 28, 2019	13	0	15427	105	16345	15	1320	-2122
March 28, 2019	14	2.3	15305	161	16300	16	1098	-1894
March 28, 2019	15	24.76	15441	193	16943	14	865	-2254
March 28, 2019	16	29.06	15648	182	17545	13	988	-2786
March 28, 2019	17	27.55	15834	212	17357	15	1427	-2667
March 28, 2019	18	24.01	15960	202	16887	13	1626	-2313
March 28, 2019	19	26.41	16398	163	17025	12	1641	-2108
March 28, 2019	20	28.56	16548	193	17699	13	1626	-2576
March 28, 2019	21	20.67	15910	163	16944	13	1626	-2330
March 28, 2019	22	13.26	14954	195	15762	12	1561	-2161
March 28, 2019	23	11.49	13838	173	15264	12	1256	-2506
March 28, 2019	24	29.01	13075	191	14895	12	769	-2546

March 29, 2019	1	32.89	12778	202	14683	13	1052	-2812
March 29, 2019	2	19.55	12607	196	14051	13	1186	-2413
March 29, 2019	3	21.03	12555	177	13981	13	1176	-2434
March 29, 2019	4	22.16	12742	185	14436	12	608	-2228
March 29, 2019	5	14.75	13381	162	14523	12	1740	-2660
March 29, 2019	6	28.2	14700	184	15652	11	1708	-2431
March 29, 2019	7	29.7	15948	195	16750	14	1606	-2235
March 29, 2019	8	29.76	16068	169	16988	14	1663	-2235
March 29, 2019	9	13.02	15672	123	16385	15	1651	-1981
March 29, 2019	10	27.53	15071	99	15765	15	1626	-2110
March 29, 2019	11	27.91	14693	131	15388	15	1631	-2228
March 29, 2019	12	26.46	14357	166	15352	13	1651	-2479
March 29, 2019	13	24.82	14143	174	15102	13	1651	-2478
March 29, 2019	14	3.19	13893	124	14858	13	1616	-2398
March 29, 2019	15	-0.01	13685	120	14746	13	1388	-2318
March 29, 2019	16	13.78	13919	124	14665	13	1586	-2284
March 29, 2019	17	22.08	14401	98	15161	13	1616	-2217
March 29, 2019	18	24.18	14854	73	15575	14	1651	-2248
March 29, 2019	19	28.39	15566	79	16142	14	1722	-2209
March 29, 2019	20	30.12	16042	125	16367	14	1730	-1997
March 29, 2019	21	29.09	15630	105	16159	14	1722	-2183
March 29, 2019	22	25.34	14839	95	15212	14	1722	-1996
March 29, 2019	23	18.21	13770	174	14620	13	1660	-2288
March 29, 2019	24	17	12949	176	13827	12	1435	-2091
March 30, 2019	1	9.74	12448	209	13640	13	728	-1659
March 30, 2019	2	3.32	12229	223	13694	13	567	-1807
March 30, 2019	3	8.04	12122	216	14039	13	624	-2324
March 30, 2019	4	14.35	12139	167	14441	13	616	-2755
March 30, 2019	5	19.1	12456	149	14371	13	1290	-3147
March 30, 2019	6	14.36	13106	176	14714	13	1586	-2965
March 30, 2019	7	9.49	13927	169	14672	13	1436	-2056
March 30, 2019	8	19.65	14865	171	15443	12	1189	-1651
March 30, 2019	9	39.87	15583	116	16117	13	1319	-1760
March 30, 2019	10	35.63	15993	132	16273	14	1797	-1948
March 30, 2019	11	35.69	16158	122	15776	13	1830	-1281
March 30, 2019	12	38.28	16122	138	15588	14	1769	-903
March 30, 2019	13	14.92	15807	121	15177	15	1653	-687
March 30, 2019	14	20.06	15577	189	15513	14	1098	-832
March 30, 2019	15	10.26	15403	178	15808	12	1087	-1249
March 30, 2019	16	19.88	15498	214	16424	12	419	-1151
March 30, 2019	17	25.13	15784	201	16776	12	536	-1350
March 30, 2019	18	25.65	15726	204	16560	14	786	-1364
March 30, 2019	19	17.22	15835	173	16061	13	1629	-1507
March 30, 2019	20	10.85	15741	197	15682	13	1689	-1373
March 30, 2019	21	12.25	15336	221	15859	12	1303	-1569
March 30, 2019	22	12.37	14697	274	15904	12	1200	-2103
March 30, 2019	23	10.68	14047	188	15867	13	845	-2432
March 30, 2019	24	11.54	13359	213	15557	13	688	-2649
March 31, 2019	1	9.74	12935	254	15336	13	113	-2260
March 31, 2019	2	5.86	12620	244	15237	12	229	-2603

March 31, 2019	3	5.86	12442	197	15131	12	255	-2735
March 31, 2019	4	5.93	12509	255	15168	12	246	-2712
March 31, 2019	5	9.07	12736	226	15373	13	189	-2642
March 31, 2019	6	16.18	13118	151	15454	11	193	-2414
March 31, 2019	7	21.54	13621	131	15595	12	450	-2318
March 31, 2019	8	70.18	14315	183	16039	13	562	-2182
March 31, 2019	9	93.52	14819	179	15881	14	993	-1781
March 31, 2019	10	17.47	15028	197	15523	13	1105	-1326
March 31, 2019	11	13.36	15076	192	15631	12	1023	-1321
March 31, 2019	12	13.34	15037	203	15290	12	1603	-1584
March 31, 2019	13	7.15	14855	216	15157	12	1714	-1651
March 31, 2019	14	5.91	14750	234	15283	12	1471	-1731
March 31, 2019	15	13.34	14763	163	15452	12	1263	-1752
March 31, 2019	16	15.27	15151	143	16043	13	949	-1730
March 31, 2019	17	24.3	15623	127	16599	12	1084	-1888
March 31, 2019	18	27.54	15874	150	16541	14	1637	-2093
March 31, 2019	19	41.69	16238	161	16776	13	1652	-1944
March 31, 2019	20	24.06	16554	171	16723	14	1868	-1765
March 31, 2019	21	28.19	16100	148	16687	14	1579	-1846
March 31, 2019	22	14.63	15296	173	16368	14	1229	-1895
March 31, 2019	23	13.17	14364	179	15431	14	1484	-2257
March 31, 2019	24	13.96	13713	160	15159	13	1009	-2213
April 1, 2019	1	15.29	13380	144	15000	14	765	-2200
April 1, 2019	2	23.09	13284	225	15001	13	623	-2224
April 1, 2019	3	27.07	13263	173	15347	14	430	-2335
April 1, 2019	4	13.64	13439	198	15364	14	721	-2423
April 1, 2019	5	16.56	14178	239	15528	14	1116	-2325
April 1, 2019	6	28.56	15556	265	16401	13	1603	-2251
April 1, 2019	7	29.22	16681	232	17237	14	1618	-1996
April 1, 2019	8	29.27	16573	244	17079	15	1694	-1988
April 1, 2019	9	29.19	16067	226	16786	15	1617	-2039
April 1, 2019	10	29.23	15580	246	16456	14	1597	-2174
April 1, 2019	11	29.35	15337	210	16089	13	1633	-2180
April 1, 2019	12	29.98	15121	204	15946	14	1506	-2178
April 1, 2019	13	27.79	15086	184	15656	17	1756	-2048
April 1, 2019	14	22.56	14925	206	15575	13	1715	-2133
April 1, 2019	15	21.18	14811	203	15745	13	1316	-2059
April 1, 2019	16	23.47	15198	205	15879	13	1470	-2032
April 1, 2019	17	20.81	15636	255	16086	22	1675	-1872
April 1, 2019	18	18.33	16009	271	16265	13	1623	-1629
April 1, 2019	19	49.26	16759	271	17081	11	1702	-1893
April 1, 2019	20	96.75	17139	257	17468	13	1897	-1842
April 1, 2019	21	39.76	16553	256	17042	15	1771	-1884
April 1, 2019	22	22.02	15550	257	16207	15	1679	-2053
April 1, 2019	23	13.34	14416	250	15099	12	1830	-2204
April 1, 2019	24	14.36	13709	181	14921	12	1206	-2280
April 2, 2019	1	27.49	13324	172	15137	12	620	-2263
April 2, 2019	2	30.62	13071	161	15119	13	360	-2216
April 2, 2019	3	22.04	13050	167	15052	14	363	-2203
April 2, 2019	4	13.34	13082	107	14728	15	742	-2216

April 2, 2019	5	6.93	13720	132	14822	13	1254	-2230
April 2, 2019	6	3.8	14960	130	15533	13	1772	-2140
April 2, 2019	7	26.66	16057	141	16797	13	968	-1628
April 2, 2019	8	21.44	16197	144	16685	12	1617	-1939
April 2, 2019	9	26.2	15785	148	16840	12	1198	-2095
April 2, 2019	10	24.8	15392	110	16692	12	1182	-2240
April 2, 2019	11	17.87	15016	173	16336	12	1136	-2226
April 2, 2019	12	13.97	14605	194	15921	12	1191	-2264
April 2, 2019	13	4.25	14491	133	15778	12	947	-2086
April 2, 2019	14	15.65	14573	232	16326	12	553	-2209
April 2, 2019	15	27.3	14878	209	16788	13	451	-2238
April 2, 2019	16	36.48	15385	206	17015	13	653	-2171
April 2, 2019	17	33.05	15879	233	16841	13	1238	-2046
April 2, 2019	18	23.48	15940	254	16678	16	1442	-1975
April 2, 2019	19	23.92	16334	251	16890	14	1505	-1852
April 2, 2019	20	10.44	16497	221	16573	12	1676	-1412
April 2, 2019	21	11.51	16012	251	16611	12	1597	-1949
April 2, 2019	22	5.72	14848	224	16122	12	1074	-2046
April 2, 2019	23	1.91	13720	218	15606	12	675	-2347
April 2, 2019	24	0.43	12988	234	15230	13	279	-2358
April 3, 2019	1	0	12629	241	15166	13	189	-2499
April 3, 2019	2	0	12454	180	15196	12	221	-2766
April 3, 2019	3	7.47	12390	170	15222	12	215	-2874
April 3, 2019	4	9.72	12553	196	15318	12	193	-2824
April 3, 2019	5	4.98	13167	134	15434	12	412	-2511
April 3, 2019	6	10.82	14510	113	15985	12	1026	-2425
April 3, 2019	7	14.86	15590	106	16503	12	1478	-2262
April 3, 2019	8	21.9	15503	119	16739	13	1041	-2161
April 3, 2019	9	13.87	15083	130	16692	13	750	-2186
April 3, 2019	10	18.04	14963	100	16885	13	263	-2092
April 3, 2019	11	16.79	14921	130	16648	12	302	-1948
April 3, 2019	12	7.57	14768	183	16114	12	1005	-2123
April 3, 2019	13	12.35	14616	180	15733	12	720	-1700
April 3, 2019	14	12.24	14384	194	15668	13	393	-1502
April 3, 2019	15	2.11	14378	196	15647	12	269	-1415
April 3, 2019	16	10.01	14665	220	16032	13	328	-1546
April 3, 2019	17	8.75	15135	142	16462	13	496	-1711
April 3, 2019	18	22.07	15494	141	16599	12	620	-1714
April 3, 2019	19	61.16	16263	144	16642	12	1297	-1779
April 3, 2019	20	69.41	16917	152	16851	13	1754	-1496
April 3, 2019	21	101.24	16445	149	16306	14	1694	-1364
April 3, 2019	22	36.67	15495	161	15489	14	1920	-1641
April 3, 2019	23	50.76	14433	161	14928	15	1530	-1704
April 3, 2019	24	26.86	13694	202	14175	14	1369	-1528
April 4, 2019	1	27.06	13281	260	13958	14	1056	-1446
April 4, 2019	2	20.6	13066	248	13984	14	936	-1567
April 4, 2019	3	14.45	13071	248	13418	13	1525	-1643
April 4, 2019	4	6.66	13223	240	13380	12	1456	-1502
April 4, 2019	5	15.03	13888	241	13974	12	1788	-1688
April 4, 2019	6	26.58	15199	208	15242	13	1924	-1690

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April 4, 2019	8	28.06	16097	220	15686	12	1891	-1221
April 4, 2019	9	29.2	15554	225	15537	13	1299	-1022
April 4, 2019	10	54.46	15225	242	16409	13	623	-1520
April 4, 2019	11	28.6	14997	254	15655	14	1605	-1933
April 4, 2019	12	26.31	14826	222	15501	14	1605	-2046
April 4, 2019	13	25.16	14720	232	14656	13	1614	-1355
April 4, 2019	14	22.87	14536	217	14284	13	1644	-1210
April 4, 2019	15	23.73	14541	226	14269	20	1396	-975
April 4, 2019	16	20.72	14903	233	14402	13	1534	-849
April 4, 2019	17	28.22	15461	259	15048	13	1564	-951
April 4, 2019	18	29.03	15845	269	15387	14	1822	-1024
April 4, 2019	19	41.6	16521	271	16077	15	1588	-962
April 4, 2019	20	41.36	17044	271	16424	14	1836	-989
April 4, 2019	21	28.63	16449	210	16015	14	1791	-1094
April 4, 2019	22	24.1	15412	244	15315	13	1816	-1363
April 4, 2019	23	16.08	14363	205	14514	12	1796	-1664
April 4, 2019	24	16.62	13608	204	14390	12	1384	-1897
April 5, 2019	1	16.4	13175	208	14577	13	615	-1828
April 5, 2019	2	6.22	12898	215	14575	14	628	-2035
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April 5, 2019	4	35.93	13095	206	15096	14	495	-2285
April 5, 2019	5	5.29	13655	240	14873	14	1365	-2406
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April 5, 2019	7	29.99	16069	135	17145	14	634	-1616
April 5, 2019	8	29.96	16383	167	17433	13	455	-1450
April 5, 2019	9	29.89	16243	166	17293	14	482	-1507
April 5, 2019	10	30.31	16193	193	17229	16	860	-1709
April 5, 2019	11	29.22	16179	141	16496	17	1503	-1629
April 5, 2019	12	29.2	16150	184	16085	17	1792	-1554
April 5, 2019	13	29.21	16216	197	16025	17	1778	-1431
April 5, 2019	14	29.49	16155	250	16152	16	1664	-1424
April 5, 2019	15	29.21	16096	245	15937	14	1667	-1349
April 5, 2019	16	29.65	16241	162	16367	14	1393	-1359
April 5, 2019	17	49.7	16427	181	16806	14	1150	-1391
April 5, 2019	18	44.54	16310	198	16707	15	1209	-1359
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April 5, 2019	20	27.43	16589	201	16428	14	1615	-1216
April 5, 2019	21	33.98	15981	219	16638	14	600	-1031
April 5, 2019	22	27.98	14950	272	15641	15	809	-1157
April 5, 2019	23	23.59	13919	259	14085	12	1622	-1511
April 5, 2019	24	26.86	13085	206	13358	12	1398	-1425
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April 6, 2019	3	33.05	12239	249	13123	13	882	-1467
April 6, 2019	4	31.49	12266	207	13126	13	805	-1416
April 6, 2019	5	25.49	12540	196	12993	15	1099	-1328
April 6, 2019	6	30.02	13090	168	13085	14	1435	-1173
April 6, 2019	7	25.33	13716	204	13424	15	1406	-877
April 6, 2019	8	59.66	14303	196	14387	14	685	-574

April 6, 2019	9	86.13	14524	205	14810	14	793	-812
April 6, 2019	10	14.38	14319	138	13938	14	1551	-876
April 6, 2019	11	20.93	14120	139	14068	12	1496	-1214
April 6, 2019	12	19.27	13796	152	13837	12	1358	-1127
April 6, 2019	13	28.49	13416	145	13774	14	1651	-1799
April 6, 2019	14	14.84	13093	136	13248	13	1714	-1644
April 6, 2019	15	14.38	13068	137	13402	12	1511	-1705
April 6, 2019	16	21.62	13221	186	14028	12	623	-1247
April 6, 2019	17	16.22	13721	214	14099	13	1321	-1464
April 6, 2019	18	17.88	14059	227	14301	12	1390	-1412
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April 7, 2019	1	17.64	11768	238	13755	14	261	-1979
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April 7, 2019	3	9.08	11437	204	13706	13	154	-2189
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April 7, 2019	6	14.35	12039	266	14268	12	135	-1977
April 7, 2019	7	12.92	12454	265	14576	15	139	-1962
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April 7, 2019	12	14.9	13385	197	14171	14	1111	-1656
April 7, 2019	13	14.9	13229	211	14168	13	814	-1513
April 7, 2019	14	14.36	13193	231	14234	13	928	-1738
April 7, 2019	15	13.05	13400	246	14595	13	909	-1793
April 7, 2019	16	7.87	13944	268	14959	13	1133	-1882
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April 8, 2019	1	1.45	11869	290	14789	13	190	-2787
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April 8, 2019	13	29.49	15072	231	15800	14	1149	-1647
April 8, 2019	14	28.86	14858	227	15601	15	1080	-1532
April 8, 2019	15	28.33	14805	220	15729	12	646	-1319
April 8, 2019	16	29.65	15068	249	16032	10	392	-1202
April 8, 2019	17	34.78	15360	220	16826	10	129	-1342
April 8, 2019	18	47.11	15500	249	16501	11	465	-1238
April 8, 2019	19	35.54	15785	241	16418	11	734	-1055
April 8, 2019	20	39.12	16222	269	16303	11	877	-708
April 8, 2019	21	45.31	15660	235	16510	11	662	-1193
April 8, 2019	22	12.82	14578	322	15514	11	1002	-1571
April 8, 2019	23	5.81	13414	249	14547	9	1002	-1793
April 8, 2019	24	16.64	12671	268	14154	9	428	-1663
April 9, 2019	1	18.54	12256	237	14279	10	440	-2195
April 9, 2019	2	40.52	12008	235	14118	8	364	-2284
April 9, 2019	3	22.71	11974	246	14194	11	355	-2340
April 9, 2019	4	48.92	12104	181	14187	10	280	-2238
April 9, 2019	5	13.35	12676	202	14257	11	902	-2107
April 9, 2019	6	6.52	14002	218	15136	9	479	-1446
April 9, 2019	7	5.87	15212	122	15862	10	985	-1483
April 9, 2019	8	8.4	15461	132	16272	10	654	-1300
April 9, 2019	9	13.32	15478	174	16359	9	704	-1418
April 9, 2019	10	23.35	15368	208	16681	9	392	-1501
April 9, 2019	11	78.45	15236	200	16833	11	455	-1864
April 9, 2019	12	13.83	15035	155	16242	11	637	-1598
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April 9, 2019	14	25.95	15020	204	16867	13	134	-1758
April 9, 2019	15	29.66	15147	180	17032	14	229	-1934
April 9, 2019	16	54.92	15376	153	17287	15	153	-1914
April 9, 2019	17	82.71	15622	158	17244	15	68	-1558
April 9, 2019	18	138.6	15736	217	17285	15	102	-1491
April 9, 2019	19	52.08	16050	194	17086	15	501	-1165
April 9, 2019	20	29.48	16459	202	16701	15	880	-965
April 9, 2019	21	30.09	16014	212	16495	15	745	-961
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April 9, 2019	24	16.51	13102	156	14565	14	407	-1620
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April 10, 2019	2	20.62	12588	182	14060	14	106	-1329
April 10, 2019	3	18.69	12525	217	14319	14	185	-1729
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April 10, 2019	6	29.37	14697	206	15550	13	1151	-1780
April 10, 2019	7	42.88	15845	179	17043	14	458	-1486
April 10, 2019	8	29.12	15939	112	16936	14	634	-1415
April 10, 2019	9	23.98	15667	125	16569	14	953	-1513
April 10, 2019	10	27.25	15406	140	16105	13	828	-1320
April 10, 2019	11	29.08	15102	147	15914	13	1025	-1593
April 10, 2019	12	29.37	14822	150	15808	14	1051	-1778

April 10, 2019	13	30.72	14766	130	15617	15	1138	-1799
April 10, 2019	14	26.43	14516	166	14970	15	1138	-1459
April 10, 2019	15	23.39	14518	145	14817	13	1297	-1352
April 10, 2019	16	24.94	14835	109	15162	13	1160	-1329
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April 10, 2019	19	27.77	16159	134	16257	13	1444	-1396
April 10, 2019	20	30.5	16713	162	16849	11	1562	-1526
April 10, 2019	21	30.15	16203	156	16639	14	1314	-1459
April 10, 2019	22	27.02	15294	155	15585	14	1209	-1246
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April 11, 2019	4	5.1	12834	210	14317	14	656	-1923
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April 11, 2019	6	27.23	14759	232	16521	12	1123	-2637
April 11, 2019	7	29.77	15878	206	17475	13	1002	-2394
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April 11, 2019	9	29.39	15933	210	17842	14	409	-2057
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April 11, 2019	13	10.98	15399	190	16363	17	1095	-1832
April 11, 2019	14	14.38	15511	238	16746	13	832	-1847
April 11, 2019	15	22.08	15615	248	17364	12	933	-2352
April 11, 2019	16	23.23	15883	210	17268	15	1214	-2335
April 11, 2019	17	27.49	16221	217	17557	14	1263	-2348
April 11, 2019	18	29.11	16268	176	17442	14	1254	-2230
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April 12, 2019	3	0	12514	270	15727	13	258	-3123
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April 12, 2019	10	7.67	15101	198	17099	28	667	-2581
April 12, 2019	11	66.36	15122	225	17226	12	622	-2565
April 12, 2019	12	21.93	15081	236	17623	16	213	-2448
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April 12, 2019	15	0	14823	230	17075	13	718	-2696
April 12, 2019	16	0	14838	234	17148	12	722	-2754
April 12, 2019	17	0	14824	221	16993	13	720	-2624
April 12, 2019	18	0	14701	229	17130	13	592	-2805
April 12, 2019	19	0	14883	257	17339	12	625	-2813
April 12, 2019	20	3.22	15295	255	17549	13	661	-2635
April 12, 2019	21	0	14940	253	17175	12	661	-2597
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April 13, 2019	3	-3	11483	207	13775	12	56	-1975
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April 13, 2019	9	-0.06	12912	171	15253	13	109	-2029
April 13, 2019	10	-1.32	12663	214	15020	13	159	-2062
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April 13, 2019	12	-3	12470	133	14736	13	51	-1971
April 13, 2019	13	-3	12303	160	14514	14	135	-2055
April 13, 2019	14	-3	12094	194	14359	13	50	-1971
April 13, 2019	15	-3	12121	199	14379	13	50	-1971
April 13, 2019	16	-1.31	12511	225	14696	12	100	-2021
April 13, 2019	17	0	13094	184	15218	13	100	-2021
April 13, 2019	18	10.01	13552	194	15594	13	99	-2021
April 13, 2019	19	79.62	13892	161	15802	13	170	-1937
April 13, 2019	20	33.76	14395	166	16125	15	188	-1725
April 13, 2019	21	11.54	14169	117	15492	14	194	-1278
April 13, 2019	22	7.6	13574	127	15306	14	169	-1590
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April 13, 2019	24	0.96	12099	126	14192	13	159	-1983
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April 14, 2019	8	14.33	13098	178	15731	13	142	-2494
April 14, 2019	9	13	13702	147	16215	13	139	-2479
April 14, 2019	10	14.38	14123	176	16790	13	82	-2491
April 14, 2019	11	14.38	14445	183	16843	13	169	-2318
April 14, 2019	12	19.9	14659	185	17104	13	84	-2233
April 14, 2019	13	26.87	14802	154	17141	12	96	-2252
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April 14, 2019	18	6.64	15637	186	17301	14	307	-1634
April 14, 2019	19	0.89	15678	162	16891	13	560	-1483
April 14, 2019	20	5.1	15721	176	16775	13	864	-1550
April 14, 2019	21	13.01	15133	157	16592	13	641	-1815
April 14, 2019	22	10.9	14295	178	16211	13	286	-1906
April 14, 2019	23	12.31	13380	198	15739	13	168	-2240
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April 15, 2019	1	14.34	12376	158	15134	13	178	-2610
April 15, 2019	2	14.33	12223	188	14948	13	198	-2615
April 15, 2019	3	3.59	12156	175	14963	13	227	-2675
April 15, 2019	4	0	12328	190	15006	13	191	-2582
April 15, 2019	5	1.35	12946	170	15472	12	109	-2496
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April 15, 2019	7	25.23	15572	214	17320	14	681	-2316
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April 15, 2019	9	14.33	16061	155	16826	14	1201	-1789
April 15, 2019	10	14.34	16044	235	17014	13	1202	-1916
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April 15, 2019	14	0	14672	208	15831	13	735	-1745
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April 15, 2019	23	8.83	13938	245	15525	13	553	-1572
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April 17, 2019	5	6.5	13277	237	15008	12	797	-2226
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April 21, 2019	21	14.78	13668	217	15969	13	159	-2044
April 21, 2019	22	10.93	13130	237	15457	13	127	-2025
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April 22, 2019	2	5.82	11408	254	14828	13	60	-2963
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May 3, 2019	11	14.18	15384	230	16313	14	828	-1523
May 3, 2019	12	13.34	15234	273	15753	13	1349	-1524
May 3, 2019	13	7.77	15122	246	15685	14	1348	-1484
May 3, 2019	14	5.88	14858	207	15676	13	1095	-1564
May 3, 2019	15	5.89	14676	237	16018	13	735	-1745
May 3, 2019	16	9.69	14845	167	16140	13	635	-1685
May 3, 2019	17	16.24	15001	144	16155	13	655	-1706
May 3, 2019	18	14.28	15085	176	16272	12	670	-1657
May 3, 2019	19	6.42	15175	127	15765	12	1080	-1422
May 3, 2019	20	14.41	15448	146	16124	12	1252	-1635
May 3, 2019	21	11.63	15153	136	15774	13	1306	-1643
May 3, 2019	22	9.68	14336	113	15582	12	615	-1627
May 3, 2019	23	9.68	13296	174	15311	12	380	-2090
May 3, 2019	24	7.76	12517	178	15076	12	168	-2381
May 4, 2019	1	14.37	11860	285	14925	12	144	-2864
May 4, 2019	2	18.62	11682	236	15022	12	96	-3154
May 4, 2019	3	15.4	11520	221	14978	12	68	-3257
May 4, 2019	4	6.73	11533	197	14701	12	202	-3152
May 4, 2019	5	5.85	11700	207	14728	13	202	-2926
May 4, 2019	6	10.24	12148	170	15270	13	202	-3141
May 4, 2019	7	28	12841	169	15587	13	189	-2794
May 4, 2019	8	131.14	13504	179	16408	10	189	-2920
May 4, 2019	9	26.09	13864	155	16153	17	344	-2371
May 4, 2019	10	20.67	14039	175	15996	15	635	-2395
May 4, 2019	11	19.73	13958	153	16367	14	191	-2405
May 4, 2019	12	18.47	13677	167	16406	14	132	-2551
May 4, 2019	13	16.61	13401	164	16322	15	132	-2819
May 4, 2019	14	15.06	13111	173	16022	15	146	-2850
May 4, 2019	15	15.36	13048	167	16095	15	101	-2965
May 4, 2019	16	14.53	13111	179	16178	15	100	-2981
May 4, 2019	17	15.19	13397	146	16187	14	151	-2727
May 4, 2019	18	21.42	13628	153	16273	13	73	-2572
May 4, 2019	19	15.49	13748	168	15847	13	413	-2275
May 4, 2019	20	18.79	13950	183	15823	13	270	-1885
May 4, 2019	21	16.69	14019	176	15781	13	601	-2089
May 4, 2019	22	21.23	13474	169	15805	13	148	-2261
May 4, 2019	23	19.93	12681	162	15522	13	73	-2638
May 4, 2019	24	17.79	12006	176	15413	13	39	-3192
May 5, 2019	1	9.12	11542	172	14862	13	9	-3014
May 5, 2019	2	5.93	11283	170	14741	13	9	-3234
May 5, 2019	3	5.88	11219	161	14584	13	9	-3140
May 5, 2019	4	5.95	11248	171	14733	13	9	-3248
May 5, 2019	5	5.94	11401	155	14881	13	9	-3216
May 5, 2019	6	6.62	11599	151	15043	13	9	-3246
May 5, 2019	7	5.92	11845	116	15118	13	9	-2942
May 5, 2019	8	5.81	11961	113	15014	14	9	-2774
May 5, 2019	9	12.1	11999	157	15481	14	9	-3287
May 5, 2019	10	8.42	11949	114	15511	14	9	-3410
May 5, 2019	11	8.97	11935	102	15527	13	9	-3426
May 5, 2019	12	6.28	11865	111	15462	13	9	-3427

May 5, 2019	13	5.91	11715	156	15384	13	9	-3460
May 5, 2019	14	5.72	11577	190	15414	13	9	-3557
May 5, 2019	15	5.55	11721	186	15489	13	9	-3527
May 5, 2019	16	6.25	12231	209	15828	13	9	-3305
May 5, 2019	17	15.94	12899	228	16338	13	9	-3179
May 5, 2019	18	23.82	13398	208	16444	11	9	-2801
May 5, 2019	19	35	13750	228	16534	13	159	-2691
May 5, 2019	20	25.72	14159	235	16367	15	614	-2546
May 5, 2019	21	25	14142	219	16546	13	614	-2671
May 5, 2019	22	23.19	13372	213	16369	13	68	-2766
May 5, 2019	23	11.04	12401	227	15835	13	68	-3164
May 5, 2019	24	4.42	11668	204	15216	13	9	-3247
May 6, 2019	1	0	11311	227	14252	12	9	-2698
May 6, 2019	2	0	11176	123	14098	13	98	-2803
May 6, 2019	3	-0.52	11021	188	14067	13	61	-2789
May 6, 2019	4	-0.5	11217	182	14241	13	9	-2804
May 6, 2019	5	9.99	11876	181	15112	13	9	-3098
May 6, 2019	6	39.36	13021	184	15818	12	9	-2673
May 6, 2019	7	24.7	13996	185	16228	13	439	-2445
May 6, 2019	8	5.86	14087	193	15786	13	485	-1945
May 6, 2019	9	5.89	13967	175	15758	13	397	-1909
May 6, 2019	10	6.67	13867	181	15870	13	489	-2106
May 6, 2019	11	5.37	13862	176	15566	19	550	-2042
May 6, 2019	12	5.14	13891	186	15737	19	550	-2174
May 6, 2019	13	19.45	14149	176	16111	11	550	-2305
May 6, 2019	14	15.06	14249	177	16340	11	550	-2324
May 6, 2019	15	3.2	14275	165	16128	11	550	-2120
May 6, 2019	16	1.79	14570	191	15905	12	795	-1836
May 6, 2019	17	6.83	14877	182	16478	11	450	-1839
May 6, 2019	18	55.57	15101	141	16472	13	632	-1791
May 6, 2019	19	170.06	15357	138	16614	12	662	-1780
May 6, 2019	20	65.07	15497	175	16543	14	882	-1607
May 6, 2019	21	5.48	15038	186	15937	14	782	-1292
May 6, 2019	22	3.66	13994	218	15561	13	450	-1621
May 6, 2019	23	3.45	12871	187	15009	14	93	-1964
May 6, 2019	24	2.13	12165	249	14308	13	204	-2022
May 7, 2019	1	-1.06	11693	244	13933	13	46	-1909
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May 7, 2019	3	-2.93	11408	299	13777	12	9	-2026
May 7, 2019	4	-3	11455	309	13873	12	9	-2036
May 7, 2019	5	-3.18	12007	225	14268	13	9	-1990
May 7, 2019	6	2.76	13051	240	15457	12	49	-2217
May 7, 2019	7	19.65	14398	246	16001	12	586	-2073
May 7, 2019	8	26.43	14582	140	15956	18	623	-1789
May 7, 2019	9	37.21	14654	66	15778	16	700	-1684
May 7, 2019	10	8.74	14482	118	15137	15	820	-1089
May 7, 2019	11	5.88	14324	131	14701	12	812	-1016
May 7, 2019	12	7.59	14179	137	15016	11	681	-1369
May 7, 2019	13	8.59	13979	131	15264	11	740	-1830
May 7, 2019	14	3.71	13769	134	15366	12	786	-2101

May 7, 2019	15	0.55	13669	115	15416	12	663	-2236
May 7, 2019	16	0	13881	127	15405	12	745	-2010
May 7, 2019	17	4.18	14186	128	15667	11	613	-1866
May 7, 2019	18	4.44	14385	123	15733	11	659	-1798
May 7, 2019	19	17.96	14846	117	15889	12	708	-1609
May 7, 2019	20	25.67	15206	125	16108	12	788	-1447
May 7, 2019	21	15.93	15043	115	15907	14	787	-1353
May 7, 2019	22	9.73	14029	127	15295	14	799	-1793
May 7, 2019	23	16.14	13000	133	14864	14	154	-1774
May 7, 2019	24	4.88	12293	145	14243	14	68	-1728
May 8, 2019	1	0	11883	199	14040	14	165	-2083
May 8, 2019	2	0	11736	212	13953	14	9	-1987
May 8, 2019	3	0	11671	208	13886	13	49	-2036
May 8, 2019	4	0	11766	178	13957	13	37	-1879
May 8, 2019	5	0.69	12359	135	14583	14	125	-2228
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May 8, 2019	7	5.79	14316	93	15636	14	520	-1710
May 8, 2019	8	2.76	14168	123	15590	14	566	-1768
May 8, 2019	9	0.68	13663	117	15670	13	450	-2186
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May 8, 2019	16	0	13441	176	15369	13	488	-2179
May 8, 2019	17	1.95	13998	109	16013	13	450	-2322
May 8, 2019	18	4.26	14336	149	15986	13	540	-2027
May 8, 2019	19	5.87	14846	131	16363	13	569	-1895
May 8, 2019	20	9.07	15244	149	16538	13	729	-1760
May 8, 2019	21	3.31	14920	173	16342	13	695	-1767
May 8, 2019	22	0	13908	143	15865	13	452	-2112
May 8, 2019	23	0	12790	160	15396	13	9	-2369
May 8, 2019	24	-0.05	12018	165	14644	13	168	-2566
May 9, 2019	1	-0.13	11522	162	14224	13	109	-2568
May 9, 2019	2	-1.27	11438	159	14014	13	143	-2534
May 9, 2019	3	-2.93	11385	130	13816	13	196	-2432
May 9, 2019	4	-0.31	11524	68	14064	12	112	-2510
May 9, 2019	5	-0.01	12042	96	14640	11	109	-2602
May 9, 2019	6	0	13077	83	15570	11	109	-2487
May 9, 2019	7	0	14278	104	15942	11	532	-2066
May 9, 2019	8	0	14570	82	16685	11	597	-2564
May 9, 2019	9	0.43	14606	97	16485	11	469	-2235
May 9, 2019	10	5.84	14608	108	16840	27	550	-2659
May 9, 2019	11	0.93	14514	61	16718	11	480	-2385
May 9, 2019	12	0	14262	56	15832	11	550	-1981
May 9, 2019	13	0	14267	54	16066	12	473	-2219
May 9, 2019	14	0	14504	54	16466	13	499	-2291
May 9, 2019	15	0	14530	100	16522	14	522	-2337
May 9, 2019	16	6.08	14995	115	16829	14	483	-2330

May 9, 2019	17	37.96	15472	109	17479	15	450	-2254
May 9, 2019	18	14.89	15342	139	16713	15	501	-1622
May 9, 2019	19	5.87	15378	144	16441	14	450	-1244
May 9, 2019	20	5.78	15563	173	16282	14	501	-811
May 9, 2019	21	4.33	15104	254	15990	14	791	-1188
May 9, 2019	22	0.38	14130	250	15602	14	450	-1547
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May 9, 2019	24	0	12288	256	14970	14	9	-2400
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May 10, 2019	4	0	11671	274	14491	13	103	-2626
May 10, 2019	5	2.41	12017	247	14548	13	159	-2318
May 10, 2019	6	8.96	13221	268	15280	13	134	-1974
May 10, 2019	7	12.86	14465	250	15612	12	567	-1419
May 10, 2019	8	14.02	14895	245	16171	11	580	-1611
May 10, 2019	9	8.4	15067	230	16303	12	676	-1636
May 10, 2019	10	7.75	15029	233	16219	12	644	-1368
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May 10, 2019	12	4.58	14631	215	16308	14	610	-1960
May 10, 2019	13	2.88	14416	204	16535	16	596	-2345
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May 10, 2019	20	20.76	15091	201	15727	15	880	-1201
May 10, 2019	21	20.06	14873	210	15353	16	924	-1016
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May 11, 2019	6	5.9	11925	166	13595	14	59	-1384
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May 11, 2019	8	7.57	12551	167	14678	13	131	-1946
May 11, 2019	9	10.08	12631	174	14879	13	140	-2131
May 11, 2019	10	14.12	12807	179	14949	12	199	-2203
May 11, 2019	11	30.46	12872	113	15019	14	299	-2344
May 11, 2019	12	14.94	12670	111	14785	15	235	-2163
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May 11, 2019	17	11.37	13302	142	15030	12	221	-1802
May 11, 2019	18	16.29	13584	226	15074	14	236	-1460

May 11, 2019	19	22.78	13769	214	15354	14	236	-1647
May 11, 2019	20	18.66	13945	180	15268	14	422	-1496
May 11, 2019	21	12.63	13763	185	14922	14	545	-1334
May 11, 2019	22	6.46	13104	193	14845	14	275	-1751
May 11, 2019	23	5.92	12288	184	14491	14	230	-2294
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May 12, 2019	18	12.77	13904	178	15911	15	9	-1781
May 12, 2019	19	13.37	14140	168	15995	13	9	-1661
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May 15, 2019	13	5.22	14067	145	16544	14	309	-2372
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May 15, 2019	15	4.37	14092	152	16786	16	309	-2631
May 15, 2019	16	4.68	14306	267	17009	13	421	-2784
May 15, 2019	17	28.07	14573	250	16999	13	363	-2445
May 15, 2019	18	17.33	14744	258	17113	15	417	-2429
May 15, 2019	19	12.33	14978	245	16545	15	575	-1787
May 15, 2019	20	14.35	15298	276	16345	14	829	-1490
May 15, 2019	21	10.8	15186	252	16237	13	829	-1486
May 15, 2019	22	8.93	14201	223	15866	14	407	-1664

May 15, 2019	23	3.97	13018	234	15196	14	68	-1860
May 15, 2019	24	3.21	12179	244	14999	14	168	-2633
May 16, 2019	1	-0.02	11777	252	14452	15	67	-2458
May 16, 2019	2	1.9	11541	236	14373	15	98	-2661
May 16, 2019	3	-0.01	11516	242	14220	14	218	-2689
May 16, 2019	4	1.92	11639	209	14325	14	274	-2748
May 16, 2019	5	4.62	12136	165	14663	12	92	-2392
May 16, 2019	6	5.84	13181	162	15322	12	92	-2079
May 16, 2019	7	12.98	14252	154	16030	12	454	-2010
May 16, 2019	8	8.08	14368	182	15992	13	611	-1980
May 16, 2019	9	5.8	14260	88	15984	13	522	-2007
May 16, 2019	10	5.92	14158	173	16039	13	458	-2144
May 16, 2019	11	5.83	14084	140	15847	13	409	-1928
May 16, 2019	12	2.6	14001	183	15842	13	340	-1954
May 16, 2019	13	3.38	14064	187	15870	14	351	-1866
May 16, 2019	14	0	14053	191	16160	14	354	-2147
May 16, 2019	15	0	13999	178	16144	14	319	-2193
May 16, 2019	16	0	14330	216	15901	15	309	-1597
May 16, 2019	17	5.24	14769	203	16686	13	409	-2042
May 16, 2019	18	4.94	14865	228	16892	12	409	-2063
May 16, 2019	19	5.83	15176	239	17265	12	345	-2058
May 16, 2019	20	4.73	15327	256	17546	12	341	-2012
May 16, 2019	21	0	14956	268	16736	12	373	-1723
May 16, 2019	22	0.4	14028	237	16255	12	347	-2236
May 16, 2019	23	0	12935	206	15636	12	9	-2311
May 16, 2019	24	0	12264	190	14870	12	68	-2380
May 17, 2019	1	0	11765	294	14693	12	92	-2631
May 17, 2019	2	0	11593	270	14491	12	104	-2644
May 17, 2019	3	0	11514	275	14346	13	134	-2674
May 17, 2019	4	0	11553	305	14374	13	162	-2686
May 17, 2019	5	2.7	12058	277	14696	13	124	-2464
May 17, 2019	6	5.83	13075	307	15566	13	176	-2392
May 17, 2019	7	5.79	14153	247	15978	12	522	-2058
May 17, 2019	8	5.86	14447	203	16216	12	553	-2043
May 17, 2019	9	1.91	14409	240	16133	13	463	-1792
May 17, 2019	10	0	14232	260	15793	13	379	-1577
May 17, 2019	11	0	14090	275	16254	13	339	-2187
May 17, 2019	12	0	13922	268	16197	14	363	-2337
May 17, 2019	13	0.46	13775	212	16337	16	312	-2511
May 17, 2019	14	0	13620	202	15930	15	363	-2458
May 17, 2019	15	0	13337	197	15995	16	309	-2596
May 17, 2019	16	0	13442	208	15463	15	309	-2004
May 17, 2019	17	0.95	13857	277	15833	15	309	-1973
May 17, 2019	18	14.05	14097	277	16086	15	316	-1971
May 17, 2019	19	13.04	14389	255	15971	15	309	-1571
May 17, 2019	20	19.34	14616	194	16336	15	342	-1771
May 17, 2019	21	25.6	14660	192	16467	15	375	-1934
May 17, 2019	22	13.6	13884	182	15813	16	338	-1927
May 17, 2019	23	8.7	12836	187	15525	15	9	-2278
May 17, 2019	24	10.11	12102	280	14903	16	9	-2497

May 18, 2019	1	6.91	11672	275	14450	15	109	-2612
May 18, 2019	2	5.9	11374	288	14297	15	146	-2782
May 18, 2019	3	5.83	11259	278	14266	15	160	-2845
May 18, 2019	4	0	11241	295	14228	15	85	-2718
May 18, 2019	5	0	11332	255	14238	16	59	-2573
May 18, 2019	6	2.89	11540	225	14396	15	109	-2715
May 18, 2019	7	5.86	12023	233	14764	16	109	-2585
May 18, 2019	8	-0.01	12405	180	15249	16	135	-2673
May 18, 2019	9	2.1	12696	230	15756	16	302	-3076
May 18, 2019	10	5.82	12913	210	15954	15	282	-3096
May 18, 2019	11	3.12	12907	207	15902	16	229	-2985
May 18, 2019	12	0	12744	229	15578	16	247	-2744
May 18, 2019	13	0.94	12604	215	15395	16	247	-2731
May 18, 2019	14	0	12555	234	15287	16	247	-2651
May 18, 2019	15	0.04	12697	223	15313	16	247	-2546
May 18, 2019	16	5.75	13004	221	15939	16	245	-2889
May 18, 2019	17	3.67	13362	228	16107	16	343	-2808
May 18, 2019	18	0.67	13533	250	16177	15	249	-2616
May 18, 2019	19	0.04	13666	218	16277	15	214	-2553
May 18, 2019	20	2	13774	245	16802	16	199	-2881
May 18, 2019	21	0.96	13551	210	16740	15	199	-3020
May 18, 2019	22	0	12878	258	15939	15	158	-2871
May 18, 2019	23	-1.72	12092	204	15081	15	58	-2726
May 18, 2019	24	-3.37	11439	183	14568	14	9	-2864
May 19, 2019	1	-2.46	11074	187	14184	14	18	-2917
May 19, 2019	2	-3.74	10899	190	13966	14	9	-2880
May 19, 2019	3	-4.16	10763	138	13766	14	57	-2731
May 19, 2019	4	-4.2	10721	185	13551	15	9	-2600
May 19, 2019	5	-3.09	10777	206	13956	15	31	-3030
May 19, 2019	6	-3.28	10882	215	14113	14	33	-2958
May 19, 2019	7	-3.2	11220	183	14327	15	59	-2884
May 19, 2019	8	-3.74	11598	181	14670	15	9	-2764
May 19, 2019	9	-3	11816	194	14949	15	45	-2851
May 19, 2019	10	-3	11944	206	15112	15	40	-2883
May 19, 2019	11	-3	11987	208	15006	15	70	-2719
May 19, 2019	12	-3	12047	180	15195	15	45	-2872
May 19, 2019	13	-3	11963	196	15387	15	50	-3149
May 19, 2019	14	-3	11859	205	15078	15	95	-2943
May 19, 2019	15	-1.09	12358	204	15479	15	85	-3011
May 19, 2019	16	-0.01	12920	199	16178	15	125	-3131
May 19, 2019	17	0	13440	191	16698	15	109	-3164
May 19, 2019	18	0	13562	221	16803	15	116	-3170
May 19, 2019	19	0	13695	194	16912	15	9	-2883
May 19, 2019	20	0	13698	163	17082	15	114	-3182
May 19, 2019	21	0	13312	162	16612	15	181	-3097
May 19, 2019	22	-0.01	12597	202	15848	15	109	-3061
May 19, 2019	23	-1.47	12038	162	14808	15	199	-2604
May 19, 2019	24	-3.38	11235	259	14392	14	9	-2683
May 20, 2019	1	-4.18	10721	226	13776	15	9	-2712
May 20, 2019	2	-4.35	10432	129	13383	14	9	-2638

May 20, 2019	3	-4.41	10368	87	13339	15	9	-2798
May 20, 2019	4	-4.45	10263	78	13284	15	9	-2825
May 20, 2019	5	-4.38	10361	85	13467	15	41	-2931
May 20, 2019	6	-4.28	10581	109	13613	15	9	-2900
May 20, 2019	7	-4.13	10943	153	13958	15	9	-2760
May 20, 2019	8	-3.46	11424	171	14556	14	56	-2929
May 20, 2019	9	-3	11824	146	14994	15	39	-2942
May 20, 2019	10	-3	12062	158	15254	15	81	-2953
May 20, 2019	11	-3	12320	155	15272	15	73	-2828
May 20, 2019	12	-3	12419	178	14967	15	110	-2398
May 20, 2019	13	-3	12067	120	14930	15	295	-2660
May 20, 2019	14	-3	12035	171	15266	21	309	-3063
May 20, 2019	15	-3	12066	129	15245	22	291	-2980
May 20, 2019	16	-0.25	12520	124	15673	16	309	-3013
May 20, 2019	17	0	13140	173	16098	15	338	-2899
May 20, 2019	18	0	13239	160	16097	15	339	-2758
May 20, 2019	19	0	13456	170	16153	15	380	-2593
May 20, 2019	20	7.57	13744	212	16516	15	379	-2677
May 20, 2019	21	0	13627	231	16050	15	388	-2227
May 20, 2019	22	1.42	13129	219	15529	15	394	-2483
May 20, 2019	23	5.78	12367	219	15140	15	94	-2577
May 20, 2019	24	4.31	11745	235	14827	14	50	-2834
May 21, 2019	1	5.21	11412	142	14567	15	18	-2933
May 21, 2019	2	-4.13	11223	95	14163	15	9	-2643
May 21, 2019	3	-4.28	11203	108	13976	15	9	-2552
May 21, 2019	4	-4.19	11304	87	14074	15	9	-2506
May 21, 2019	5	-1.94	11885	143	14536	15	9	-2493
May 21, 2019	6	1.67	12898	92	15304	15	9	-2222
May 21, 2019	7	3.85	14029	89	15938	15	309	-2039
May 21, 2019	8	-1	14105	153	15980	15	309	-1871
May 21, 2019	9	-0.46	13820	147	15864	15	309	-2052
May 21, 2019	10	2.29	13669	192	15996	15	309	-2334
May 21, 2019	11	5.31	13676	176	16083	15	366	-2523
May 21, 2019	12	-2.78	13558	135	15542	15	467	-2077
May 21, 2019	13	-1.43	13631	164	15604	15	509	-2129
May 21, 2019	14	-2.53	13631	175	15625	14	450	-2082
May 21, 2019	15	0	13724	252	15944	14	450	-2328
May 21, 2019	16	-0.49	13932	244	15787	14	479	-1931
May 21, 2019	17	6.3	14442	244	16603	14	509	-2466
May 21, 2019	18	8.99	14668	229	16478	14	509	-2030
May 21, 2019	19	10.15	15001	230	16574	14	450	-1674
May 21, 2019	20	12.58	15374	253	16570	14	760	-1599
May 21, 2019	21	18.91	15290	290	16705	15	547	-1504
May 21, 2019	22	3.8	14214	269	16015	16	450	-1699
May 21, 2019	23	5.47	13076	209	15361	15	9	-1919
May 21, 2019	24	4.35	12181	238	15173	15	9	-2605
May 22, 2019	1	-0.01	11772	183	14792	15	9	-2729
May 22, 2019	2	-3.46	11524	188	14238	15	9	-2441
May 22, 2019	3	-3.83	11515	240	14062	15	9	-2314
May 22, 2019	4	-3	11586	241	14240	14	9	-2391

May 22, 2019	5	-2.07	11962	244	14673	14	9	-2436
May 22, 2019	6	-0.03	12859	236	15491	14	9	-2430
May 22, 2019	7	-0.01	13869	179	16322	14	450	-2687
May 22, 2019	8	0	14214	191	16754	14	450	-2792
May 22, 2019	9	0	14253	138	16890	14	450	-2928
May 22, 2019	10	0	14236	138	16853	14	450	-2885
May 22, 2019	11	0	14310	135	17032	14	450	-3025
May 22, 2019	12	0	14410	212	17146	14	450	-3026
May 22, 2019	13	0	14422	201	17127	14	509	-2923
May 22, 2019	14	0	14330	195	16862	14	509	-2739
May 22, 2019	15	0	14508	190	16936	14	450	-2648
May 22, 2019	16	6.74	14917	197	17422	14	450	-2718
May 22, 2019	17	17.08	15172	163	17741	14	450	-2708
May 22, 2019	18	4.08	15150	163	17053	15	450	-2119
May 22, 2019	19	19.42	15369	185	17056	14	560	-2028
May 22, 2019	20	18.91	15611	135	16944	14	730	-1852
May 22, 2019	21	8.98	15299	211	17038	14	671	-1920
May 22, 2019	22	0.94	14247	247	16125	14	450	-1895
May 22, 2019	23	-0.21	13051	227	15575	14	127	-2242
May 22, 2019	24	-0.54	12181	233	14899	14	167	-2630
May 23, 2019	1	-2.77	11690	190	14369	14	9	-2442
May 23, 2019	2	-3	11452	215	14085	14	9	-2395
May 23, 2019	3	-3	11425	192	13975	14	9	-2390
May 23, 2019	4	-3	11484	198	14156	14	45	-2594
May 23, 2019	5	-0.06	11945	185	14739	14	54	-2718
May 23, 2019	6	0	13087	155	15788	14	125	-2813
May 23, 2019	7	0	14291	143	16466	14	396	-2395
May 23, 2019	8	0	14737	144	16766	13	514	-2354
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May 23, 2019	11	0	14867	153	17534	21	552	-2878
May 23, 2019	12	0	14656	118	17277	14	694	-3123
May 23, 2019	13	0	14642	136	17133	14	1096	-3324
May 23, 2019	14	0	14370	206	16915	14	1069	-3277
May 23, 2019	15	0	14543	193	16938	15	1061	-3175
May 23, 2019	16	0	14710	167	17068	15	1040	-3105
May 23, 2019	17	0	14892	204	17068	15	1041	-2929
May 23, 2019	18	0	14940	150	16901	15	1046	-2765
May 23, 2019	19	0	14982	96	16946	15	1032	-2742
May 23, 2019	20	0	15195	102	17241	15	1012	-2845
May 23, 2019	21	0	15112	197	17085	15	1410	-2990
May 23, 2019	22	-1.3	14125	251	15760	14	1559	-2728
May 23, 2019	23	-0.26	13050	259	15443	15	29	-2051
May 23, 2019	24	-1.96	12186	254	14772	14	9	-2220
May 24, 2019	1	-3	11704	257	14484	14	9	-2504
May 24, 2019	2	-4.1	11425	265	14024	14	9	-2323
May 24, 2019	3	-4.11	11324	198	13989	14	14	-2441
May 24, 2019	4	-3.55	11433	295	14163	14	14	-2478
May 24, 2019	5	-1	11915	285	14611	14	42	-2499
May 24, 2019	6	5.89	12943	201	15352	14	60	-2395

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May 24, 2019	8	25.11	14527	238	16550	13	1239	-2935
May 24, 2019	9	5.09	14533	140	16240	14	1439	-2833
May 24, 2019	10	-1.61	14547	186	16116	14	1439	-2770
May 24, 2019	11	5.74	14515	200	16551	14	1050	-2871
May 24, 2019	12	0.48	14462	175	16320	15	1413	-2957
May 24, 2019	13	7.44	14424	231	16485	17	1267	-3024
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May 24, 2019	16	9.95	14557	257	16495	17	1299	-2909
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May 24, 2019	18	4.8	14784	231	16321	17	1499	-2637
May 24, 2019	19	5.77	14924	212	16319	16	1058	-2144
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May 24, 2019	21	7.97	15007	194	16475	15	1058	-2211
May 24, 2019	22	2.06	14123	195	16068	15	1373	-2850
May 24, 2019	23	-3.47	12810	183	15289	15	120	-2060
May 24, 2019	24	-4.18	12013	218	14437	15	9	-2110
May 25, 2019	1	-4.33	11347	171	14272	15	41	-2627
May 25, 2019	2	-4.33	10990	175	14063	15	102	-2892
May 25, 2019	3	-4.02	10762	185	13767	15	64	-2860
May 25, 2019	4	-4.11	10775	215	13808	15	9	-2813
May 25, 2019	5	-4.42	10903	176	13719	16	155	-2727
May 25, 2019	6	-4.54	11132	204	13849	17	56	-2544
May 25, 2019	7	-4.31	11858	179	14610	19	9	-2600
May 25, 2019	8	-3	12572	185	15434	19	19	-2752
May 25, 2019	9	-1.34	13110	202	15716	18	19	-2462
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May 25, 2019	11	-0.09	13652	172	16448	15	69	-2582
May 25, 2019	12	-0.48	13642	198	16539	15	108	-2576
May 25, 2019	13	-2.7	13408	206	16363	15	45	-2534
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May 25, 2019	15	-0.12	13436	191	16655	16	29	-2964
May 25, 2019	16	-0.05	13852	216	16910	15	9	-2793
May 25, 2019	17	0	14440	212	17497	15	29	-2862
May 25, 2019	18	0	14355	189	17330	15	69	-2672
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May 25, 2019	23	-2.95	12456	135	15229	13	79	-2610
May 25, 2019	24	-4.32	11685	122	14226	15	9	-2290
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May 26, 2019	4	-4.83	10755	262	13294	15	9	-2186
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May 26, 2019	6	-4.86	10842	235	13361	16	9	-2275
May 26, 2019	7	-31.03	11324	156	13589	15	9	-2055
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May 26, 2019	10	-0.26	12407	213	15656	15	9	-2997
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May 26, 2019	12	-4.1	12701	225	15385	15	9	-2307
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May 26, 2019	16	1.21	13298	197	16348	15	9	-2837
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May 26, 2019	18	-2.93	14047	166	16371	15	462	-2490
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May 26, 2019	22	9.68	13681	256	16567	15	75	-2567
May 26, 2019	23	3.05	12667	228	15715	15	58	-2688
May 26, 2019	24	-3.99	11785	220	14801	15	9	-2598
May 27, 2019	1	-4.53	11350	210	14000	15	9	-2395
May 27, 2019	2	-4.73	11056	185	13788	15	82	-2527
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May 27, 2019	5	-4.75	11557	112	14066	15	62	-2279
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May 27, 2019	11	8.73	14550	182	17352	24	139	-2758
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May 27, 2019	16	5.98	15076	222	17454	15	9	-2184
May 27, 2019	17	24.94	15390	175	17717	14	179	-2205
May 27, 2019	18	15.48	15486	196	17715	16	134	-2065
May 27, 2019	19	8.77	15697	165	17607	16	609	-2221
May 27, 2019	20	24.42	15769	135	17965	14	9	-2014
May 27, 2019	21	11.73	15535	206	17997	15	9	-2096
May 27, 2019	22	5.85	14410	211	17222	14	9	-2539
May 27, 2019	23	1.33	13118	199	16060	15	9	-2656
May 27, 2019	24	-2.56	12205	207	15321	15	9	-2834
May 28, 2019	1	-4.14	11680	229	14835	15	9	-2894
May 28, 2019	2	-4.3	11380	214	14412	15	9	-2782
May 28, 2019	3	-4.35	11253	171	14387	15	9	-2842
May 28, 2019	4	-4.19	11387	159	14410	15	9	-2820
May 28, 2019	5	-3.65	11954	169	14972	15	9	-2923
May 28, 2019	6	-0.53	12983	170	15978	15	9	-2836
May 28, 2019	7	3.73	14352	175	16628	15	568	-2727
May 28, 2019	8	0.93	14895	183	16921	14	587	-2427
May 28, 2019	9	5.84	15076	160	17643	13	509	-2892
May 28, 2019	10	2.21	15148	185	17687	21	575	-2924

May 28, 2019	11	5.37	15168	157	17813	15	575	-3036
May 28, 2019	12	3.1	15162	159	17747	15	575	-2933
May 28, 2019	13	2.92	15116	182	17818	15	60	-2374
May 28, 2019	14	2.92	14938	191	17542	15	27	-2265
May 28, 2019	15	6.24	14922	180	17235	15	0	-2060
May 28, 2019	16	10.08	15109	204	17887	12	70	-2632
May 28, 2019	17	22.31	15346	199	18026	16	9	-2452
May 28, 2019	18	0	15295	214	17435	15	490	-2183
May 28, 2019	19	4.71	15436	203	17522	15	128	-1906
May 28, 2019	20	5.88	15574	192	17358	15	220	-1685
May 28, 2019	21	3.85	15270	167	16908	14	693	-1973
May 28, 2019	22	9.33	14385	248	16625	14	385	-2325
May 28, 2019	23	8.69	13252	240	16046	15	13	-2488
May 28, 2019	24	5.77	12444	243	15743	14	63	-3010
May 29, 2019	1	-0.38	11928	250	15342	14	9	-3098
May 29, 2019	2	-4.1	11684	215	15001	14	9	-3098
May 29, 2019	3	-4.1	11581	187	14916	14	68	-3179
May 29, 2019	4	-4.35	11640	227	14937	14	9	-3017
May 29, 2019	5	-2.48	12118	247	15452	15	9	-3092
May 29, 2019	6	6.01	13150	191	16152	15	9	-2888
May 29, 2019	7	12.26	14481	198	16928	14	9	-2296
May 29, 2019	8	9.08	14957	141	17387	14	22	-2231
May 29, 2019	9	21.71	15069	126	17481	15	9	-2313
May 29, 2019	10	6.57	15040	127	17480	14	68	-2330
May 29, 2019	11	7.14	14987	132	16905	17	324	-2027
May 29, 2019	12	5.72	14783	125	17011	16	118	-2048
May 29, 2019	13	5.68	14599	144	17116	16	70	-2245
May 29, 2019	14	5.37	14545	157	17229	15	9	-2526
May 29, 2019	15	-0.19	14461	143	17342	15	9	-2682
May 29, 2019	16	5.06	14677	199	17313	15	9	-2306
May 29, 2019	17	13.27	14916	166	17500	13	9	-2244
May 29, 2019	18	6.14	14906	227	17299	15	194	-2240
May 29, 2019	19	11.85	15143	160	17469	15	9	-2084
May 29, 2019	20	6.56	15378	215	17591	15	9	-1883
May 29, 2019	21	13.58	15359	198	17630	16	77	-2028
May 29, 2019	22	2.81	14477	199	17205	16	9	-2303
May 29, 2019	23	1.33	13199	192	16434	16	87	-2804
May 29, 2019	24	-1.81	12373	214	15837	15	81	-3215
May 30, 2019	1	-4.33	11926	128	15176	15	68	-2957
May 30, 2019	2	-4.49	11632	130	14788	16	68	-2993
May 30, 2019	3	-4.48	11590	134	14863	18	68	-3166
May 30, 2019	4	-4.46	11625	175	15002	17	68	-3211
May 30, 2019	5	-3.55	12130	131	15382	18	65	-3191
May 30, 2019	6	4.36	13149	122	16418	17	26	-3224
May 30, 2019	7	7.77	14315	147	16906	18	142	-2587
May 30, 2019	8	5.76	14654	147	17265	17	168	-2492
May 30, 2019	9	3.54	14730	134	17776	17	89	-2924
May 30, 2019	10	5.82	14762	149	18276	17	9	-3360
May 30, 2019	11	1.46	14693	136	18052	17	9	-3227
May 30, 2019	12	1.35	14475	189	17430	15	136	-2873

May 30, 2019	13	2.6	14654	74	17509	13	9	-2753
May 30, 2019	14	1.91	14710	60	17698	13	109	-2911
May 30, 2019	15	1.27	14753	62	17499	14	109	-2717
May 30, 2019	16	13.12	15072	85	17737	14	109	-2650
May 30, 2019	17	13.29	15215	137	18257	14	36	-2870
May 30, 2019	18	5.8	15250	146	17922	14	109	-2401
May 30, 2019	19	5.89	15364	240	17832	14	106	-2235
May 30, 2019	20	9.19	15573	234	17959	14	313	-2371
May 30, 2019	21	6.51	15452	168	17972	14	219	-2405
May 30, 2019	22	5.58	14587	220	17461	14	109	-2687
May 30, 2019	23	-0.81	13377	258	16422	14	68	-2684
May 30, 2019	24	-3.96	12464	272	15614	14	109	-2833
May 31, 2019	1	-4.33	11893	225	15357	14	26	-3130
May 31, 2019	2	-4.51	11556	221	14946	14	26	-3103
May 31, 2019	3	-4.5	11473	245	14885	14	9	-3108
May 31, 2019	4	-4.59	11545	273	14884	14	9	-3015
May 31, 2019	5	-4.46	11932	246	15265	14	26	-3108
May 31, 2019	6	-2.5	12857	217	16063	14	9	-2990
May 31, 2019	7	5.28	14025	185	17196	15	14	-2962
May 31, 2019	8	5.96	14363	186	17623	13	18	-2987
May 31, 2019	9	5.8	14313	202	17842	14	33	-3252
May 31, 2019	10	5.98	14257	206	17692	14	109	-3250
May 31, 2019	11	9.97	14204	199	17655	14	67	-3247
May 31, 2019	12	7.65	14201	192	17514	13	119	-3222
May 31, 2019	13	39.35	14145	161	17711	16	93	-3396
May 31, 2019	14	23.13	14168	203	17777	15	93	-3410
May 31, 2019	15	5.87	14178	202	17620	14	54	-3220
May 31, 2019	16	5.65	14526	253	17809	14	19	-2992
May 31, 2019	17	4.85	14717	246	17635	14	9	-2607
May 31, 2019	18	4.65	14729	241	17828	14	30	-2676
May 31, 2019	19	5.72	14845	252	17712	14	32	-2503
May 31, 2019	20	3.93	14950	225	17842	15	46	-2612
May 31, 2019	21	1.81	14855	251	17862	15	42	-2616
May 31, 2019	22	-0.01	14054	294	17806	15	58	-3321
May 31, 2019	23	-1.12	12843	288	16517	15	79	-3316
May 31, 2019	24	-4.38	11963	274	15445	15	68	-3171
June 1, 2019	1	-4.44	11511	281	15062	14	53	-3361
June 1, 2019	2	-4.51	11186	275	14779	14	9	-3306
June 1, 2019	3	-4.53	11061	293	14635	15	9	-3298
June 1, 2019	4	-4.58	11011	273	14618	14	58	-3363
June 1, 2019	5	-4.6	10990	139	14522	14	54	-3360
June 1, 2019	6	-4.62	11226	185	14717	14	94	-3398
June 1, 2019	7	-4.44	11865	149	15313	14	9	-3275
June 1, 2019	8	-3.37	12609	172	16214	15	9	-3404
June 1, 2019	9	5.28	13151	163	16688	14	9	-3346
June 1, 2019	10	5.75	13305	172	16958	14	9	-3385
June 1, 2019	11	5.87	13463	168	16954	16	39	-3349
June 1, 2019	12	5.89	13522	191	17082	13	39	-3382
June 1, 2019	13	5.87	13391	211	17022	15	39	-3455
June 1, 2019	14	4.8	13231	221	16853	16	39	-3397

June 1, 2019	15	-0.06	13313	204	16713	15	39	-3102
June 1, 2019	16	-1.24	13587	212	16841	15	39	-3039
June 1, 2019	17	3.97	13986	200	17672	15	120	-3414
June 1, 2019	18	5.86	14239	215	17435	15	149	-3089
June 1, 2019	19	6.08	14165	190	17437	14	36	-2929
June 1, 2019	20	1.36	14109	194	17166	15	39	-2835
June 1, 2019	21	0	13988	188	17130	15	9	-2778
June 1, 2019	22	-0.19	13370	200	16946	14	9	-3347
June 1, 2019	23	-0.97	12511	222	16164	14	68	-3377
June 1, 2019	24	-4.07	11739	203	15390	14	43	-3302
June 2, 2019	1	-4.39	11313	219	14796	15	19	-3328
June 2, 2019	2	-4.53	11043	233	14265	15	9	-3003
June 2, 2019	3	-4.58	10901	226	13700	15	9	-2598
June 2, 2019	4	-4.47	10854	244	13751	15	9	-2614
June 2, 2019	5	-4.82	10811	262	13497	15	79	-2348
June 2, 2019	6	-4.57	10925	260	13841	13	90	-2580
June 2, 2019	7	-4.47	11442	164	14094	13	9	-2332
June 2, 2019	8	-0.3	12156	173	15348	13	173	-3202
June 2, 2019	9	3.22	12676	196	16357	13	9	-3406
June 2, 2019	10	4.64	12736	193	16451	13	9	-3391
June 2, 2019	11	-2.43	12769	188	15966	13	9	-2875
June 2, 2019	12	-0.28	12662	254	16269	13	9	-3259
June 2, 2019	13	-2.93	12492	219	16062	13	14	-3295
June 2, 2019	14	-3	12253	207	15965	13	9	-3332
June 2, 2019	15	-3	12288	207	15873	13	39	-3338
June 2, 2019	16	-3	12591	203	16051	12	46	-3200
June 2, 2019	17	-0.04	13220	224	16805	12	39	-3351
June 2, 2019	18	0	13619	225	17055	13	120	-3293
June 2, 2019	19	1.33	13886	197	16942	12	90	-2891
June 2, 2019	20	6.59	14073	222	17394	13	118	-3209
June 2, 2019	21	11.34	14062	186	17400	13	109	-3188
June 2, 2019	22	3.02	13339	224	16886	13	87	-3331
June 2, 2019	23	-0.01	12453	212	16085	13	65	-3374
June 2, 2019	24	-3.39	11854	173	15015	14	9	-2951
June 3, 2019	1	-4.03	11257	237	14605	14	71	-3096
June 3, 2019	2	-4.42	11111	216	14385	15	51	-3076
June 3, 2019	3	-4.48	11038	217	13978	14	9	-2715
June 3, 2019	4	-4.53	11128	214	14038	14	9	-2681
June 3, 2019	5	-4.28	11650	94	14372	14	9	-2606
June 3, 2019	6	-1.51	12596	105	15553	14	9	-2858
June 3, 2019	7	-0.26	13721	90	16570	13	9	-2675
June 3, 2019	8	0	14000	124	16814	13	9	-2643
June 3, 2019	9	0	14011	104	16764	13	9	-2572
June 3, 2019	10	0	13934	87	16571	13	60	-2559
June 3, 2019	11	0	13886	110	16667	19	9	-2613
June 3, 2019	12	0	13778	122	16588	20	20	-2639
June 3, 2019	13	-0.77	13611	142	16515	14	46	-2665
June 3, 2019	14	-3	13559	173	16438	14	47	-2666
June 3, 2019	15	-3	13634	172	16542	13	97	-2676
June 3, 2019	16	-1.75	13958	191	16574	13	34	-2284

June 3, 2019	17	0.37	14362	172	17061	13	93	-2459
June 3, 2019	18	-0.03	14515	221	17201	13	686	-2971
June 3, 2019	19	0.38	14889	271	17227	13	9	-1908
June 3, 2019	20	13.6	15180	282	17636	14	94	-2127
June 3, 2019	21	18.93	15132	263	17183	13	107	-1697
June 3, 2019	22	16.52	14268	282	17031	14	88	-2330
June 3, 2019	23	2.81	13061	252	16223	14	47	-2654
June 3, 2019	24	-2.78	12262	270	15320	14	9	-2629
June 4, 2019	1	-4.2	11764	186	14769	14	132	-2708
June 4, 2019	2	-4.28	11591	192	14450	14	180	-2705
June 4, 2019	3	-4.39	11519	197	14478	14	9	-2644
June 4, 2019	4	-4.4	11582	205	14546	14	68	-2701
June 4, 2019	5	-4.18	11851	193	14832	14	148	-2766
June 4, 2019	6	2.6	12950	194	15780	14	44	-2620
June 4, 2019	7	1.5	14072	119	16350	13	168	-2223
June 4, 2019	8	0	14466	185	16480	14	109	-1819
June 4, 2019	9	7.31	14496	165	16956	14	163	-2365
June 4, 2019	10	16.12	14468	208	17203	14	199	-2648
June 4, 2019	11	17.87	14578	228	17383	14	200	-2715
June 4, 2019	12	1.44	14683	213	17542	14	107	-2655
June 4, 2019	13	0	14654	224	17539	14	9	-2460
June 4, 2019	14	0	14648	221	17597	14	136	-2664
June 4, 2019	15	0	14752	211	17678	14	113	-2634
June 4, 2019	16	0	15021	209	17895	14	9	-2476
June 4, 2019	17	0	15236	223	18167	14	113	-2662
June 4, 2019	18	0	15079	235	18055	14	113	-2614
June 4, 2019	19	0	15177	268	18147	14	113	-2665
June 4, 2019	20	0	15289	284	18180	14	109	-2523
June 4, 2019	21	6.25	15166	269	18111	14	123	-2611
June 4, 2019	22	4.32	14294	281	17264	14	72	-2587
June 4, 2019	23	-0.48	13106	237	15918	14	9	-2276
June 4, 2019	24	-2.7	12289	273	15198	14	36	-2436
June 5, 2019	1	-4.3	11669	260	14671	14	9	-2522
June 5, 2019	2	-4.48	11386	289	14437	14	59	-2635
June 5, 2019	3	-4.68	11280	258	14113	14	9	-2394
June 5, 2019	4	-4.64	11413	253	14217	14	9	-2394
June 5, 2019	5	-4.39	11882	215	14505	14	9	-2284
June 5, 2019	6	-0.11	12972	218	15831	13	9	-2599
June 5, 2019	7	-0.29	14154	137	16532	14	26	-1998
June 5, 2019	8	24.24	14728	164	17478	14	53	-2490
June 5, 2019	9	31.86	14730	82	17165	14	36	-2170
June 5, 2019	10	14.59	14829	120	17369	15	40	-2220
June 5, 2019	11	18.05	14981	153	17254	17	9	-1932
June 5, 2019	12	12.61	15096	84	17636	16	9	-2285
June 5, 2019	13	21.28	15221	67	18059	19	9	-2485
June 5, 2019	14	6.86	15210	59	17599	18	9	-2091
June 5, 2019	15	6.26	15311	65	17785	14	9	-2249
June 5, 2019	16	13.52	15489	137	17674	9	9	-1836
June 5, 2019	17	24.39	15665	91	17280	15	352	-1608
June 5, 2019	18	20.29	15653	85	17422	14	354	-1773

June 5, 2019	19	13.86	15811	170	17503	14	826	-2163
June 5, 2019	20	7.22	15695	151	17397	14	816	-2061
June 5, 2019	21	8.49	15392	201	17394	13	646	-2102
June 5, 2019	22	1.9	14419	186	17045	14	67	-2148
June 5, 2019	23	5.96	13373	229	16512	14	9	-2788
June 5, 2019	24	3.35	12486	233	15840	15	9	-2919
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June 6, 2019	3	-3.55	11565	126	14951	14	9	-3091
June 6, 2019	4	-4.01	11613	139	14987	14	19	-3093
June 6, 2019	5	-1.13	12062	115	15285	14	15	-3002
June 6, 2019	6	2.39	13025	143	15660	14	79	-2504
June 6, 2019	7	9.44	14202	110	16721	14	77	-2383
June 6, 2019	8	5.68	14462	109	16884	13	68	-2190
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June 6, 2019	11	16.68	14390	120	17041	22	79	-2550
June 6, 2019	12	5.93	14328	135	16999	27	109	-2544
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June 6, 2019	17	5.96	15236	134	17903	16	9	-2352
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June 6, 2019	19	5.87	15644	178	17909	14	215	-2040
June 6, 2019	20	5.89	15611	148	17835	14	42	-1781
June 6, 2019	21	6.78	15717	186	17951	14	69	-1931
June 6, 2019	22	4.59	14933	183	17738	14	9	-2400
June 6, 2019	23	0.32	13581	146	16099	15	23	-2090
June 6, 2019	24	-2.35	12656	208	15594	14	43	-2571
June 7, 2019	1	-4.25	12046	175	14934	14	9	-2508
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June 7, 2019	19	5.38	16049	158	17980	14	127	-1764
June 7, 2019	20	5.64	15893	138	17841	14	183	-1732

June 7, 2019	21	2.22	15708	118	17722	14	198	-1857
June 7, 2019	22	-1.49	14799	186	17039	14	175	-1887
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June 8, 2019	15	-4.4	12887	207	15783	15	80	-2446
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June 8, 2019	17	-2.93	13826	200	16665	14	87	-2458
June 8, 2019	18	-0.11	14188	204	16961	14	52	-2407
June 8, 2019	19	0	14358	215	17101	14	73	-2490
June 8, 2019	20	-0.08	14156	175	16889	14	141	-2426
June 8, 2019	21	-0.02	14116	151	17095	14	90	-2682
June 8, 2019	22	-2.18	13495	172	16371	14	139	-2577
June 8, 2019	23	-3.86	12477	150	15329	14	9	-2347
June 8, 2019	24	-4.53	11612	178	14528	14	9	-2406
June 9, 2019	1	-4.54	10986	242	14374	14	42	-2969
June 9, 2019	2	-4.71	10616	250	14086	14	9	-3059
June 9, 2019	3	-4.84	10438	261	13762	14	9	-2883
June 9, 2019	4	-4.79	10332	209	13872	14	9	-3124
June 9, 2019	5	-4.89	10257	113	13781	14	9	-3148
June 9, 2019	6	-4.91	10434	209	13744	14	9	-2957
June 9, 2019	7	-15.36	10893	165	14079	14	9	-2843
June 9, 2019	8	-4.67	11528	198	14794	14	9	-2966
June 9, 2019	9	-4.3	12082	208	15337	14	9	-2925
June 9, 2019	10	-4.01	12411	195	15762	14	9	-2975
June 9, 2019	11	-0.82	12840	202	16578	14	9	-3440
June 9, 2019	12	0	13091	191	16998	14	78	-3583
June 9, 2019	13	0	13130	161	16720	13	78	-3325
June 9, 2019	14	0	13386	166	16853	12	77	-3208
June 9, 2019	15	0	13689	136	17195	12	78	-3256
June 9, 2019	16	1.34	14288	115	17291	12	108	-2813
June 9, 2019	17	6.12	15005	130	17734	12	109	-2570
June 9, 2019	18	10.05	15245	137	17864	12	139	-2511
June 9, 2019	19	23.35	15390	134	18005	12	114	-2526
June 9, 2019	20	14.74	15321	156	17996	12	14	-2390
June 9, 2019	21	3.82	15279	153	18095	12	9	-2422
June 9, 2019	22	-0.01	14277	119	17477	12	27	-2811

June 9, 2019	23	-0.05	13224	155	16525	12	47	-2970
June 9, 2019	24	-1.97	12280	154	15742	13	9	-3141
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June 10, 2019	4	-4.33	11353	155	14697	13	9	-3081
June 10, 2019	5	-3.76	11792	146	15190	13	9	-3066
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June 10, 2019	7	-0.71	14166	148	16962	12	42	-2569
June 10, 2019	8	0	14795	128	17794	13	97	-2850
June 10, 2019	9	1.37	15082	163	17854	13	48	-2554
June 10, 2019	10	5.79	15331	195	18394	14	9	-2824
June 10, 2019	11	3.63	15467	191	17980	14	9	-2266
June 10, 2019	12	7.67	15566	155	18325	14	9	-2597
June 10, 2019	13	28.71	15668	150	18773	13	9	-2760
June 10, 2019	14	3.69	15679	121	19012	21	15	-2861
June 10, 2019	15	0.4	15657	107	18615	14	9	-2648
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June 10, 2019	18	0	15630	131	18590	14	32	-2647
June 10, 2019	19	0	15507	118	18589	14	75	-2833
June 10, 2019	20	0	15427	198	18659	14	9	-2886
June 10, 2019	21	0	15069	235	18596	14	82	-3279
June 10, 2019	22	-0.27	14222	250	17871	14	82	-3292
June 10, 2019	23	-1.76	13106	227	16735	14	98	-3196
June 10, 2019	24	-3.48	12265	244	15858	15	56	-3217
June 11, 2019	1	-4.52	11722	238	15101	15	20	-2970
June 11, 2019	2	-4.72	11298	266	14725	16	28	-3053
June 11, 2019	3	-4.81	11175	242	14464	15	25	-2948
June 11, 2019	4	-4.78	11239	287	14614	16	53	-3039
June 11, 2019	5	-4.83	11616	258	14974	16	56	-3036
June 11, 2019	6	-4.13	12715	179	15811	15	42	-2888
June 11, 2019	7	-2.48	13780	129	16755	15	46	-2723
June 11, 2019	8	-1.55	14070	122	17160	15	0	-2817
June 11, 2019	9	-3	14058	116	17175	14	0	-2826
June 11, 2019	10	-3.56	13996	139	17142	14	0	-2803
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June 11, 2019	13	-3	14222	128	17402	25	0	-2840
June 11, 2019	14	-3.09	14230	122	17447	24	0	-2782
June 11, 2019	15	-4.1	14340	135	17121	24	0	-2283
June 11, 2019	16	-3.67	14675	128	17277	23	0	-2149
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June 11, 2019	18	-2.84	15360	173	17711	16	0	-2024
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June 11, 2019	21	5.76	15580	229	18001	15	0	-2017
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June 11, 2019	24	-4.65	12205	227	15291	16	0	-2640

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June 12, 2019	4	-4.73	11275	198	14298	14	48	-2774
June 12, 2019	5	-4.5	11670	139	14629	14	48	-2774
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June 12, 2019	8	-3.75	14091	144	16929	13	86	-2639
June 12, 2019	9	-3.08	14198	134	17036	15	54	-2660
June 12, 2019	10	-3	14269	126	17236	14	52	-2777
June 12, 2019	11	-3	14350	126	17296	14	25	-2739
June 12, 2019	12	-3	14350	131	17361	15	71	-2800
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June 12, 2019	14	-0.07	14490	87	17535	15	0	-2717
June 12, 2019	15	0	14745	139	17754	14	10	-2735
June 12, 2019	16	3.69	15098	128	17968	14	55	-2755
June 12, 2019	17	4.69	15566	127	18413	15	139	-2731
June 12, 2019	18	4.87	15612	186	18584	14	119	-2642
June 12, 2019	19	5.62	15762	184	18660	14	100	-2625
June 12, 2019	20	0.46	15642	229	18579	15	100	-2543
June 12, 2019	21	-0.01	15522	198	18358	15	115	-2510
June 12, 2019	22	-1.71	14500	203	17670	14	106	-2659
June 12, 2019	23	-2.46	13153	180	16396	15	17	-2815
June 12, 2019	24	-4.21	12153	237	15391	14	53	-2848
June 13, 2019	1	-4.36	11669	256	14859	14	18	-2840
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June 13, 2019	3	-4.5	11349	233	14523	14	23	-2844
June 13, 2019	4	-4.63	11371	226	14465	14	33	-2755
June 13, 2019	5	-4.37	11825	246	14937	14	0	-2792
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June 13, 2019	11	5.95	15428	146	18255	21	0	-2577
June 13, 2019	12	5.71	15322	148	18083	22	0	-2493
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June 13, 2019	14	4.75	15282	131	18170	15	0	-2645
June 13, 2019	15	5.14	15358	136	18008	16	108	-2593
June 13, 2019	16	3.84	15499	140	18223	16	48	-2482
June 13, 2019	17	0	15415	130	18059	15	42	-2338
June 13, 2019	18	0	15219	146	17912	15	140	-2547
June 13, 2019	19	0	15247	136	18100	15	3	-2612
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June 14, 2019	18	0	14536	86	17885	2	100	-3222
June 14, 2019	19	0	14759	80	18021	2	193	-3257
June 14, 2019	20	0	14891	121	18329	2	133	-3358
June 14, 2019	21	0	14857	108	18267	2	57	-3059
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June 16, 2019	15	-3.58	12909	114	15907	22	50	-2843
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June 18, 2019	16	14.97	16496	237	18380	15	854	-2375
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June 18, 2019	21	14.65	16661	213	18066	14	1038	-2086
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June 19, 2019	9	18.51	15337	202	17616	13	364	-2295
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June 20, 2019	14	5.87	16282	181	17982	15	586	-2037
June 20, 2019	15	5.96	16410	93	18019	15	586	-2020
June 20, 2019	16	4.49	16513	159	18520	14	647	-2402
June 20, 2019	17	0	16501	203	18450	14	646	-2265
June 20, 2019	18	0	16312	213	18369	14	646	-2430
June 20, 2019	19	0	16260	196	18259	14	574	-2271
June 20, 2019	20	0	16158	206	18245	14	623	-2417
June 20, 2019	21	0	15838	218	18361	15	705	-2833
June 20, 2019	22	-1.12	14817	201	17768	15	236	-2772
June 20, 2019	23	-3.63	13598	200	16530	15	9	-2581
June 20, 2019	24	-4.18	12521	202	15659	15	153	-2850
June 21, 2019	1	-4.25	11976	212	15146	15	125	-3019
June 21, 2019	2	-4.52	11650	211	14621	14	9	-2686
June 21, 2019	3	-4.5	11389	158	14442	14	22	-2794
June 21, 2019	4	-4.5	11382	205	14467	15	29	-2827
June 21, 2019	5	-4.48	11724	188	14632	14	22	-2720
June 21, 2019	6	-4.18	12675	116	15659	15	9	-2942
June 21, 2019	7	-4.17	13976	139	16391	15	47	-2352
June 21, 2019	8	-1.7	14462	96	17142	17	9	-2633
June 21, 2019	9	-2.68	14651	123	17321	17	259	-2731
June 21, 2019	10	-3	14643	135	17372	24	184	-2711
June 21, 2019	11	0	14770	161	17518	25	165	-2720
June 21, 2019	12	0	14908	151	17654	25	198	-2757
June 21, 2019	13	0	15035	188	17493	17	671	-2813
June 21, 2019	14	-0.43	15022	203	17468	15	314	-2360
June 21, 2019	15	0	15016	201	17987	14	582	-3270
June 21, 2019	16	0.84	15280	215	17967	14	634	-3040
June 21, 2019	17	5.65	15597	194	18332	10	607	-3089
June 21, 2019	18	6.59	15738	190	18370	10	605	-3000
June 21, 2019	19	18.91	15757	201	18243	11	581	-2831
June 21, 2019	20	57.82	15641	272	18296	11	632	-2993
June 21, 2019	21	6.25	15465	240	17583	11	652	-2398
June 21, 2019	22	9.73	14642	251	17351	11	53	-2335
June 21, 2019	23	0.03	13352	244	16646	12	77	-3009
June 21, 2019	24	-4.19	12293	252	15337	12	19	-2676
June 22, 2019	1	-4.35	11601	165	14511	11	9	-2680
June 22, 2019	2	-4.49	11176	173	14118	11	33	-2722
June 22, 2019	3	-4.68	10991	174	13931	11	9	-2710
June 22, 2019	4	-4.53	10866	164	13964	11	34	-2904
June 22, 2019	5	-4.5	10920	175	14032	10	19	-2892
June 22, 2019	6	-4.33	11177	184	14675	10	25	-3378
June 22, 2019	7	-4.13	11860	144	15244	10	9	-3272
June 22, 2019	8	-4.11	12496	115	15961	10	9	-3340
June 22, 2019	9	-3.86	13071	137	16409	10	39	-3189
June 22, 2019	10	-4.11	13363	156	16156	10	9	-2594

June 22, 2019	11	-4	13537	157	16451	10	9	-2713
June 22, 2019	12	-4	13586	186	16539	12	9	-2710
June 22, 2019	13	-3.25	13576	167	16636	10	31	-2808
June 22, 2019	14	-3.58	13555	166	16678	10	34	-2805
June 22, 2019	15	-3.08	13749	172	16727	10	27	-2772
June 22, 2019	16	-1.04	14164	218	17178	10	79	-2771
June 22, 2019	17	5.35	14913	206	17744	11	42	-2671
June 22, 2019	18	5.6	15293	246	17800	11	504	-2752
June 22, 2019	19	6.17	15394	225	17743	10	47	-2176
June 22, 2019	20	6.01	15069	246	17586	10	47	-2229
June 22, 2019	21	4.76	14870	236	17334	11	109	-2267
June 22, 2019	22	3.31	14241	192	17290	12	108	-2849
June 22, 2019	23	-0.42	13102	178	16336	11	83	-2937
June 22, 2019	24	-1.2	12234	172	15926	11	40	-3517
June 23, 2019	1	-4.15	11608	148	15141	11	28	-3317
June 23, 2019	2	-4.46	11207	142	14177	11	21	-2790
June 23, 2019	3	-4.53	10871	260	13970	11	19	-2808
June 23, 2019	4	-4.75	10712	253	13905	11	45	-2901
June 23, 2019	5	-4.8	10669	222	13796	11	9	-2860
June 23, 2019	6	-4.83	10770	224	13828	11	9	-2795
June 23, 2019	7	-4.58	11263	208	14242	11	9	-2728
June 23, 2019	8	-4.39	11919	230	15083	8	9	-2994
June 23, 2019	9	-4.03	12488	165	16254	8	9	-3614
June 23, 2019	10	-3.68	12956	154	16667	8	9	-3550
June 23, 2019	11	-1.15	13349	163	17287	8	9	-3781
June 23, 2019	12	-0.61	13624	138	17154	9	9	-3293
June 23, 2019	13	0.42	13820	175	17419	9	9	-3406
June 23, 2019	14	1.05	14027	192	17297	9	29	-3068
June 23, 2019	15	5.57	14389	193	17373	9	71	-2836
June 23, 2019	16	11.91	15131	205	18097	9	9	-2855
June 23, 2019	17	26.91	15947	201	18862	9	104	-2862
June 23, 2019	18	41.68	16478	198	18962	9	121	-2502
June 23, 2019	19	24.09	16638	220	18788	10	443	-2324
June 23, 2019	20	13.47	16331	274	18356	10	324	-2043
June 23, 2019	21	14.07	16160	279	18271	10	168	-1966
June 23, 2019	22	1.93	15283	272	17602	9	109	-2037
June 23, 2019	23	2.13	13984	257	16942	9	9	-2626
June 23, 2019	24	-0.28	12959	266	16362	9	9	-3107
June 24, 2019	1	-0.02	12293	251	16162	9	9	-3627
June 24, 2019	2	-3.18	11883	220	15685	9	9	-3490
June 24, 2019	3	-4	11699	143	15493	9	9	-3555
June 24, 2019	4	-3.83	11689	136	15524	9	41	-3662
June 24, 2019	5	-3.09	12062	198	15825	8	17	-3595
June 24, 2019	6	-1.46	13048	156	16437	9	17	-3307
June 24, 2019	7	-1.12	14402	146	17229	9	620	-3288
June 24, 2019	8	0	15053	164	17944	9	677	-3508
June 24, 2019	9	0	15388	102	17805	9	620	-2982
June 24, 2019	10	0	15680	137	18044	9	662	-2927
June 24, 2019	11	0	15990	151	18576	18	620	-3105
June 24, 2019	12	2.24	16032	219	18629	20	620	-3025

June 24, 2019	13	6.15	16283	189	19011	9	620	-3169
June 24, 2019	14	5.61	16559	222	18930	9	620	-2782
June 24, 2019	15	2.84	16971	186	18839	9	620	-2340
June 24, 2019	16	16.7	17465	190	19336	9	620	-2370
June 24, 2019	17	81.47	17812	201	19599	10	849	-2482
June 24, 2019	18	22.19	17689	212	19354	11	849	-2288
June 24, 2019	19	16.37	17678	214	18998	11	849	-1929
June 24, 2019	20	9.61	17486	184	18870	11	849	-1946
June 24, 2019	21	5.9	17270	187	18812	10	1049	-2294
June 24, 2019	22	1.73	16170	175	18031	10	687	-2273
June 24, 2019	23	2.39	14833	112	17211	10	9	-2254
June 24, 2019	24	-2.19	13723	139	16069	10	9	-2030
June 25, 2019	1	-4.08	12979	130	15513	10	9	-2193
June 25, 2019	2	-4.17	12571	172	15235	10	9	-2424
June 25, 2019	3	-3.58	12370	173	15895	9	9	-3361
June 25, 2019	4	-3	12261	173	16136	10	9	-3663
June 25, 2019	5	-2.37	12550	216	16280	10	29	-3478
June 25, 2019	6	-0.78	13617	181	16899	10	59	-3219
June 25, 2019	7	-0.26	15168	162	17666	10	627	-3047
June 25, 2019	8	0	15915	155	18280	10	647	-2802
June 25, 2019	9	0	16233	156	18218	11	620	-2508
June 25, 2019	10	0	16469	176	18270	10	620	-2264
June 25, 2019	11	0	16541	150	18456	10	620	-2398
June 25, 2019	12	0	16538	178	18588	10	631	-2491
June 25, 2019	13	0	16103	183	18658	8	620	-2437
June 25, 2019	14	0	16162	187	18720	16	670	-2505
June 25, 2019	15	0	16468	144	18793	9	705	-2322
June 25, 2019	16	0	16852	122	19127	8	620	-2311
June 25, 2019	17	10.95	17469	56	19462	9	620	-2558
June 25, 2019	18	29.89	17661	89	19547	8	629	-2535
June 25, 2019	19	66.86	17817	134	19697	9	620	-2448
June 25, 2019	20	23.93	17617	167	18913	9	849	-2013
June 25, 2019	21	5.89	16922	205	18459	8	912	-1837
June 25, 2019	22	2.41	16435	220	18209	8	861	-2326
June 25, 2019	23	-0.27	14878	247	16990	8	79	-1724
June 25, 2019	24	-0.76	13831	250	16365	8	199	-2381
June 26, 2019	1	-1.23	13006	291	16278	8	199	-3017
June 26, 2019	2	-1.46	12563	274	16431	8	112	-3511
June 26, 2019	3	-3	12288	270	16151	8	37	-3488
June 26, 2019	4	-2.93	12311	256	16006	8	9	-3406
June 26, 2019	5	-1.9	12644	181	16247	8	9	-3295
June 26, 2019	6	-0.94	13677	157	16514	8	137	-2799
June 26, 2019	7	3.02	15314	152	17638	8	358	-2695
June 26, 2019	8	59.24	16270	216	18459	8	784	-2866
June 26, 2019	9	41.89	16833	232	18673	9	908	-2556
June 26, 2019	10	10.41	17228	234	18743	9	1036	-2265
June 26, 2019	11	4.92	17541	175	18866	8	1237	-2320
June 26, 2019	12	-0.02	17770	141	18321	8	1640	-2057
June 26, 2019	13	0	18026	160	19057	8	1648	-2517
June 26, 2019	14	0	18139	182	19081	8	1570	-2109

June 26, 2019	15	5.24	18475	223	19272	8	1590	-2066
June 26, 2019	16	12.38	18900	252	19819	8	1570	-2214
June 26, 2019	17	18.96	19264	223	20186	9	1562	-2218
June 26, 2019	18	29.15	19479	162	20269	11	1582	-2213
June 26, 2019	19	36.72	19558	163	20417	11	1534	-2190
June 26, 2019	20	31.44	19258	229	20108	12	1330	-1921
June 26, 2019	21	39.84	18835	229	19401	11	1298	-1559
June 26, 2019	22	25.67	17692	239	18860	11	1341	-2232
June 26, 2019	23	14.06	16022	278	17291	12	1353	-2235
June 26, 2019	24	7	14697	200	16414	12	813	-2122
June 27, 2019	1	4.41	13732	276	15954	13	68	-1831
June 27, 2019	2	1.88	13179	239	15631	13	140	-2195
June 27, 2019	3	5.28	12807	204	15590	12	9	-2526
June 27, 2019	4	5.72	12759	234	15815	12	68	-2836
June 27, 2019	5	-0.27	13016	238	15981	13	114	-2682
June 27, 2019	6	3.77	14029	202	16652	13	68	-2465
June 27, 2019	7	18.75	15547	172	17505	13	470	-2267
June 27, 2019	8	20.49	16449	205	18285	13	479	-2048
June 27, 2019	9	22.61	17017	177	18819	13	679	-2274
June 27, 2019	10	21.92	17432	183	19135	14	699	-2097
June 27, 2019	11	22.63	17809	127	19275	14	861	-2183
June 27, 2019	12	24.61	18102	109	19174	15	1116	-2055
June 27, 2019	13	22.71	18490	112	19537	15	1132	-2040
June 27, 2019	14	22.72	18837	184	19763	15	1437	-2080
June 27, 2019	15	21.91	19191	158	19783	33	1579	-1931
June 27, 2019	16	24.8	19669	117	20010	65	1556	-1722
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June 27, 2019	18	24.33	19903	103	19681	80	1585	-1178
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June 27, 2019	20	27.83	19551	119	19621	76	1585	-1279
June 27, 2019	21	28.62	19351	132	19267	68	1715	-1411
June 27, 2019	22	15.12	18270	232	18604	66	1641	-1555
June 27, 2019	23	9.84	16641	243	17032	22	1689	-1644
June 27, 2019	24	7.91	15183	297	16198	13	1287	-1742
June 28, 2019	1	13.55	14174	280	16119	13	425	-1900
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June 28, 2019	3	-1.69	13108	255	15574	13	170	-2062
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June 28, 2019	8	23.94	16629	231	18382	10	562	-2113
June 28, 2019	9	21.69	17293	252	18467	11	864	-1715
June 28, 2019	10	18.06	17763	263	18711	10	967	-1541
June 28, 2019	11	19.64	18324	229	19114	10	1058	-1531
June 28, 2019	12	21.56	18882	269	19550	10	1157	-1609
June 28, 2019	13	24.42	19180	252	20031	11	1107	-1709
June 28, 2019	14	24.4	19066	198	19891	11	1532	-1947
June 28, 2019	15	22.26	18724	185	19152	11	1652	-1804
June 28, 2019	16	21.26	18751	210	18971	11	1669	-1602

June 28, 2019	17	23.47	18706	169	18891	11	1687	-1626
June 28, 2019	18	15.25	18517	155	18647	11	1652	-1567
June 28, 2019	19	31.11	18387	136	18277	11	1713	-1445
June 28, 2019	20	70.88	18151	193	18758	11	1156	-1425
June 28, 2019	21	7.84	17887	227	18255	12	1423	-1387
June 28, 2019	22	34.49	17073	227	18099	11	884	-1548
June 28, 2019	23	15.36	15686	250	17530	11	192	-1556
June 28, 2019	24	6.58	14491	217	16469	11	204	-1712
June 29, 2019	1	3.81	13675	236	15980	10	144	-2004
June 29, 2019	2	3.68	13157	236	15782	11	166	-2472
June 29, 2019	3	5.2	12791	245	15682	11	164	-2693
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June 29, 2019	5	-0.02	12533	218	15620	10	98	-2775
June 29, 2019	6	-2.46	12816	228	15542	10	83	-2453
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June 29, 2019	16	11.73	18010	213	19093	16	1495	-2377
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June 29, 2019	23	18.88	15011	157	17041	10	174	-1884
June 29, 2019	24	7.25	13906	176	16088	11	242	-2015
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June 30, 2019	3	-3.11	12042	162	15521	11	226	-3295
June 30, 2019	4	-4.04	11701	189	15050	11	68	-2998
June 30, 2019	5	-4.03	11544	163	14865	10	138	-3224
June 30, 2019	6	-4.08	11614	164	15030	11	68	-3282
June 30, 2019	7	-2.79	12247	218	15527	11	93	-3167
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June 30, 2019	12	-0.27	14159	229	16979	11	199	-2619
June 30, 2019	13	0	14161	217	17328	11	198	-3061
June 30, 2019	14	-3	14292	176	17371	11	258	-2966
June 30, 2019	15	-1.93	14626	153	17492	11	159	-2714
June 30, 2019	16	2.81	15193	216	17704	11	9	-2243
June 30, 2019	17	18.1	15847	222	18285	11	192	-2409
June 30, 2019	18	17.28	16213	188	18567	11	104	-2264

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June 30, 2019	20	5.39	15779	200	17687	11	326	-1823
June 30, 2019	21	5.89	15434	200	17725	11	174	-2197
June 30, 2019	22	6.52	14824	202	17202	11	152	-2238
June 30, 2019	23	5.34	13829	191	16458	11	265	-2558
June 30, 2019	24	1.45	12901	204	15570	11	156	-2497
July 1, 2019	1	-4.2	12187	173	15058	11	162	-2643
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July 1, 2019	3	-4.13	11352	155	14619	11	48	-2938
July 1, 2019	4	-4.23	11171	171	14458	11	88	-2960
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July 1, 2019	16	9.42	16389	177	19353	11	22	-2433
July 1, 2019	17	22.08	17255	161	19648	10	556	-2512
July 1, 2019	18	20.47	17648	167	19845	10	769	-2516
July 1, 2019	19	22.17	17713	152	19837	10	594	-2222
July 1, 2019	20	13.1	17268	143	18964	10	680	-1938
July 1, 2019	21	10.69	16830	190	18689	9	1051	-2325
July 1, 2019	22	7.06	16354	205	17742	9	816	-1951
July 1, 2019	23	10.13	15395	206	17346	11	245	-1921
July 1, 2019	24	11.62	14284	195	16704	10	41	-2054
July 2, 2019	1	2.42	13531	197	15577	9	109	-1699
July 2, 2019	2	-0.5	13029	213	15291	9	109	-1988
July 2, 2019	3	0.39	12795	203	15253	10	73	-2289
July 2, 2019	4	-0.56	12810	201	15373	10	136	-2525
July 2, 2019	5	1.97	13258	200	15390	11	74	-2085
July 2, 2019	6	4.68	14154	186	16439	10	13	-2126
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July 2, 2019	9	17.41	17044	212	18342	11	1016	-2093
July 2, 2019	10	21.87	17642	196	18919	10	1102	-2166
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July 2, 2019	13	21.87	18531	141	19197	18	1526	-2012
July 2, 2019	14	23.67	18861	152	19711	21	1521	-2206
July 2, 2019	15	25.14	19186	194	20259	15	1526	-2374
July 2, 2019	16	24.42	19649	183	20369	11	1599	-2055
July 2, 2019	17	24.34	19883	145	20833	12	1599	-2296
July 2, 2019	18	24.15	19730	161	20796	11	1603	-2382
July 2, 2019	19	23.1	19670	178	20636	12	1580	-2225
July 2, 2019	20	21.68	19325	216	20299	12	1577	-2187

July 2, 2019	21	20.35	18924	206	20022	11	1573	-2209
July 2, 2019	22	25.32	17926	222	19482	11	855	-2179
July 2, 2019	23	21.52	16304	212	18496	11	383	-2358
July 2, 2019	24	13.66	15010	254	16755	11	1166	-2567
July 3, 2019	1	10.84	14154	203	16232	14	371	-2184
July 3, 2019	2	11.48	13532	193	16281	16	77	-2565
July 3, 2019	3	11.48	13218	184	16138	17	109	-2809
July 3, 2019	4	12.71	13153	133	16157	15	109	-2868
July 3, 2019	5	4.56	13374	218	16055	17	128	-2444
July 3, 2019	6	15.89	14384	137	16832	16	208	-2570
July 3, 2019	7	16.17	15721	163	17532	14	717	-2373
July 3, 2019	8	17.41	16699	178	17884	17	1433	-2389
July 3, 2019	9	18.95	17508	171	18435	15	1451	-2305
July 3, 2019	10	21	18277	156	19112	20	1579	-2192
July 3, 2019	11	21.97	18779	145	19927	18	1142	-2196
July 3, 2019	12	23.88	19206	166	20015	18	1593	-2262
July 3, 2019	13	24.33	19674	131	20603	51	1461	-2267
July 3, 2019	14	24.32	19997	99	20823	70	1653	-2404
July 3, 2019	15	24.4	20201	81	20979	72	1621	-2370
July 3, 2019	16	24.33	20423	62	21341	70	1637	-2518
July 3, 2019	17	24.13	20675	55	21471	73	1487	-2284
July 3, 2019	18	24.33	20729	54	21262	73	1509	-2036
July 3, 2019	19	24.33	20584	47	21049	74	1554	-1994
July 3, 2019	20	24.24	20179	97	20987	73	1247	-1911
July 3, 2019	21	24.1	19999	126	20734	72	1246	-1889
July 3, 2019	22	25.2	18883	168	20449	27	1166	-2509
July 3, 2019	23	19.38	17117	233	18937	16	1187	-2603
July 3, 2019	24	14.8	15571	234	17425	16	1164	-2650
July 4, 2019	1	10.03	14524	234	16670	15	865	-2681
July 4, 2019	2	10.49	13843	237	16384	15	475	-2714
July 4, 2019	3	10.98	13341	214	16128	15	148	-2661
July 4, 2019	4	5.21	13163	247	15993	16	148	-2658
July 4, 2019	5	5.65	13445	239	16184	16	148	-2668
July 4, 2019	6	10.61	14362	212	16934	16	67	-2498
July 4, 2019	7	5.28	15903	233	17767	15	647	-2318
July 4, 2019	8	14.5	17076	227	18571	16	1396	-2548
July 4, 2019	9	20.2	17920	211	19115	16	1468	-2392
July 4, 2019	10	21.84	18664	207	19723	16	1578	-2412
July 4, 2019	11	22.57	19258	164	20157	15	1596	-2297
July 4, 2019	12	24.22	19730	159	20843	16	1499	-2442
July 4, 2019	13	24.24	20141	137	21224	19	1380	-2234
July 4, 2019	14	24.99	20508	141	21444	19	1504	-2214
July 4, 2019	15	24.36	20816	133	21623	62	1503	-2208
July 4, 2019	16	24.24	21003	23	21593	71	1435	-1953
July 4, 2019	17	25.14	21183	23	21906	72	1261	-1959
July 4, 2019	18	24.26	21231	24	21737	71	1454	-1950
July 4, 2019	19	26.21	21153	26	21509	71	1483	-1812
July 4, 2019	20	23.29	20717	79	21580	71	1352	-2057
July 4, 2019	21	24.19	20476	136	21292	71	1283	-1927
July 4, 2019	22	23.14	19571	188	21201	25	1320	-2659

July 4, 2019	23	21.31	17998	201	19480	16	1395	-2537
July 4, 2019	24	20.27	16427	267	17838	15	1490	-2512
July 5, 2019	1	16.28	15433	244	16791	15	1488	-2568
July 5, 2019	2	2.49	14710	256	16355	15	1119	-2457
July 5, 2019	3	2.17	14224	215	16440	15	753	-2658
July 5, 2019	4	4.75	14044	243	16565	15	561	-2793
July 5, 2019	5	1.11	14313	176	16656	15	604	-2678
July 5, 2019	6	1.97	15172	234	17581	15	533	-2728
July 5, 2019	7	19.59	16894	206	18550	14	1031	-2651
July 5, 2019	8	21.64	18424	268	19703	15	1415	-2525
July 5, 2019	9	28.11	19580	189	20703	15	1362	-2407
July 5, 2019	10	32.64	20440	173	21458	33	1202	-2140
July 5, 2019	11	28.72	20959	119	21683	18	1469	-2129
July 5, 2019	12	27.24	21242	70	21803	62	1311	-1794
July 5, 2019	13	24.05	21228	20	21704	77	1397	-1708
July 5, 2019	14	25.59	21164	49	21808	72	1516	-2071
July 5, 2019	15	28.09	21151	49	22168	72	1230	-2296
July 5, 2019	16	40.32	21388	40	22495	71	1317	-2474
July 5, 2019	17	32.97	21589	22	22919	71	1269	-2506
July 5, 2019	18	27.77	21333	22	22473	71	1215	-2368
July 5, 2019	19	30.54	21027	45	21955	71	1215	-2093
July 5, 2019	20	28.11	20778	141	21517	26	1315	-1827
July 5, 2019	21	32.49	20526	130	21104	16	1315	-1707
July 5, 2019	22	28.03	19609	216	20942	16	1302	-2359
July 5, 2019	23	20.98	18143	270	19939	16	1302	-2701
July 5, 2019	24	20.91	16840	193	18457	15	1300	-2682
July 6, 2019	1	31.56	15881	228	17508	13	1318	-2714
July 6, 2019	2	18.6	15285	208	16909	16	1373	-2751
July 6, 2019	3	22.8	14858	225	16412	16	1414	-2737
July 6, 2019	4	22.93	14586	227	16366	15	1197	-2688
July 6, 2019	5	14.36	14533	222	16112	15	1409	-2696
July 6, 2019	6	16.66	14826	179	16181	16	1387	-2617
July 6, 2019	7	17.71	15665	133	17090	14	1124	-2377
July 6, 2019	8	21.26	16863	189	18203	14	1269	-2441
July 6, 2019	9	24.9	17974	177	19345	15	1300	-2551
July 6, 2019	10	25.25	18758	208	20190	16	1340	-2560
July 6, 2019	11	28.78	19203	124	20185	16	1372	-2251
July 6, 2019	12	47.43	19460	177	20671	16	1474	-2454
July 6, 2019	13	47.9	19372	127	20782	17	1474	-2733
July 6, 2019	14	29.58	19323	138	20799	17	1374	-2625
July 6, 2019	15	24.5	19476	138	20812	17	1374	-2481
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July 6, 2019	18	26.05	20020	114	21206	16	1357	-2395
July 6, 2019	19	23.53	19583	141	20769	17	1341	-2284
July 6, 2019	20	21.1	18886	181	20300	17	1341	-2295
July 6, 2019	21	20.75	18426	172	19627	16	1341	-2282
July 6, 2019	22	18.21	17554	176	18893	16	1374	-2422
July 6, 2019	23	11.65	16264	221	17982	15	1474	-2858
July 6, 2019	24	0.48	15039	227	16555	15	1435	-2639

July 7, 2019	1	-0.37	14084	204	16186	14	1086	-2896
July 7, 2019	2	-0.5	13220	221	15965	14	401	-2846
July 7, 2019	3	-1.26	12697	202	15685	14	48	-2777
July 7, 2019	4	-3	12378	226	15540	14	48	-2847
July 7, 2019	5	-3	12221	220	15645	13	74	-3198
July 7, 2019	6	-1.32	12238	191	15668	13	48	-3265
July 7, 2019	7	-1.87	12682	215	15767	13	108	-2837
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July 7, 2019	9	2.23	14165	218	17267	13	148	-2990
July 7, 2019	10	9.8	14677	219	17902	14	186	-3148
July 7, 2019	11	25.74	15063	194	18211	13	148	-3066
July 7, 2019	12	20.28	15387	223	18567	15	219	-3134
July 7, 2019	13	5.78	15534	241	18678	14	299	-3054
July 7, 2019	14	1.6	15643	253	18640	14	175	-2794
July 7, 2019	15	5.52	15938	220	18796	14	317	-2957
July 7, 2019	16	13.78	16549	207	19111	13	525	-2969
July 7, 2019	17	21.89	17291	216	19788	12	716	-3054
July 7, 2019	18	22.13	17679	192	19673	13	867	-2665
July 7, 2019	19	22.64	17643	149	19478	14	1259	-2873
July 7, 2019	20	20.58	17058	190	18753	14	1283	-2559
July 7, 2019	21	20.5	16654	197	18142	13	1373	-2583
July 7, 2019	22	12.52	15851	211	17446	13	1420	-2744
July 7, 2019	23	7.49	14545	202	16679	13	984	-2897
July 7, 2019	24	4.27	13494	205	16029	13	546	-2929
July 8, 2019	1	3.57	12742	226	15943	12	48	-2938
July 8, 2019	2	-1.59	12314	217	15416	12	48	-2817
July 8, 2019	3	-3.84	12052	200	15054	12	48	-2828
July 8, 2019	4	-4	12061	182	15040	12	48	-2823
July 8, 2019	5	-2.08	12344	163	15310	12	48	-2793
July 8, 2019	6	0.27	13063	120	15955	12	137	-2836
July 8, 2019	7	13.11	14356	169	16912	12	173	-2602
July 8, 2019	8	10.21	15124	177	17215	13	392	-2333
July 8, 2019	9	12.95	15737	99	17444	13	719	-2366
July 8, 2019	10	13	16216	166	17904	13	819	-2356
July 8, 2019	11	19.41	16660	173	18281	20	933	-2335
July 8, 2019	12	18.68	16903	165	18448	20	987	-2269
July 8, 2019	13	20.22	17257	195	18740	20	957	-2264
July 8, 2019	14	21.51	17592	190	18968	12	1110	-2306
July 8, 2019	15	21.98	18079	168	19075	12	1444	-2260
July 8, 2019	16	23.58	18629	255	19475	12	1483	-2046
July 8, 2019	17	24.23	19197	265	19676	11	1453	-1678
July 8, 2019	18	24.49	19220	246	19719	13	1441	-1666
July 8, 2019	19	23.36	18959	249	19411	13	1441	-1496
July 8, 2019	20	21.23	18426	282	19506	13	1493	-2161
July 8, 2019	21	20.75	17944	260	19206	13	1411	-2315
July 8, 2019	22	18.08	16732	266	18060	12	1363	-2247
July 8, 2019	23	12.01	15209	258	16780	13	1131	-2297
July 8, 2019	24	12.7	14038	181	16103	13	288	-2086
July 9, 2019	1	14.6	13238	174	15543	14	101	-2194
July 9, 2019	2	7.86	12773	188	15369	13	97	-2380

July 9, 2019	3	-2.92	12453	170	15172	13	84	-2459
July 9, 2019	4	-2.54	12444	159	15264	13	90	-2631
July 9, 2019	5	-4.08	12665	235	15289	14	36	-2205
July 9, 2019	6	0.42	13408	231	15913	13	132	-2238
July 9, 2019	7	19.29	14609	170	16933	14	54	-2116
July 9, 2019	8	17.88	15455	184	17490	14	255	-2114
July 9, 2019	9	15.39	16016	147	17703	14	789	-2260
July 9, 2019	10	20.8	16591	184	18281	14	675	-2240
July 9, 2019	11	22.96	17137	143	18414	15	1220	-2293
July 9, 2019	12	22.84	17495	135	18882	16	1086	-2283
July 9, 2019	13	23.2	17925	152	18959	16	1397	-2194
July 9, 2019	14	23.88	18276	242	19427	15	1384	-2264
July 9, 2019	15	24.39	18792	254	19955	16	1392	-2291
July 9, 2019	16	23.55	19427	244	20470	15	1462	-2252
July 9, 2019	17	25.32	19880	218	21064	15	1302	-2200
July 9, 2019	18	25.33	19920	180	20958	16	1353	-2087
July 9, 2019	19	25.11	19667	171	20571	16	1314	-1818
July 9, 2019	20	25.06	19176	204	20347	16	1396	-2302
July 9, 2019	21	22.94	18886	145	20025	16	1416	-2285
July 9, 2019	22	22.46	17548	198	18893	16	1473	-2343
July 9, 2019	23	16.97	15844	251	17143	15	1406	-2289
July 9, 2019	24	12.12	14489	242	16298	14	602	-2076
July 10, 2019	1	5.75	13646	220	15799	14	199	-2071
July 10, 2019	2	4.29	13067	214	15528	14	269	-2452
July 10, 2019	3	-0.21	12703	170	15136	14	139	-2292
July 10, 2019	4	0.35	12653	185	15268	14	150	-2533
July 10, 2019	5	-0.59	12985	170	15517	13	128	-2399
July 10, 2019	6	1.37	13723	221	16024	14	113	-2062
July 10, 2019	7	21.66	15031	184	17419	14	85	-2233
July 10, 2019	8	22.78	16026	174	17900	13	610	-2252
July 10, 2019	9	22.43	16809	188	18606	22	618	-2254
July 10, 2019	10	22.55	17570	202	18691	23	1322	-2208
July 10, 2019	11	23.4	18169	185	19362	24	1301	-2240
July 10, 2019	12	23.76	18603	201	19590	24	1367	-2035
July 10, 2019	13	25.65	19256	188	20188	17	1453	-2255
July 10, 2019	14	25.68	19768	148	20778	17	1421	-2274
July 10, 2019	15	25.16	20186	63	21060	17	1362	-2204
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July 10, 2019	18	26.71	20848	22	21310	15	1332	-1681
July 10, 2019	19	25.58	20611	29	21038	15	1332	-1668
July 10, 2019	20	25.15	20277	120	20888	15	1332	-1854
July 10, 2019	21	28.55	20090	132	20945	14	1332	-1976
July 10, 2019	22	20.99	18934	145	20085	15	1366	-2269
July 10, 2019	23	19.2	17385	122	18511	14	1438	-2383
July 10, 2019	24	9.53	15999	210	17233	16	1177	-2168
July 11, 2019	1	16.78	15142	245	17083	15	634	-2275
July 11, 2019	2	14.35	14510	235	16905	15	238	-2238
July 11, 2019	3	4.1	14154	202	16356	15	148	-2090
July 11, 2019	4	13.61	14065	268	16377	15	119	-2177

July 11, 2019	5	13.64	14461	214	16679	15	101	-2139
July 11, 2019	6	5.52	15375	247	16878	15	773	-2062
July 11, 2019	7	16.79	16759	243	17922	16	1188	-2136
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July 11, 2019	9	26.62	18483	159	19502	15	1175	-2098
July 11, 2019	10	26.7	19081	188	20030	15	1153	-2059
July 11, 2019	11	26.7	19446	200	20778	16	1131	-2193
July 11, 2019	12	26.66	19984	158	21087	15	1122	-2173
July 11, 2019	13	26.7	20467	153	21637	15	1142	-2142
July 11, 2019	14	26.39	20125	123	21288	15	1219	-2243
July 11, 2019	15	24.57	20151	108	20899	14	1304	-2055
July 11, 2019	16	25.61	20487	116	21462	14	1273	-2194
July 11, 2019	17	25.68	20365	106	21361	15	1304	-2174
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July 11, 2019	22	12.84	17157	199	18452	15	1310	-2192
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July 11, 2019	24	6.93	14370	204	15409	14	1326	-2124
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July 12, 2019	9	24.58	16709	222	17457	17	1494	-1997
July 12, 2019	10	25.81	16959	188	18243	15	772	-1975
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July 12, 2019	12	24.58	16934	191	18428	16	901	-2216
July 12, 2019	13	24.58	16850	179	18427	16	906	-2216
July 12, 2019	14	24.58	16838	176	18196	15	1158	-2266
July 12, 2019	15	20.28	16885	144	18134	14	1192	-2221
July 12, 2019	16	20.55	17274	158	18455	15	1222	-2196
July 12, 2019	17	24.65	17719	213	18751	14	1476	-2222
July 12, 2019	18	26.12	17852	242	18971	15	1560	-2327
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July 13, 2019	2	10.82	12398	277	14891	14	452	-2625
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July 13, 2019	4	3.38	11974	237	15034	13	9	-2805
July 13, 2019	5	0	11956	243	14997	13	9	-2768
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July 13, 2019	7	-1.01	12795	215	15749	14	73	-2701
July 13, 2019	8	12.92	13873	222	16730	15	9	-2604
July 13, 2019	9	4.59	14862	209	17322	15	770	-2949
July 13, 2019	10	13.8	15592	198	17788	15	936	-2800
July 13, 2019	11	24.26	16343	176	18365	14	1176	-2977
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July 13, 2019	14	23.73	17668	250	19043	14	1481	-2590
July 13, 2019	15	24.23	17586	247	19267	15	1534	-2760
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July 14, 2019	11	24.7	15213	159	16857	14	1426	-2709
July 14, 2019	12	25.57	15544	238	17237	15	1547	-2910
July 14, 2019	13	25.99	15767	188	17618	15	1534	-3144
July 14, 2019	14	26.45	16034	174	17897	15	1371	-3090
July 14, 2019	15	26.55	16461	160	18140	15	1565	-3091
July 14, 2019	16	26.52	17114	169	18730	14	1510	-2945
July 14, 2019	17	27.76	17892	159	19534	16	1483	-2925
July 14, 2019	18	28.29	18249	159	20002	16	1525	-3059
July 14, 2019	19	29.04	18238	140	19744	15	1592	-2794
July 14, 2019	20	26.74	17599	286	19402	16	1511	-2835
July 14, 2019	21	26.12	17259	258	18900	16	1611	-2907
July 14, 2019	22	24.62	16300	267	18060	19	1402	-2717
July 14, 2019	23	24.04	14985	256	16863	15	1380	-2891
July 14, 2019	24	23.4	13880	247	15718	14	1435	-2989
July 15, 2019	1	20.22	13021	256	15305	14	1102	-3061
July 15, 2019	2	13.89	12546	262	14793	15	907	-2832
July 15, 2019	3	13.33	12222	209	14556	15	680	-2771
July 15, 2019	4	13.37	12257	172	14739	15	672	-2971
July 15, 2019	5	13.98	12654	148	14949	15	693	-2833
July 15, 2019	6	3.98	13402	108	15400	14	1228	-2968
July 15, 2019	7	23.86	14706	58	16963	13	259	-2463
July 15, 2019	8	24.54	15605	114	17433	14	759	-2438

July 15, 2019	9	23.19	16273	151	18091	11	851	-2525
July 15, 2019	10	25.29	16852	169	18231	12	1440	-2493
July 15, 2019	11	25.9	17255	134	18610	21	1457	-2551
July 15, 2019	12	26.43	17746	177	19032	23	1450	-2614
July 15, 2019	13	26.85	18156	199	19627	14	1505	-2782
July 15, 2019	14	26.91	18524	179	19808	15	1456	-2577
July 15, 2019	15	27.09	19108	153	20308	16	1489	-2618
July 15, 2019	16	29.3	19753	187	20843	15	1492	-2502
July 15, 2019	17	34.7	20303	162	21314	15	1558	-2411
July 15, 2019	18	27.47	20017	184	20869	15	1558	-2171
July 15, 2019	19	27.11	19738	186	20546	15	1558	-2167
July 15, 2019	20	28.18	19470	200	20617	15	1474	-2480
July 15, 2019	21	26.91	19133	176	20373	15	1510	-2491
July 15, 2019	22	24.07	17920	218	19150	15	1660	-2551
July 15, 2019	23	22.63	16304	263	17995	15	1529	-2899
July 15, 2019	24	16.89	15011	286	16997	16	1350	-2952
July 16, 2019	1	14.79	14153	259	16533	14	731	-2812
July 16, 2019	2	9.26	13563	280	16103	14	717	-3029
July 16, 2019	3	13.33	13225	302	16188	14	100	-2748
July 16, 2019	4	13.36	13194	284	16181	14	258	-2913
July 16, 2019	5	2.19	13599	302	16189	14	629	-2913
July 16, 2019	6	5.19	14596	304	16740	14	1171	-3009
July 16, 2019	7	19.86	16096	249	17405	14	1295	-2433
July 16, 2019	8	21.89	17340	256	18501	14	1392	-2361
July 16, 2019	9	24.64	18222	226	19255	14	1613	-2408
July 16, 2019	10	26.05	19055	166	19907	14	1655	-2449
July 16, 2019	11	28.15	19772	114	20647	14	1720	-2582
July 16, 2019	12	26.85	20053	99	21178	15	1577	-2574
July 16, 2019	13	22	20065	69	21186	22	1627	-2589
July 16, 2019	14	22.16	20227	69	20998	15	1648	-2550
July 16, 2019	15	24.22	20206	56	21300	40	1523	-2647
July 16, 2019	16	25.56	20159	77	21736	68	1462	-3161
July 16, 2019	17	24.22	20372	74	21751	70	1731	-3121
July 16, 2019	18	23.11	20253	90	21549	69	1689	-3044
July 16, 2019	19	22.17	20315	84	21445	70	1659	-2897
July 16, 2019	20	24.38	20276	81	21177	70	1713	-2702
July 16, 2019	21	30.82	20320	85	21330	72	1712	-2770
July 16, 2019	22	26.68	19203	77	20346	24	1612	-2574
July 16, 2019	23	23.91	17535	216	18959	15	1612	-2784
July 16, 2019	24	21.63	16242	226	17541	14	1640	-2666
July 17, 2019	1	23.42	15396	252	16947	14	1616	-2926
July 17, 2019	2	16.91	14764	254	16528	15	1548	-3021
July 17, 2019	3	13.34	14433	241	16336	15	1288	-2971
July 17, 2019	4	13.34	14420	216	16198	15	1388	-2969
July 17, 2019	5	15.32	14922	210	16565	14	1558	-2995
July 17, 2019	6	31.44	15890	203	17199	14	1698	-2949
July 17, 2019	7	24.47	17228	163	18129	14	1678	-2470
July 17, 2019	8	24.75	18102	166	18729	15	1678	-2242
July 17, 2019	9	24.73	18531	162	18987	15	1679	-1911
July 17, 2019	10	27.06	18813	184	19379	15	1679	-2105

July 17, 2019	11	28.85	19077	161	19769	15	1497	-2120
July 17, 2019	12	30.23	19506	94	20076	15	1697	-2344
July 17, 2019	13	35.63	19957	82	20409	15	1775	-2311
July 17, 2019	14	34.81	20199	81	20660	15	1809	-2271
July 17, 2019	15	29.43	20405	79	20566	15	1895	-2102
July 17, 2019	16	25.07	20803	89	21007	15	2001	-2234
July 17, 2019	17	35.12	20943	43	21208	15	1773	-2109
July 17, 2019	18	24.2	20845	49	21134	15	1759	-2067
July 17, 2019	19	29.41	20718	66	21055	15	1580	-2001
July 17, 2019	20	32.66	20469	90	20917	15	1529	-2048
July 17, 2019	21	32.41	20124	90	20781	15	1479	-2031
July 17, 2019	22	24.66	18930	81	19632	15	1576	-2076
July 17, 2019	23	24.72	17271	121	18337	14	1576	-2429
July 17, 2019	24	22.17	15900	117	17264	14	1476	-2721
July 18, 2019	1	15.68	14848	219	16307	14	1385	-2515
July 18, 2019	2	15.05	14335	90	16230	14	885	-2694
July 18, 2019	3	16.38	13952	79	16261	15	555	-2828
July 18, 2019	4	9.26	13870	94	15886	15	1084	-3055
July 18, 2019	5	6.26	14221	79	15956	15	1236	-2971
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July 18, 2019	8	22.59	17232	70	18054	15	1591	-2375
July 18, 2019	9	25.38	17878	138	18732	15	1617	-2425
July 18, 2019	10	25.8	18302	145	19029	15	1686	-2318
July 18, 2019	11	28.07	18937	141	19535	15	1686	-2230
July 18, 2019	12	26.41	19291	150	20009	14	1626	-2194
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July 18, 2019	14	26.21	19893	141	20697	15	1416	-2111
July 18, 2019	15	25.78	20439	76	21036	18	1617	-2156
July 18, 2019	16	25.43	20597	77	21551	30	1597	-2384
July 18, 2019	17	27.84	20798	50	21361	27	1646	-2298
July 18, 2019	18	26.17	20855	14	21322	26	1527	-2064
July 18, 2019	19	25.72	20686	21	21132	25	1499	-1928
July 18, 2019	20	25.81	20434	54	20914	26	1552	-2177
July 18, 2019	21	25.06	20376	57	20830	27	1568	-2128
July 18, 2019	22	26.17	19263	30	20117	27	1549	-2262
July 18, 2019	23	16.86	17686	49	18965	30	1439	-2593
July 18, 2019	24	14.63	16431	120	17987	28	1369	-2823
July 19, 2019	1	14.04	15412	69	17720	24	698	-2852
July 19, 2019	2	1.9	14708	179	16994	24	767	-2829
July 19, 2019	3	5.93	14464	107	17260	24	400	-3049
July 19, 2019	4	10.72	14459	138	17439	23	148	-3065
July 19, 2019	5	0.41	14830	235	17554	24	471	-2951
July 19, 2019	6	4.92	15866	228	18051	24	910	-2987
July 19, 2019	7	18.68	17562	219	19023	23	1127	-2451
July 19, 2019	8	24.88	18932	194	19984	22	1532	-2451
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July 19, 2019	10	29.21	20766	71	21177	23	1433	-1800
July 19, 2019	11	28.41	21227	28	21692	23	1448	-1970
July 19, 2019	12	27.6	21318	31	21742	31	1639	-2137

July 19, 2019	13	23.8	20892	43	21504	25	1632	-2117
July 19, 2019	14	25.16	20221	49	21259	24	1388	-2315
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July 19, 2019	16	27.37	20731	51	21418	24	1523	-2274
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July 19, 2019	18	28.7	21108	18	21271	24	1462	-1742
July 19, 2019	19	35.33	21174	29	21125	25	1562	-1619
July 19, 2019	20	40.93	21074	65	20890	26	1662	-1557
July 19, 2019	21	57.55	20902	148	21008	25	1597	-1649
July 19, 2019	22	31.02	19922	127	20188	21	1697	-1787
July 19, 2019	23	29.57	18529	81	18933	24	1610	-1933
July 19, 2019	24	22.88	17160	90	17675	24	1604	-2023
July 20, 2019	1	21.05	16237	142	17318	23	1239	-2304
July 20, 2019	2	16.18	15442	259	17154	23	1055	-2382
July 20, 2019	3	13.3	14935	215	17134	18	757	-2634
July 20, 2019	4	8.53	14720	206	16625	14	914	-2601
July 20, 2019	5	7.23	14721	135	16951	14	578	-2619
July 20, 2019	6	8.73	14935	186	16552	14	1037	-2537
July 20, 2019	7	12.83	15760	177	17385	13	891	-2421
July 20, 2019	8	15.75	16908	198	18012	14	1277	-2274
July 20, 2019	9	25.59	18113	229	19320	13	1197	-2293
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July 20, 2019	11	27.38	19822	102	20349	15	1626	-2117
July 20, 2019	12	29.35	20305	114	20964	15	1638	-2149
July 20, 2019	13	30.23	20577	50	20946	15	1638	-1939
July 20, 2019	14	46.11	20872	21	21460	15	1595	-2251
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July 20, 2019	17	60.28	21503	17	20986	15	1869	-1502
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July 20, 2019	19	24.86	20760	12	20069	15	1995	-1308
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July 20, 2019	21	32.96	20122	90	20339	15	1543	-1469
July 20, 2019	22	24	18935	100	19026	15	1693	-1674
July 20, 2019	23	19.23	17539	199	17857	16	1684	-1782
July 20, 2019	24	21.06	16375	245	17177	15	1617	-2213
July 21, 2019	1	20.21	15501	216	16897	14	1224	-2520
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July 21, 2019	3	21.07	14349	247	16273	14	1233	-2969
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July 21, 2019	12	24.68	17624	166	18056	15	1640	-2024
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July 22, 2019	4	43.3	13194	240	14992	14	1251	-2838
July 22, 2019	5	34.16	13615	262	15231	13	1247	-2687
July 22, 2019	6	18.82	14458	297	15469	14	1408	-2125
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July 22, 2019	8	22.57	16350	229	16573	15	1647	-1631
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July 22, 2019	11	24.07	17636	217	17908	20	1639	-1733
July 22, 2019	12	24.88	17998	219	18484	21	1607	-1958
July 22, 2019	13	25.32	18250	251	18906	16	1626	-1997
July 22, 2019	14	25.55	18394	186	18951	16	1626	-1950
July 22, 2019	15	25.01	18518	180	19157	16	1627	-1981
July 22, 2019	16	24.2	18491	209	18531	16	1627	-1470
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July 23, 2019	16	23.68	18371	289	18439	23	1720	-1613

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July 26, 2019	4	14.38	13167	249	15594	13	131	-2304
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July 26, 2019	6	9.45	14252	247	15663	13	1448	-2523
July 26, 2019	7	12.65	15510	236	16367	14	1375	-2013
July 26, 2019	8	21.33	16591	235	17063	13	1318	-1628
July 26, 2019	9	24	17469	232	17907	13	1367	-1691
July 26, 2019	10	25.04	18277	243	18778	13	1641	-2019
July 26, 2019	11	28.83	19008	225	19419	15	1637	-1947
July 26, 2019	12	31.35	19513	250	19939	15	1637	-1893
July 26, 2019	13	51.82	19885	270	20500	15	1573	-2018
July 26, 2019	14	43.64	20205	210	20545	15	1739	-1912
July 26, 2019	15	45.97	20353	201	20635	15	1638	-1818
July 26, 2019	16	34.73	20530	213	20474	16	1800	-1612
July 26, 2019	17	44.42	20776	158	20734	14	1591	-1547
July 26, 2019	18	30.48	20729	130	20625	14	1624	-1415
July 26, 2019	19	29.72	20414	162	20492	15	1624	-1620
July 26, 2019	20	24.3	19870	142	20178	15	1599	-1783
July 26, 2019	21	22.89	19459	183	19851	15	1593	-1750
July 26, 2019	22	20.81	18088	232	18856	15	1624	-1904
July 26, 2019	23	20.02	16530	260	17662	15	1603	-2373
July 26, 2019	24	16.09	15222	282	16468	15	1538	-2392
July 27, 2019	1	8.87	14219	272	15684	14	1296	-2364
July 27, 2019	2	2.51	13504	302	15199	14	1271	-2562
July 27, 2019	3	3.47	13059	242	15251	14	700	-2584
July 27, 2019	4	5.37	12787	312	15340	14	276	-2503
July 27, 2019	5	0	12747	275	15205	14	238	-2409
July 27, 2019	6	0	12950	231	15318	14	238	-2396
July 27, 2019	7	0.38	13751	222	16114	14	238	-2431
July 27, 2019	8	17.29	15064	220	17088	15	883	-2731
July 27, 2019	9	21.05	16280	243	17945	14	1150	-2697
July 27, 2019	10	23.84	17265	220	18796	14	1581	-2797
July 27, 2019	11	23.07	17911	223	19416	16	1610	-2698
July 27, 2019	12	22.01	17974	264	19354	17	1704	-2820
July 27, 2019	13	21.75	18104	232	19461	17	1682	-2823
July 27, 2019	14	21.74	18437	235	20046	16	1414	-2803
July 27, 2019	15	21.74	18601	262	20280	15	1446	-2803
July 27, 2019	16	22.17	18889	254	20236	15	1648	-2737
July 27, 2019	17	22.52	19385	221	20619	15	1666	-2737
July 27, 2019	18	22.95	19406	188	20645	16	1651	-2742
July 27, 2019	19	20.78	18922	162	20099	16	1761	-2710
July 27, 2019	20	19.81	18307	195	19584	15	1748	-2796

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July 27, 2019	22	23.13	17055	250	18958	15	1134	-2722
July 27, 2019	23	19.98	15962	200	17447	15	1292	-2552
July 27, 2019	24	18.47	14994	183	16775	14	795	-2422
July 28, 2019	1	9.7	14242	185	16025	16	990	-2552
July 28, 2019	2	12.81	13601	188	16082	15	342	-2541
July 28, 2019	3	13.51	13226	160	15706	14	204	-2475
July 28, 2019	4	2.68	13025	184	15545	14	95	-2369
July 28, 2019	5	11.44	12968	192	15572	14	109	-2474
July 28, 2019	6	14.33	13114	159	15579	14	144	-2463
July 28, 2019	7	5	13639	202	16033	14	257	-2418
July 28, 2019	8	3.59	14751	243	16367	15	1060	-2481
July 28, 2019	9	17.5	16062	196	17288	15	1243	-2391
July 28, 2019	10	22.06	17166	245	18261	15	1457	-2344
July 28, 2019	11	24.38	17966	238	19371	16	1580	-2721
July 28, 2019	12	24.06	18527	212	19521	16	1641	-2303
July 28, 2019	13	24.77	18922	234	20312	16	1614	-2665
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July 28, 2019	15	24.51	19533	248	20975	16	1424	-2674
July 28, 2019	16	25.97	20049	211	21195	16	1535	-2530
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July 28, 2019	22	24.78	18493	227	19781	16	1478	-2421
July 28, 2019	23	22.87	17090	256	18359	16	1438	-2398
July 28, 2019	24	18.17	15803	259	17211	17	1364	-2392
July 29, 2019	1	13.71	14894	277	16376	15	1264	-2404
July 29, 2019	2	9.6	14330	277	15726	15	1372	-2436
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July 29, 2019	4	8.22	13942	123	16087	15	554	-2417
July 29, 2019	5	0	14346	172	16001	15	1002	-2388
July 29, 2019	6	2.76	15220	179	17034	14	862	-2423
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July 29, 2019	8	22.18	18054	204	19025	14	1487	-2314
July 29, 2019	9	23.97	19044	186	20045	16	1536	-2387
July 29, 2019	10	24.94	20011	180	21029	16	1599	-2429
July 29, 2019	11	24.13	20591	158	21579	23	1559	-2275
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July 29, 2019	14	23.96	21027	1	22035	16	1526	-2560
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July 29, 2019	16	22.76	21384	1	22136	16	1816	-2710
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July 30, 2019	2	19.15	14764	214	16242	13	1101	-2439
July 30, 2019	3	19.14	14446	190	16196	13	934	-2552
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July 30, 2019	10	25.28	18635	149	19232	19	1549	-2083
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July 30, 2019	12	35.58	19462	126	20141	23	1555	-2027
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July 30, 2019	14	42.72	19985	157	20926	16	1736	-2387
July 30, 2019	15	41.05	20251	93	21405	16	1596	-2516
July 30, 2019	16	60.84	20639	101	21511	16	1625	-2381
July 30, 2019	17	94.46	20807	42	21648	16	1607	-2404
July 30, 2019	18	45.5	20621	52	21113	16	1607	-2057
July 30, 2019	19	39.16	20386	78	20803	17	1584	-1834
July 30, 2019	20	26.67	19854	89	20048	15	1781	-1804
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July 30, 2019	22	23.51	18162	97	18802	16	1672	-2061
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July 31, 2019	2	9.73	13610	147	15602	14	1223	-3066
July 31, 2019	3	12.94	13247	110	15623	14	750	-3020
July 31, 2019	4	11.8	13130	151	15756	14	461	-2977
July 31, 2019	5	2.53	13387	143	15964	14	658	-3022
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July 31, 2019	12	22.59	17862	186	18706	14	1555	-2259
July 31, 2019	13	22.3	18265	201	19150	15	1467	-2172
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July 31, 2019	17	24.16	20093	171	20627	15	1609	-2010
July 31, 2019	18	24.16	20164	196	20680	15	1605	-1945
July 31, 2019	19	23.79	19861	230	20337	16	1609	-1831
July 31, 2019	20	22.67	19143	254	19723	16	1609	-1891
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July 31, 2019	24	3.08	14248	289	15204	15	1658	-2238

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August 1, 2019	2	0.46	12985	162	14982	14	518	-2290
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August 6, 2019	24	16.64	15105	199	16091	14	1375	-2114
August 7, 2019	1	12.63	14295	172	15471	14	1200	-2161
August 7, 2019	2	14.35	13780	203	15594	13	573	-2201
August 7, 2019	3	16.23	13458	192	15630	13	208	-2122
August 7, 2019	4	20.07	13446	169	15744	13	117	-2170
August 7, 2019	5	17.88	13809	183	16028	13	262	-2270
August 7, 2019	6	16.25	14759	189	16511	12	691	-2188

August 7, 2019	7	21.9	15851	182	17174	14	819	-2003
August 7, 2019	8	22.1	16734	139	17396	13	1108	-1652
August 7, 2019	9	23.48	17391	153	18097	12	1119	-1822
August 7, 2019	10	24.35	18102	144	18710	12	1259	-1821
August 7, 2019	11	24.44	18676	139	19008	15	1609	-1900
August 7, 2019	12	26.47	19119	138	19333	16	1736	-1931
August 7, 2019	13	26.44	19342	156	19496	47	1678	-1658
August 7, 2019	14	29.36	19662	129	19781	68	1859	-1871
August 7, 2019	15	27.31	19924	130	20224	69	1697	-1926
August 7, 2019	16	27.23	20148	126	20245	79	1667	-1699
August 7, 2019	17	54.89	20644	138	20475	70	1924	-1817
August 7, 2019	18	58.19	20686	135	20740	69	1796	-1850
August 7, 2019	19	41.1	20472	106	20242	77	1787	-1558
August 7, 2019	20	27.66	20093	103	19815	69	1879	-1605
August 7, 2019	21	24.91	19605	71	19485	24	1524	-1355
August 7, 2019	22	21.52	18173	77	18194	15	1523	-1407
August 7, 2019	23	21.79	16524	62	16781	13	1586	-1745
August 7, 2019	24	13.81	15139	42	15706	13	1592	-2025
August 8, 2019	1	1.26	14069	156	14942	14	1668	-2299
August 8, 2019	2	0.4	13340	172	15012	14	726	-2110
August 8, 2019	3	6.79	13068	168	15175	13	286	-2251
August 8, 2019	4	0	13005	167	15110	14	215	-2182
August 8, 2019	5	0	13402	162	15608	14	346	-2453
August 8, 2019	6	2.04	14267	155	16073	13	694	-2399
August 8, 2019	7	14.85	15475	119	17083	13	734	-2295
August 8, 2019	8	19.34	16456	133	18245	15	529	-2289
August 8, 2019	9	14.4	17074	100	18593	15	934	-2280
August 8, 2019	10	4.45	17289	93	18623	14	1099	-2279
August 8, 2019	11	0	17411	88	18386	13	1361	-2278
August 8, 2019	12	3.36	17706	94	18931	13	1020	-2290
August 8, 2019	13	0.86	17835	99	19499	13	751	-2358
August 8, 2019	14	9.33	18043	112	19588	13	810	-2368
August 8, 2019	15	7.99	18246	97	19148	13	1348	-2245
August 8, 2019	16	19.38	18524	141	19267	13	1606	-2252
August 8, 2019	17	20.74	18944	144	19689	13	1632	-2306
August 8, 2019	18	22.78	18935	187	19745	14	1515	-2248
August 8, 2019	19	25.04	18713	194	19402	15	1568	-2096
August 8, 2019	20	22.39	18317	182	18980	15	1574	-2081
August 8, 2019	21	20.89	17881	92	18063	13	1746	-1755
August 8, 2019	22	15.34	16623	129	17428	14	1680	-2332
August 8, 2019	23	13.8	15200	209	16529	15	1134	-2312
August 8, 2019	24	6.65	13976	218	15733	14	653	-2210
August 9, 2019	1	2.73	13097	189	15347	22	235	-2259
August 9, 2019	2	0	12611	202	14913	14	246	-2285
August 9, 2019	3	0	12319	173	14739	14	111	-2309
August 9, 2019	4	0	12298	210	14818	14	27	-2367
August 9, 2019	5	3.46	12635	190	15041	14	113	-2322
August 9, 2019	6	11.82	13421	207	15721	14	220	-2322
August 9, 2019	7	11.25	14476	192	16640	14	358	-2375
August 9, 2019	8	7.58	15333	191	16796	14	821	-2122

August 9, 2019	9	5.48	15821	184	17152	12	1171	-2338
August 9, 2019	10	11.76	16203	187	17618	12	1148	-2350
August 9, 2019	11	6.31	16587	169	17982	13	1143	-2334
August 9, 2019	12	2.82	16811	186	18808	15	453	-2303
August 9, 2019	13	5.34	16860	198	18949	14	582	-2399
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August 9, 2019	15	6.55	16851	201	18467	15	1037	-2406
August 9, 2019	16	6.74	17121	191	18107	15	1423	-2279
August 9, 2019	17	15.88	17430	182	18147	15	1792	-2331
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August 9, 2019	19	44.11	17312	167	17928	14	1639	-2112
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August 10, 2019	5	-1.5	11725	109	14774	14	187	-3098
August 10, 2019	6	5.66	11951	157	15050	14	209	-3173
August 10, 2019	7	0.13	12486	151	15261	14	45	-2680
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August 10, 2019	9	5.93	13736	228	16084	14	159	-2257
August 10, 2019	10	5.69	14102	235	16295	14	388	-2323
August 10, 2019	11	5.59	14448	221	16562	14	406	-2269
August 10, 2019	12	5.79	14701	164	16902	14	432	-2377
August 10, 2019	13	4.41	14678	206	16819	14	474	-2261
August 10, 2019	14	4.23	14590	228	16729	14	381	-2207
August 10, 2019	15	5.24	14653	205	16701	14	312	-2130
August 10, 2019	16	5.4	15067	202	16740	14	772	-2211
August 10, 2019	17	21.27	15644	176	17049	14	942	-2206
August 10, 2019	18	18.4	15898	180	17531	14	605	-2055
August 10, 2019	19	26.17	15800	183	17335	14	669	-2001
August 10, 2019	20	20.74	15437	176	17225	15	345	-1915
August 10, 2019	21	14.39	15111	164	16730	15	712	-2093
August 10, 2019	22	11.79	14296	182	16392	14	199	-2112
August 10, 2019	23	11.35	13353	176	15731	14	243	-2410
August 10, 2019	24	6.42	12499	190	15177	14	198	-2577
August 11, 2019	1	1.31	12008	183	14897	14	14	-2648
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August 11, 2019	4	-3.92	11092	190	14292	14	68	-2978
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August 11, 2019	11	5.53	14187	172	16208	13	176	-2015
August 11, 2019	12	6.53	14692	132	16698	13	187	-2029
August 11, 2019	13	5.88	15175	102	16846	13	557	-2100
August 11, 2019	14	5.58	15521	167	17145	13	616	-2001
August 11, 2019	15	3.56	15975	138	17028	14	1193	-2067
August 11, 2019	16	8.1	16645	182	17275	14	1466	-1880
August 11, 2019	17	24.85	17400	148	17951	15	1482	-1914
August 11, 2019	18	32.93	17806	146	18130	12	1695	-1866
August 11, 2019	19	28.69	17773	149	18057	14	1626	-1812
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August 11, 2019	21	29.91	17213	160	17678	17	1645	-1759
August 11, 2019	22	24.68	16198	194	17265	16	1152	-1886
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August 12, 2019	4	11.45	12772	185	15535	14	136	-2792
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August 12, 2019	16	24.33	20018	59	20045	89	1519	-1657
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August 12, 2019	23	22.58	16525	141	17380	15	1574	-2294
August 12, 2019	24	17.57	15282	143	15976	15	1585	-2085
August 13, 2019	1	15.57	14504	115	15084	14	1760	-2204
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August 13, 2019	3	13.34	13506	209	14880	13	929	-2084
August 13, 2019	4	4.18	13429	198	14858	14	904	-2093
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August 13, 2019	6	13.34	14648	198	15516	13	1488	-2142
August 13, 2019	7	20.74	15733	153	16666	13	1221	-2046
August 13, 2019	8	21.98	16736	153	17919	15	859	-1997
August 13, 2019	9	23.4	17440	95	18258	14	1536	-2259
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August 13, 2019	12	24.61	18800	116	19269	15	1490	-1973

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August 13, 2019	14	24.54	19616	156	20194	15	1578	-2070
August 13, 2019	15	24.45	19995	190	20599	15	1697	-2208
August 13, 2019	16	23.27	20441	181	20991	15	1628	-2071
August 13, 2019	17	28.86	20828	150	21049	15	1722	-1871
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August 14, 2019	22	17.85	16649	235	17507	15	1800	-2363
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August 15, 2019	9	20.73	15807	155	17101	14	1130	-2350
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August 15, 2019	14	22.35	17161	156	17840	14	1919	-2355

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August 15, 2019	17	23.43	17682	196	18218	14	1821	-2260
August 15, 2019	18	21.76	17699	213	18369	14	1804	-2325
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August 18, 2019	22	0.86	16761	160	16939	16	1740	-1843
August 18, 2019	23	4.25	15655	148	16552	16	1025	-1802
August 18, 2019	24	7.15	14620	182	16196	16	681	-2080
August 19, 2019	1	10.66	13844	149	15845	16	279	-2100
August 19, 2019	2	4.81	13380	164	15723	16	201	-2270
August 19, 2019	3	0	13094	163	15218	16	259	-2217
August 19, 2019	4	1.4	13155	172	15360	16	209	-2299
August 19, 2019	5	2.06	13694	110	15517	16	340	-2083
August 19, 2019	6	3.72	14722	104	15694	16	1074	-1930
August 19, 2019	7	13.66	15955	97	16804	16	857	-1671
August 19, 2019	8	22.23	17006	108	17264	16	1673	-1909
August 19, 2019	9	22.44	17692	89	17932	16	1643	-1870
August 19, 2019	10	25	18217	69	18418	15	1723	-1914
August 19, 2019	11	25.61	18651	77	18974	25	1739	-2060
August 19, 2019	12	25.84	18905	106	19286	27	1611	-1850
August 19, 2019	13	25.51	19156	120	19620	18	1554	-2001
August 19, 2019	14	24.75	19308	195	19796	44	1738	-2199
August 19, 2019	15	24.95	19532	153	20238	58	1534	-2215
August 19, 2019	16	25.92	19954	166	20403	54	1848	-2272
August 19, 2019	17	43.35	20536	177	20739	51	1853	-2140
August 19, 2019	18	37.16	20539	127	20435	46	1895	-1792

August 19, 2019	19	34.22	20221	149	20067	46	1894	-1697
August 19, 2019	20	26.23	19680	207	19750	26	1854	-1773
August 19, 2019	21	24.26	18953	205	19201	14	1878	-1892
August 19, 2019	22	20.59	17467	182	17892	15	1743	-1856
August 19, 2019	23	19.09	15829	193	15939	15	1688	-1518
August 19, 2019	24	16.11	14589	197	14958	15	1638	-1715
August 20, 2019	1	10.48	13648	201	14864	15	872	-1874
August 20, 2019	2	7.13	13095	216	15113	15	311	-2099
August 20, 2019	3	0	12844	166	14988	15	246	-2212
August 20, 2019	4	1.41	12727	258	14941	15	406	-2389
August 20, 2019	5	5.29	13107	255	15301	18	340	-2323
August 20, 2019	6	8.49	14016	221	15952	18	662	-2427
August 20, 2019	7	21.38	15108	207	16600	59	798	-2235
August 20, 2019	8	22.02	16001	177	16738	67	1470	-2171
August 20, 2019	9	22.82	16696	138	17164	67	1681	-2132
August 20, 2019	10	22.81	17247	149	17696	66	1757	-2082
August 20, 2019	11	24.01	17753	172	18055	67	1721	-1967
August 20, 2019	12	24.81	18327	159	18516	66	1723	-1962
August 20, 2019	13	24.32	19003	195	19414	65	1753	-2107
August 20, 2019	14	24.82	19466	181	19915	65	1755	-2152
August 20, 2019	15	25.4	19797	186	20340	65	1805	-2263
August 20, 2019	16	30.44	20370	161	20782	65	1710	-2167
August 20, 2019	17	33.4	20823	111	20929	67	1798	-1983
August 20, 2019	18	25.8	20716	125	20308	71	2135	-1732
August 20, 2019	19	24.04	20244	109	19933	72	1993	-1569
August 20, 2019	20	23.01	20080	131	19852	73	1880	-1574
August 20, 2019	21	30.9	19530	135	19840	20	1774	-1995
August 20, 2019	22	22.12	18285	148	18612	14	1751	-1860
August 20, 2019	23	22.88	16772	112	17141	14	1654	-1931
August 20, 2019	24	17.57	15560	161	15925	16	1726	-1889
August 21, 2019	1	10.22	14784	155	15331	15	1698	-2003
August 21, 2019	2	5.93	14225	161	15330	15	1168	-2084
August 21, 2019	3	6.02	13834	154	15307	15	758	-2102
August 21, 2019	4	2.59	13776	174	15210	15	820	-2116
August 21, 2019	5	24.24	14125	199	16101	15	336	-2213
August 21, 2019	6	21.6	15154	196	16408	13	1111	-2273
August 21, 2019	7	21.26	16273	169	16815	12	1661	-2072
August 21, 2019	8	24.36	17461	185	17907	13	1631	-2038
August 21, 2019	9	25.44	18283	172	18759	13	1646	-2042
August 21, 2019	10	30.69	18874	196	19339	13	1696	-2005
August 21, 2019	11	36	19415	170	19671	13	1806	-1910
August 21, 2019	12	36.05	19809	241	19850	14	1806	-1642
August 21, 2019	13	42.44	20273	196	20273	14	1721	-1622
August 21, 2019	14	35.92	20511	149	20195	14	1722	-1231
August 21, 2019	15	55.33	20777	129	20532	15	1943	-1533
August 21, 2019	16	69.43	20974	73	20775	16	1870	-1690
August 21, 2019	17	36.88	21179	76	20875	19	2339	-1894
August 21, 2019	18	27.57	20941	78	20472	14	2107	-1564
August 21, 2019	19	26.29	20634	91	20239	14	1776	-1379
August 21, 2019	20	35.29	20680	121	20374	14	1776	-1517

August 21, 2019	21	33.33	19980	93	20060	14	1798	-1755
August 21, 2019	22	23.71	18593	141	18814	15	1798	-1872
August 21, 2019	23	21.64	16889	158	16990	14	1748	-1604
August 21, 2019	24	23.76	15472	167	15744	13	1810	-1889
August 22, 2019	1	14.76	14362	199	15200	14	1381	-2001
August 22, 2019	2	2.77	13729	66	14465	14	1413	-2030
August 22, 2019	3	0	13238	130	14557	14	895	-2118
August 22, 2019	4	0	13065	135	14391	14	850	-2072
August 22, 2019	5	5.55	13459	128	14480	14	1151	-2116
August 22, 2019	6	8.9	14290	115	14811	15	1834	-2274
August 22, 2019	7	10.45	15297	103	15659	15	1755	-2131
August 22, 2019	8	23.61	15870	126	16381	14	1625	-2066
August 22, 2019	9	23.58	16240	116	16719	14	1721	-2146
August 22, 2019	10	23.61	16565	124	17159	14	1754	-2292
August 22, 2019	11	23.87	16880	84	17491	15	1770	-2292
August 22, 2019	12	23.78	16980	127	17584	20	1846	-2283
August 22, 2019	13	24.42	17172	137	17772	20	1818	-2283
August 22, 2019	14	24.45	17343	138	17832	32	1835	-2247
August 22, 2019	15	24.35	17581	133	18023	66	1917	-2363
August 22, 2019	16	23.11	17900	137	18504	67	1815	-2326
August 22, 2019	17	24.37	18241	157	18685	66	1921	-2335
August 22, 2019	18	23.58	18234	122	18606	67	1976	-2246
August 22, 2019	19	21.97	17791	167	18166	67	1956	-2237
August 22, 2019	20	23.34	17545	203	17315	68	2157	-1816
August 22, 2019	21	28.18	16923	208	17086	21	2030	-1893
August 22, 2019	22	31.45	15754	214	15897	13	2119	-1961
August 22, 2019	23	19.18	14430	188	15197	14	1389	-1897
August 22, 2019	24	5.71	13407	120	14699	14	987	-2040
August 23, 2019	1	13.34	12786	120	14348	12	959	-2328
August 23, 2019	2	3.26	12248	232	14413	12	441	-2244
August 23, 2019	3	9.06	12077	194	14258	12	595	-2475
August 23, 2019	4	4.63	12154	225	14166	12	584	-2358
August 23, 2019	5	24.05	12502	195	14433	12	643	-2402
August 23, 2019	6	18.09	13302	205	14771	12	841	-2084
August 23, 2019	7	17.53	14221	229	15764	12	717	-2090
August 23, 2019	8	22.78	14817	253	16386	12	855	-2241
August 23, 2019	9	22.54	15156	206	16906	13	682	-2292
August 23, 2019	10	22.91	15422	244	17046	14	989	-2292
August 23, 2019	11	22.96	15660	193	16911	13	1205	-2292
August 23, 2019	12	22.93	15895	177	16931	14	1428	-2292
August 23, 2019	13	20.94	16094	185	17074	14	1550	-2310
August 23, 2019	14	13.25	16060	186	17023	13	1556	-2307
August 23, 2019	15	5.96	16006	201	17004	14	1481	-2305
August 23, 2019	16	5.75	16174	141	16715	14	1775	-2078
August 23, 2019	17	1.67	16393	137	16966	13	1775	-2113
August 23, 2019	18	5.04	16315	157	16899	14	1624	-1981
August 23, 2019	19	7.77	16144	101	16639	14	1609	-1989
August 23, 2019	20	18.3	16058	185	16130	14	1724	-1555
August 23, 2019	21	20.75	15621	183	16289	14	1866	-2306
August 23, 2019	22	4.9	14606	212	15948	13	1164	-2139

August 23, 2019	23	2.52	13395	210	15217	13	663	-2195
August 23, 2019	24	1.93	12519	240	14613	13	306	-2078
August 24, 2019	1	1.38	11970	231	14308	14	290	-2383
August 24, 2019	2	-0.72	11599	256	14137	14	209	-2486
August 24, 2019	3	-1.52	11361	225	14113	14	209	-2717
August 24, 2019	4	-0.34	11308	278	14261	14	209	-2903
August 24, 2019	5	-0.05	11401	237	14167	14	239	-2763
August 24, 2019	6	0	11690	255	14191	13	139	-2361
August 24, 2019	7	0.86	12197	265	14434	13	180	-2155
August 24, 2019	8	15.23	12705	246	14742	14	363	-2223
August 24, 2019	9	12.75	13147	234	15013	14	595	-2263
August 24, 2019	10	6.96	13503	237	14987	14	910	-2152
August 24, 2019	11	7.71	13813	237	15297	14	916	-2182
August 24, 2019	12	8.37	13887	215	15628	14	791	-2229
August 24, 2019	13	12.08	13900	212	15667	13	787	-2267
August 24, 2019	14	13.37	14026	201	15647	13	964	-2299
August 24, 2019	15	0.48	14244	238	15630	13	1254	-2289
August 24, 2019	16	0.17	14608	218	15853	13	1212	-2145
August 24, 2019	17	7.85	15095	203	16227	13	1343	-2212
August 24, 2019	18	10.91	15342	214	16261	13	1515	-2169
August 24, 2019	19	17.39	15176	205	16090	14	1470	-2167
August 24, 2019	20	13.36	15107	182	16268	14	982	-1992
August 24, 2019	21	11.25	14760	184	15559	12	1436	-2042
August 24, 2019	22	5.79	13981	176	15335	13	803	-1973
August 24, 2019	23	4.58	13068	165	14667	13	717	-2108
August 24, 2019	24	2.87	12290	186	14439	14	325	-2270
August 25, 2019	1	-0.01	11781	140	14059	14	9	-2080
August 25, 2019	2	-0.09	11427	160	13829	14	23	-2232
August 25, 2019	3	-1.65	11205	186	13785	14	33	-2389
August 25, 2019	4	0	11114	188	13833	13	81	-2609
August 25, 2019	5	0	11132	160	13895	14	146	-2714
August 25, 2019	6	-1.66	11244	207	13810	14	105	-2386
August 25, 2019	7	-3.01	11528	197	14330	13	106	-2707
August 25, 2019	8	-0.27	12064	210	14429	13	124	-2253
August 25, 2019	9	5.86	12628	207	15056	13	9	-2307
August 25, 2019	10	5.9	13031	238	15397	13	172	-2282
August 25, 2019	11	8.46	13457	237	15695	13	113	-2161
August 25, 2019	12	12.72	13747	208	15866	14	316	-2176
August 25, 2019	13	6.56	13949	229	16037	14	505	-2313
August 25, 2019	14	5.76	14108	161	16043	14	705	-2325
August 25, 2019	15	1.72	14406	126	15984	14	914	-2220
August 25, 2019	16	7.37	15064	177	16616	14	1023	-2444
August 25, 2019	17	11.49	15719	153	17012	14	1169	-2291
August 25, 2019	18	9.8	16050	171	17237	14	1380	-2359
August 25, 2019	19	14.05	15928	175	16965	13	1314	-2177
August 25, 2019	20	7.17	15956	177	16975	13	1312	-2066
August 25, 2019	21	1.93	15450	163	16691	13	1234	-2226
August 25, 2019	22	-0.02	14494	177	16198	13	815	-2215
August 25, 2019	23	0	13451	155	15688	13	300	-2314
August 25, 2019	24	0	12631	179	15109	13	199	-2511

August 26, 2019	1	0	12092	119	14577	13	199	-2535
August 26, 2019	2	-0.01	11794	158	14397	13	207	-2669
August 26, 2019	3	-0.07	11618	180	14340	13	154	-2677
August 26, 2019	4	-0.07	11676	177	14320	13	31	-2501
August 26, 2019	5	0	12202	173	14687	13	189	-2516
August 26, 2019	6	0	13161	192	15177	13	509	-2342
August 26, 2019	7	0.46	14230	175	15811	13	1048	-2479
August 26, 2019	8	6.87	14980	119	16966	13	426	-2345
August 26, 2019	9	5.82	15446	160	17856	13	76	-2283
August 26, 2019	10	5.33	15811	178	18189	13	62	-2256
August 26, 2019	11	0	16093	163	17688	19	778	-2264
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August 26, 2019	13	0	16540	155	17773	13	1193	-2235
August 26, 2019	14	3.7	16675	128	18286	13	754	-2277
August 26, 2019	15	4.88	16882	158	18296	14	838	-2188
August 26, 2019	16	18.48	17218	213	18075	14	1499	-2190
August 26, 2019	17	21.23	17645	219	18410	14	1620	-2221
August 26, 2019	18	7.12	17522	208	18327	14	1650	-2154
August 26, 2019	19	5.89	17195	202	17961	14	1613	-2110
August 26, 2019	20	3.25	17238	216	17972	14	1701	-2118
August 26, 2019	21	2.41	16597	144	17337	14	1703	-2276
August 26, 2019	22	0	15418	144	16847	13	1079	-2339
August 26, 2019	23	0.47	14196	109	16266	14	468	-2388
August 26, 2019	24	0	13253	123	15624	14	189	-2460
August 27, 2019	1	0	12649	117	15132	13	169	-2526
August 27, 2019	2	0	12257	111	14950	13	143	-2727
August 27, 2019	3	0	12023	166	14814	13	138	-2758
August 27, 2019	4	0	12097	166	14760	13	153	-2658
August 27, 2019	5	0	12545	167	14948	13	144	-2431
August 27, 2019	6	0	13668	154	15890	13	207	-2414
August 27, 2019	7	1.94	14842	104	17011	13	221	-2341
August 27, 2019	8	13.83	15595	119	17778	13	177	-2341
August 27, 2019	9	28.67	16036	81	18197	13	59	-2262
August 27, 2019	10	21.58	16409	85	18473	13	136	-2283
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August 27, 2019	12	21.11	16819	88	18007	24	978	-2153
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August 27, 2019	14	9.75	16879	80	17558	12	1463	-2038
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August 27, 2019	16	21.18	17272	86	18242	13	1149	-2108
August 27, 2019	17	21.93	17706	82	18261	14	1643	-2171
August 27, 2019	18	21.92	17667	62	17945	14	1988	-2209
August 27, 2019	19	20.95	17662	83	17813	14	1902	-2043
August 27, 2019	20	23.77	17832	107	18123	14	1816	-2043
August 27, 2019	21	21.6	17235	118	17670	14	1816	-2142
August 27, 2019	22	15.26	16151	142	16677	13	1776	-2140
August 27, 2019	23	15.02	14944	143	15780	12	1580	-2277
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August 28, 2019	1	18.69	13335	152	15369	13	558	-2455
August 28, 2019	2	14.38	12912	165	15094	12	470	-2479

August 28, 2019	3	14.38	12704	160	14977	12	278	-2454
August 28, 2019	4	5.97	12689	215	14712	12	581	-2425
August 28, 2019	5	3.91	13126	159	14434	12	1229	-2375
August 28, 2019	6	19.74	14064	192	15152	12	1446	-2432
August 28, 2019	7	6.22	15183	172	15668	12	1824	-2228
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August 28, 2019	10	23.83	16985	220	17291	14	1838	-1956
August 28, 2019	11	20.65	17273	189	17784	16	1838	-1987
August 28, 2019	12	7.68	17314	201	17956	15	1838	-2119
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August 28, 2019	20	20.5	17894	235	18379	17	1901	-2147
August 28, 2019	21	19.21	17180	200	17777	15	1901	-2211
August 28, 2019	22	8.91	15997	248	16688	14	1903	-2262
August 28, 2019	23	3.43	14665	254	15515	14	1940	-2443
August 28, 2019	24	0.95	13637	266	15137	14	1342	-2422
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August 29, 2019	14	0	16507	192	17224	14	1788	-2286
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August 29, 2019	18	16.13	17655	244	19056	13	985	-2271
August 29, 2019	19	11.37	17466	237	18638	13	1336	-2228
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August 29, 2019	21	2.85	16772	229	18068	13	1029	-2053
August 29, 2019	22	0	15700	284	17713	14	458	-2182
August 29, 2019	23	0	14439	268	16752	13	217	-2274
August 29, 2019	24	0	13537	240	15925	13	183	-2290
August 30, 2019	1	0	12878	240	15620	13	89	-2594
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August 30, 2019	4	9.05	12430	293	15551	15	34	-2921

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August 30, 2019	6	10.83	13636	275	15194	14	859	-2081
August 30, 2019	7	4.56	14551	231	15505	14	1357	-2110
August 30, 2019	8	17.91	15244	197	16036	12	1320	-1937
August 30, 2019	9	21.89	15587	170	16340	15	1604	-1944
August 30, 2019	10	5.95	15731	198	16508	13	1384	-1943
August 30, 2019	11	5.78	15972	189	16665	14	1635	-2049
August 30, 2019	12	5.74	16034	205	17129	14	1283	-2148
August 30, 2019	13	5.89	16209	161	17207	15	1608	-2443
August 30, 2019	14	17.16	16203	138	17033	15	1812	-2469
August 30, 2019	15	18.51	16262	160	17452	15	1363	-2387
August 30, 2019	16	20.9	16509	172	17485	15	1670	-2519
August 30, 2019	17	21.54	16802	158	17426	15	1921	-2376
August 30, 2019	18	21.71	16681	152	17286	14	1833	-2320
August 30, 2019	19	21.82	16391	159	17032	15	1895	-2394
August 30, 2019	20	21.64	16327	173	17076	15	1843	-2403
August 30, 2019	21	19.32	15672	169	16493	15	1771	-2381
August 30, 2019	22	7.13	14578	245	15830	15	1259	-2218
August 30, 2019	23	4.06	13430	182	14669	14	1342	-2299
August 30, 2019	24	1.92	12513	175	14357	14	714	-2291
August 31, 2019	1	0	11843	233	14215	15	131	-2148
August 31, 2019	2	0	11439	216	14281	15	249	-2734
August 31, 2019	3	0	11192	206	14459	14	123	-3056
August 31, 2019	4	0	11038	224	14479	14	137	-3198
August 31, 2019	5	0	11146	212	14521	14	152	-3204
August 31, 2019	6	0.88	11435	205	14694	15	113	-3157
August 31, 2019	7	0.46	11814	171	14857	15	122	-2955
August 31, 2019	8	1.92	12345	156	15118	15	44	-2639
August 31, 2019	9	16.13	12802	164	15219	15	39	-2199
August 31, 2019	10	15.94	13028	209	15478	14	109	-2235
August 31, 2019	11	16.68	13288	219	15473	14	491	-2364
August 31, 2019	12	18.7	13525	187	15466	14	712	-2416
August 31, 2019	13	14.37	13578	161	15464	15	627	-2276
August 31, 2019	14	2.17	13599	137	15229	15	1012	-2334
August 31, 2019	15	6.36	13803	163	15274	15	959	-2240
August 31, 2019	16	10.87	14200	169	15480	15	1175	-2271
August 31, 2019	17	14.49	14773	148	15494	15	1569	-2104
August 31, 2019	18	8.69	14918	150	15484	15	1762	-2059
August 31, 2019	19	7.66	14782	125	15379	14	1665	-2120
August 31, 2019	20	5.91	14891	165	15729	14	1526	-2153
August 31, 2019	21	12.05	14370	186	15393	14	1455	-2127
August 31, 2019	22	2.33	13606	217	15195	14	895	-2126
August 31, 2019	23	3.54	12772	207	14568	14	756	-2210
August 31, 2019	24	1.43	12056	191	14419	14	239	-2281
September 1, 2019	1	3.05	11673	146	14457	14	199	-2776
September 1, 2019	2	13.34	11333	154	14530	14	165	-3143
September 1, 2019	3	12.71	11111	159	14443	15	145	-3182
September 1, 2019	4	0	11020	155	14320	14	46	-3076
September 1, 2019	5	-0.46	11020	179	14179	15	148	-2960
September 1, 2019	6	0	11147	160	14157	15	162	-2865

September 1, 2019	7	0	11472	154	14522	15	9	-2894
September 1, 2019	8	0	12029	164	14965	15	9	-2784
September 1, 2019	9	10.33	12479	154	15367	15	9	-2803
September 1, 2019	10	6.81	12698	168	15176	15	62	-2301
September 1, 2019	11	23.35	13117	152	15421	14	87	-2232
September 1, 2019	12	18.86	13365	155	15428	15	49	-1854
September 1, 2019	13	13.37	13521	144	15393	15	344	-1994
September 1, 2019	14	14.18	13507	153	15367	16	218	-1822
September 1, 2019	15	12.74	13593	144	15202	13	495	-1886
September 1, 2019	16	1.14	13959	105	15098	15	932	-1881
September 1, 2019	17	0.54	14346	99	15194	15	1229	-1883
September 1, 2019	18	5.76	14403	93	15363	15	1146	-1960
September 1, 2019	19	5.78	14408	100	15398	15	1096	-1926
September 1, 2019	20	17	14572	109	15896	15	819	-2001
September 1, 2019	21	10.1	14124	103	15366	15	839	-1898
September 1, 2019	22	12.75	13461	103	15093	14	643	-2086
September 1, 2019	23	8.94	12748	113	14643	15	427	-2108
September 1, 2019	24	9.57	12126	94	14467	15	124	-2260
September 2, 2019	1	3.96	11671	88	14001	15	152	-2313
September 2, 2019	2	3.67	11258	155	14132	14	172	-2792
September 2, 2019	3	-1.93	11055	104	13870	15	146	-2693
September 2, 2019	4	-2.19	11015	102	13825	14	115	-2774
September 2, 2019	5	3.89	11095	93	14054	15	152	-2942
September 2, 2019	6	13.32	11492	96	14435	15	95	-2890
September 2, 2019	7	1.43	11813	95	14445	14	9	-2547
September 2, 2019	8	2.3	12276	142	14495	14	9	-2048
September 2, 2019	9	13.05	12864	161	15000	14	9	-1955
September 2, 2019	10	27.28	13397	155	15491	15	128	-2105
September 2, 2019	11	14.45	13804	156	15589	21	253	-1883
September 2, 2019	12	9.33	14050	163	15330	21	1020	-2101
September 2, 2019	13	7.02	14018	159	15397	15	1040	-2013
September 2, 2019	14	7.28	14105	166	15512	15	1199	-2134
September 2, 2019	15	7.11	14355	171	15700	15	1338	-2224
September 2, 2019	16	4.66	14828	153	15774	15	1662	-2142
September 2, 2019	17	10.51	15353	167	16158	15	1876	-2210
September 2, 2019	18	17.96	15489	188	16142	14	1840	-2014
September 2, 2019	19	22.23	15567	178	16169	12	1811	-1964
September 2, 2019	20	22.04	15727	205	16343	14	1870	-1973
September 2, 2019	21	19.89	15094	221	15842	14	1689	-1933
September 2, 2019	22	17.48	14300	241	15088	13	1270	-1756
September 2, 2019	23	12.03	13262	214	14587	14	846	-1889
September 2, 2019	24	9.59	12482	144	14349	14	272	-1934
September 3, 2019	1	12.78	11910	170	14064	14	148	-2074
September 3, 2019	2	8.55	11631	181	13848	13	270	-2271
September 3, 2019	3	7.74	11495	182	13797	13	152	-2188
September 3, 2019	4	11.58	11498	196	13878	13	155	-2295
September 3, 2019	5	9.57	12018	194	13925	13	540	-2155
September 3, 2019	6	13.9	13254	197	14404	14	1339	-2249
September 3, 2019	7	2.46	14416	188	14964	14	1513	-1834
September 3, 2019	8	0.46	14767	156	15324	14	1359	-1812

September 3, 2019	9	0	15030	171	15887	14	987	-1705
September 3, 2019	10	0.48	15342	177	16760	14	598	-1904
September 3, 2019	11	0	15553	194	17082	13	944	-2310
September 3, 2019	12	0	15797	167	17175	13	1010	-2269
September 3, 2019	13	7.32	16071	132	17535	14	939	-2382
September 3, 2019	14	7.6	16238	203	17272	14	1468	-2335
September 3, 2019	15	0	16361	150	17096	13	1663	-2190
September 3, 2019	16	1.87	16703	182	17332	14	1760	-2261
September 3, 2019	17	5.8	16952	194	17851	14	1521	-2312
September 3, 2019	18	12.45	16971	213	18037	14	1432	-2378
September 3, 2019	19	15.89	17208	158	17890	14	1694	-2296
September 3, 2019	20	17.83	17204	247	18244	15	1590	-2280
September 3, 2019	21	7.05	16505	279	17481	14	1698	-2368
September 3, 2019	22	1.46	15351	270	16986	14	788	-2074
September 3, 2019	23	0	14118	243	16420	14	348	-2283
September 3, 2019	24	0	13228	247	15422	14	221	-2192
September 4, 2019	1	0	12727	254	15357	14	254	-2582
September 4, 2019	2	0	12423	199	15446	14	204	-2990
September 4, 2019	3	1.39	12322	180	15542	14	239	-3288
September 4, 2019	4	0.48	12379	182	15638	14	213	-3211
September 4, 2019	5	0	12764	197	15343	14	289	-2567
September 4, 2019	6	1.58	13890	186	15726	14	821	-2355
September 4, 2019	7	8.85	15070	185	16281	14	1195	-2310
September 4, 2019	8	13.25	15582	179	16565	14	1393	-2145
September 4, 2019	9	9.27	15654	96	17074	12	822	-2176
September 4, 2019	10	6.32	15579	152	16695	12	1290	-2300
September 4, 2019	11	18.65	15517	160	16683	13	1253	-2291
September 4, 2019	12	0	15471	141	16552	13	1354	-2311
September 4, 2019	13	21.12	15479	181	17188	14	737	-2338
September 4, 2019	14	13.48	15431	194	16952	14	1093	-2389
September 4, 2019	15	21.42	15443	199	16781	15	1310	-2452
September 4, 2019	16	19.5	15690	233	16594	13	1476	-2229
September 4, 2019	17	20.62	16089	215	16434	14	1829	-2037
September 4, 2019	18	31.36	16133	185	16500	15	1848	-2142
September 4, 2019	19	104.3	16253	195	16773	14	1803	-2246
September 4, 2019	20	142.99	16432	151	16849	15	1804	-2118
September 4, 2019	21	29.72	15785	184	16208	14	1738	-1913
September 4, 2019	22	20.73	14632	206	15085	13	1673	-1856
September 4, 2019	23	12.98	13349	176	14305	13	1197	-1871
September 4, 2019	24	10.91	12518	202	13943	13	888	-2038
September 5, 2019	1	13.45	12024	250	13823	13	536	-2074
September 5, 2019	2	13.34	11655	249	13639	13	474	-2143
September 5, 2019	3	13.32	11512	297	13537	13	447	-2128
September 5, 2019	4	12.2	11688	296	13751	13	419	-2223
September 5, 2019	5	10.46	12165	273	13873	13	560	-2031
September 5, 2019	6	16.4	13336	280	14318	13	1283	-2003
September 5, 2019	7	17.03	14384	252	14716	22	1823	-1838
September 5, 2019	8	13.37	14511	242	15143	37	1577	-1955
September 5, 2019	9	8.47	14461	200	15516	38	1195	-2154
September 5, 2019	10	13.38	14558	269	15935	78	836	-2107

September 5, 2019	11	19.55	14627	242	16041	114	817	-2102
September 5, 2019	12	25.24	14719	214	15827	121	1136	-2159
September 5, 2019	13	22.92	14916	171	15535	120	1746	-2137
September 5, 2019	14	23.14	15063	178	15633	121	1541	-2062
September 5, 2019	15	21.88	15156	175	15750	121	1746	-2251
September 5, 2019	16	27.22	15825	266	16284	42	1768	-2059
September 5, 2019	17	102.92	16306	194	17012	13	1345	-2034
September 5, 2019	18	24.83	16447	211	16687	14	1762	-1827
September 5, 2019	19	24.01	16551	207	16996	14	1555	-1866
September 5, 2019	20	24.69	16661	207	16893	14	1705	-1805
September 5, 2019	21	24.49	15991	225	16344	14	1705	-1818
September 5, 2019	22	28.97	14887	197	15089	14	1855	-1793
September 5, 2019	23	26.68	13671	208	14413	14	1408	-1867
September 5, 2019	24	14.48	12809	195	14037	14	1010	-1986
September 6, 2019	1	15.3	12310	234	14140	14	367	-1999
September 6, 2019	2	36.85	12036	243	14074	14	130	-2010
September 6, 2019	3	36.47	11859	246	13918	14	177	-2074
September 6, 2019	4	33.37	11900	261	13944	13	207	-2050
September 6, 2019	5	30.58	12305	193	14311	13	115	-1967
September 6, 2019	6	25.35	13395	214	14690	13	786	-1951
September 6, 2019	7	21.86	14457	181	15106	14	1432	-1897
September 6, 2019	8	12.71	14769	224	15228	13	1793	-1926
September 6, 2019	9	22.35	14974	228	15534	12	1691	-2076
September 6, 2019	10	23.82	15294	217	15961	12	1638	-2100
September 6, 2019	11	24.39	15563	206	16096	13	1638	-2005
September 6, 2019	12	24.82	15666	191	16144	14	1668	-1994
September 6, 2019	13	24.27	15749	192	16041	14	1668	-1765
September 6, 2019	14	24.24	15567	210	15782	14	1741	-1735
September 6, 2019	15	23.73	15466	253	15765	21	1696	-1741
September 6, 2019	16	24.69	15640	240	16094	15	1726	-1950
September 6, 2019	17	22.53	15791	227	16248	14	1726	-1931
September 6, 2019	18	20.27	15646	225	16076	13	1726	-1910
September 6, 2019	19	22.48	15787	213	16117	13	1726	-1886
September 6, 2019	20	21.89	15790	201	15935	13	1726	-1657
September 6, 2019	21	25.58	15260	212	15636	13	1725	-1866
September 6, 2019	22	49.91	14305	221	14970	13	1450	-1857
September 6, 2019	23	40.52	13220	213	14077	15	1329	-1848
September 6, 2019	24	9.71	12439	175	13594	13	984	-1917
September 7, 2019	1	12.72	11879	140	13460	12	677	-2099
September 7, 2019	2	10.27	11502	190	13375	14	557	-2230
September 7, 2019	3	13.34	11294	201	13458	14	367	-2359
September 7, 2019	4	10.93	11218	238	13357	14	434	-2359
September 7, 2019	5	8.39	11310	211	13366	14	537	-2413
September 7, 2019	6	6.79	11758	226	13401	14	1060	-2460
September 7, 2019	7	17.41	12292	183	13798	14	726	-2032
September 7, 2019	8	12.14	12942	179	14018	14	948	-1828
September 7, 2019	9	13.58	13421	162	14524	14	924	-1819
September 7, 2019	10	16.85	13661	160	14740	14	838	-1689
September 7, 2019	11	14.03	13857	155	14989	14	840	-1719
September 7, 2019	12	13.38	13823	189	14966	15	1091	-1977

September 7, 2019	13	6.04	13739	155	14954	15	701	-1681
September 7, 2019	14	6.84	13532	208	15210	14	380	-1676
September 7, 2019	15	2.24	13454	227	14993	14	386	-1598
September 7, 2019	16	14.47	13916	182	15293	14	550	-1622
September 7, 2019	17	11.57	14435	157	15682	14	656	-1655
September 7, 2019	18	25.94	14588	159	15577	16	1569	-2289
September 7, 2019	19	13.7	14579	164	15463	13	1389	-2005
September 7, 2019	20	8.99	14527	185	15531	15	1379	-1962
September 7, 2019	21	5.39	14034	198	15357	15	963	-1924
September 7, 2019	22	7.12	13300	192	15294	14	507	-2123
September 7, 2019	23	8.96	12443	118	14568	13	332	-2207
September 7, 2019	24	4.84	11820	131	13815	13	478	-2261
September 8, 2019	1	1.34	11283	192	13537	13	259	-2249
September 8, 2019	2	-0.26	10968	185	13341	13	232	-2342
September 8, 2019	3	-0.81	10786	131	13303	13	179	-2498
September 8, 2019	4	-0.72	10811	129	13298	13	126	-2439
September 8, 2019	5	4.53	10855	121	13576	13	213	-2758
September 8, 2019	6	9.23	11061	182	13696	14	211	-2611
September 8, 2019	7	4.01	11450	147	13775	14	108	-2255
September 8, 2019	8	10.46	11948	167	13878	15	296	-2020
September 8, 2019	9	10.19	12408	170	14118	14	414	-1865
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September 8, 2019	11	43.19	13068	152	14744	15	363	-1812
September 8, 2019	12	14.95	13285	158	14886	16	430	-1792
September 8, 2019	13	21.13	13287	115	14949	16	439	-1842
September 8, 2019	14	23.79	13260	151	14757	16	367	-1612
September 8, 2019	15	8.88	13435	128	14765	15	1073	-2097
September 8, 2019	16	9.57	13784	136	14942	15	1185	-2114
September 8, 2019	17	7.35	14213	151	15121	15	1379	-2050
September 8, 2019	18	5.58	14411	150	15021	15	1609	-2066
September 8, 2019	19	8.02	14680	139	14987	15	1686	-1860
September 8, 2019	20	10.88	14784	138	15383	15	1806	-2163
September 8, 2019	21	8.9	14174	169	14851	15	1762	-2117
September 8, 2019	22	2.55	13234	156	14383	15	1286	-2066
September 8, 2019	23	-0.01	12367	175	13988	15	1031	-2387
September 8, 2019	24	0	11654	196	13895	15	327	-2341
September 9, 2019	1	0	11272	210	13913	15	244	-2665
September 9, 2019	2	0	11099	192	13723	15	279	-2702
September 9, 2019	3	0	11044	155	13764	15	258	-2851
September 9, 2019	4	-2	11180	177	13561	15	300	-2567
September 9, 2019	5	1.59	11699	143	13739	15	644	-2553
September 9, 2019	6	13.93	13051	177	14409	15	1087	-2341
September 9, 2019	7	20.66	14232	168	15326	14	1077	-1991
September 9, 2019	8	21	14500	132	15193	15	1150	-1739
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September 9, 2019	10	11	14285	131	14580	15	1472	-1655
September 9, 2019	11	17.47	14455	111	14806	23	1718	-2024
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September 9, 2019	13	21.53	14435	159	15255	17	1739	-2294
September 9, 2019	14	17.72	14527	183	15283	16	1675	-2224

September 9, 2019	15	21.48	14692	160	15271	17	1816	-2217
September 9, 2019	16	23.26	15146	180	15526	18	1871	-2087
September 9, 2019	17	24.75	15699	181	16128	16	1727	-2062
September 9, 2019	18	24.59	15912	155	16310	13	1745	-2044
September 9, 2019	19	23.97	16089	164	16530	14	1806	-2067
September 9, 2019	20	26.29	16276	184	16714	13	1753	-2006
September 9, 2019	21	24.11	15567	169	16095	17	1715	-2035
September 9, 2019	22	17.61	14377	161	15046	15	1651	-2031
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September 10, 2019	13	21.55	15905	122	17213	15	980	-2275
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September 10, 2019	15	24.97	16280	113	17334	15	1217	-2265
September 10, 2019	16	25.48	16660	166	17567	15	1495	-2297
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September 10, 2019	19	25.85	17044	201	17690	15	1936	-2397
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September 11, 2019	17	36.04	19433	218	19851	70	1788	-2079
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September 11, 2019	22	25.8	16467	335	17416	15	1717	-2242
September 11, 2019	23	36.78	14972	306	15905	16	1308	-1952
September 11, 2019	24	21.21	13956	306	14956	14	1224	-1963
September 12, 2019	1	9.69	13158	278	14258	13	1208	-1974
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September 12, 2019	8	23.11	15274	207	16138	13	1531	-2246
September 12, 2019	9	14.38	15070	143	15922	14	1562	-2202
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September 12, 2019	11	4.73	14956	193	15694	31	1581	-2188
September 12, 2019	12	13.45	15037	184	15928	31	1395	-2157
September 12, 2019	13	21.71	15107	180	15868	31	1602	-2283
September 12, 2019	14	24.21	15106	198	15798	37	1829	-2305
September 12, 2019	15	27.48	15324	175	15839	31	1861	-2316
September 12, 2019	16	19.61	15645	188	16067	31	1911	-2152
September 12, 2019	17	26.05	16161	184	16451	30	1861	-2070
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September 12, 2019	19	21.35	16336	213	16528	31	1758	-1771
September 12, 2019	20	18.22	16360	224	16736	30	1741	-1921
September 12, 2019	21	13.12	15610	187	16257	30	1812	-2273
September 12, 2019	22	6.36	14488	207	15857	29	1087	-2203
September 12, 2019	23	0.49	13247	149	15006	30	586	-2161
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September 13, 2019	2	-0.01	11435	218	14198	30	242	-2828
September 13, 2019	3	-0.05	11359	224	14014	30	309	-2790
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September 13, 2019	5	0	11955	105	14531	30	290	-2798
September 13, 2019	6	0	13140	68	15154	31	337	-2305
September 13, 2019	7	0.47	14220	145	16041	30	364	-2125
September 13, 2019	8	0	14530	191	16350	30	497	-2115
September 13, 2019	9	6.16	14583	187	16660	30	350	-2325
September 13, 2019	10	6.49	14727	181	16803	31	229	-2195
September 13, 2019	11	9.62	14869	164	16726	14	480	-2173
September 13, 2019	12	18.46	14953	203	17020	15	279	-2146
September 13, 2019	13	16.79	15147	174	17071	15	435	-2168
September 13, 2019	14	16.31	15249	133	17064	15	560	-2223
September 13, 2019	15	5.78	15423	120	17227	17	407	-2053
September 13, 2019	16	9.66	15858	116	17453	18	519	-1984
September 13, 2019	17	10.24	16091	115	17639	18	594	-1932
September 13, 2019	18	5.76	15955	197	17762	18	289	-1816

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September 13, 2019	20	3.86	16099	203	17634	16	984	-2257
September 13, 2019	21	2.7	15460	198	17322	15	624	-2254
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September 13, 2019	23	5.3	13497	229	16183	15	135	-2512
September 13, 2019	24	0	12591	236	15767	15	238	-3079
September 14, 2019	1	0	12026	228	15399	14	207	-3268
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September 14, 2019	3	0	11427	193	14722	13	209	-3290
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September 14, 2019	7	0	12226	176	14841	13	202	-2665
September 14, 2019	8	2.25	12976	158	15619	13	174	-2673
September 14, 2019	9	0.46	13536	148	16243	13	169	-2660
September 14, 2019	10	2.07	13809	188	16442	13	87	-2522
September 14, 2019	11	0	13864	162	16361	13	80	-2402
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September 14, 2019	18	29.68	14824	124	16462	13	717	-2239
September 14, 2019	19	23.19	14805	106	16318	15	752	-2067
September 14, 2019	20	9.16	14741	164	16089	15	978	-2055
September 14, 2019	21	8.33	14113	198	15768	14	605	-2008
September 14, 2019	22	14.61	13386	196	15605	14	138	-2129
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September 15, 2019	5	-3.44	10876	37	13286	14	0	-2277
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September 15, 2019	9	15.7	12669	49	14910	14	139	-2288
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September 15, 2019	11	81.6	13621	49	15553	15	282	-2131
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September 15, 2019	15	5.86	13888	43	15254	16	709	-1908
September 15, 2019	16	4.43	14244	56	15081	15	1196	-1869
September 15, 2019	17	13.96	14717	57	15361	14	1452	-1986
September 15, 2019	18	23.44	14859	152	15393	16	1723	-2038
September 15, 2019	19	58.13	15168	142	15602	15	1694	-1982
September 15, 2019	20	19.45	15134	148	15338	16	1708	-1684

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September 15, 2019	23	6.85	12669	147	13993	13	816	-1812
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September 16, 2019	6	21.32	13314	94	14436	14	1236	-2256
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September 16, 2019	8	14.4	14852	56	14886	14	1825	-1817
September 16, 2019	9	24.59	14920	55	15241	13	1798	-2056
September 16, 2019	10	24.59	15044	54	15424	14	1605	-1957
September 16, 2019	11	24.61	15092	54	15544	20	1678	-2078
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September 16, 2019	13	23.32	15160	55	15405	13	1770	-1862
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September 23, 2019	24	6.28	12739	173	15326	13	154	-2592
September 24, 2019	1	14.35	12257	153	15163	13	102	-2924
September 24, 2019	2	14.36	11905	166	14989	13	166	-3135
September 24, 2019	3	10.9	11745	181	14770	13	168	-3023
September 24, 2019	4	7.26	11769	169	14695	13	32	-2783

September 24, 2019	5	3.34	12268	182	14725	13	82	-2377
September 24, 2019	6	19.74	13458	173	15229	13	712	-2324
September 24, 2019	7	22.32	14637	126	15753	12	947	-1906
September 24, 2019	8	22.63	14965	159	16034	14	967	-1916
September 24, 2019	9	22.62	15137	131	16172	13	1116	-2008
September 24, 2019	10	22.62	15219	96	16345	14	1112	-2100
September 24, 2019	11	22.61	15267	81	16458	15	1012	-2139
September 24, 2019	12	22.62	15372	61	16537	15	1012	-2120
September 24, 2019	13	20.99	15470	137	16834	48	921	-2223
September 24, 2019	14	15.98	15438	147	16800	67	993	-2207
September 24, 2019	15	17.45	15559	150	17016	69	909	-2269
September 24, 2019	16	19.37	15946	116	16949	23	1092	-1951
September 24, 2019	17	21.65	16396	130	17213	18	1171	-1877
September 24, 2019	18	20.63	16459	111	17218	60	1169	-1838
September 24, 2019	19	25.21	16731	128	17425	70	1071	-1724
September 24, 2019	20	21.28	16458	117	17258	69	1102	-1766
September 24, 2019	21	22.64	15680	122	16764	69	768	-1734
September 24, 2019	22	11.34	14471	142	15609	69	897	-1853
September 24, 2019	23	3.35	13338	106	14752	24	904	-2144
September 24, 2019	24	0	12470	117	14452	13	247	-2105
September 25, 2019	1	0	12000	149	14661	13	136	-2650
September 25, 2019	2	0	11693	140	14498	13	263	-2929
September 25, 2019	3	0	11464	150	14358	13	194	-2893
September 25, 2019	4	0	11512	124	14427	13	284	-2973
September 25, 2019	5	0	11978	151	14899	13	160	-3014
September 25, 2019	6	0	13262	132	15440	13	174	-2298
September 25, 2019	7	1.77	14417	158	16592	12	134	-2211
September 25, 2019	8	3.91	14654	139	16744	13	171	-2156
September 25, 2019	9	0	14807	159	17057	15	113	-2272
September 25, 2019	10	0	14953	148	17254	12	187	-2270
September 25, 2019	11	0	15208	149	17753	12	138	-2649
September 25, 2019	12	0	15430	91	17958	12	199	-2743
September 25, 2019	13	0	15658	95	18159	12	171	-2666
September 25, 2019	14	0	15870	54	18370	12	102	-2645
September 25, 2019	15	2.86	16112	54	18483	12	84	-2518
September 25, 2019	16	5.33	16437	86	18731	12	95	-2428
September 25, 2019	17	6.73	16693	94	18743	12	105	-2194
September 25, 2019	18	7.81	16733	160	18513	12	464	-2253
September 25, 2019	19	14.98	17209	158	18691	12	823	-2262
September 25, 2019	20	13.48	17019	133	18654	13	843	-2335
September 25, 2019	21	10.4	16198	171	17984	13	746	-2299
September 25, 2019	22	6.56	15063	143	17157	13	341	-2229
September 25, 2019	23	10.85	13849	199	16230	13	249	-2420
September 25, 2019	24	12.71	12900	239	15954	13	155	-2920
September 26, 2019	1	3.81	12374	206	15086	13	199	-2643
September 26, 2019	2	5.63	12115	250	15175	13	199	-2965
September 26, 2019	3	5.84	11964	216	15042	13	192	-3049
September 26, 2019	4	12.93	12014	176	15079	13	121	-3045
September 26, 2019	5	5.86	12455	238	14982	12	89	-2289
September 26, 2019	6	5.67	13660	247	15458	12	778	-2278

September 26, 2019	7	15.68	15033	178	16609	13	48	-1515
September 26, 2019	8	8.09	15384	211	17194	15	268	-1811
September 26, 2019	9	15.85	15426	164	17460	13	110	-1947
September 26, 2019	10	8.43	15248	145	17455	14	293	-2173
September 26, 2019	11	1.33	15149	210	17472	13	152	-2232
September 26, 2019	12	7.14	15145	220	17562	13	132	-2300
September 26, 2019	13	0	14892	204	17315	12	155	-2190
September 26, 2019	14	0	14755	195	17158	12	133	-2330
September 26, 2019	15	0	14782	187	17114	24	169	-2282
September 26, 2019	16	5.86	15221	204	17574	14	123	-2295
September 26, 2019	17	17.2	15675	201	18066	12	82	-2351
September 26, 2019	18	130.12	15741	189	17840	13	60	-2030
September 26, 2019	19	174	16143	193	17664	13	640	-2028
September 26, 2019	20	34.13	16004	205	17044	14	1040	-1852
September 26, 2019	21	18.63	15312	173	16520	13	990	-2028
September 26, 2019	22	12.49	14187	191	15754	13	448	-1746
September 26, 2019	23	12.48	13061	175	15110	13	48	-1864
September 26, 2019	24	7.39	12223	175	14543	13	121	-2167
September 27, 2019	1	3.16	11751	122	14237	13	54	-2298
September 27, 2019	2	5.76	11502	131	14164	13	48	-2492
September 27, 2019	3	5.75	11326	161	14191	13	69	-2692
September 27, 2019	4	1.25	11378	154	14200	13	119	-2683
September 27, 2019	5	-0.18	11954	152	14361	13	82	-2332
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September 27, 2019	7	9.17	14205	121	16465	13	95	-2117
September 27, 2019	8	0	14457	141	16618	12	152	-2021
September 27, 2019	9	0	14470	104	16557	13	360	-2259
September 27, 2019	10	0	14432	76	16771	13	189	-2447
September 27, 2019	11	0	14437	35	17146	13	181	-2837
September 27, 2019	12	0	14461	60	17153	13	15	-2610
September 27, 2019	13	0	14608	175	17348	13	218	-2790
September 27, 2019	14	0	14637	152	17374	13	108	-2583
September 27, 2019	15	2.9	14766	178	17397	13	72	-2603
September 27, 2019	16	11.04	15200	125	17670	18	48	-2534
September 27, 2019	17	16.08	15478	159	17798	18	135	-2246
September 27, 2019	18	5.89	15502	150	17954	13	83	-2398
September 27, 2019	19	0	15785	133	17968	13	135	-2111
September 27, 2019	20	2.29	15480	185	17926	13	55	-2315
September 27, 2019	21	0.49	14828	168	17371	13	156	-2469
September 27, 2019	22	0.47	13926	140	16894	12	210	-2955
September 27, 2019	23	0	12840	194	15836	12	216	-2947
September 27, 2019	24	0	12077	177	14963	12	161	-2803
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September 28, 2019	2	0	11358	166	14445	13	222	-3191
September 28, 2019	3	0	11202	192	14388	13	232	-3201
September 28, 2019	4	0	11155	216	14331	13	148	-3034
September 28, 2019	5	0.77	11334	221	14512	13	233	-3189
September 28, 2019	6	8.48	11858	225	14932	13	233	-3122
September 28, 2019	7	11.88	12584	187	15076	13	148	-2508
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September 28, 2019	9	20.21	14237	196	16341	14	146	-2114
September 28, 2019	10	13.47	14690	169	16489	13	587	-2133
September 28, 2019	11	16.97	14855	195	16460	13	695	-2090
September 28, 2019	12	12.79	14871	152	16562	13	599	-2000
September 28, 2019	13	14.06	14765	199	17051	12	29	-2057
September 28, 2019	14	13.37	14485	175	16835	14	110	-2192
September 28, 2019	15	12.83	14416	194	16922	14	123	-2353
September 28, 2019	16	13.56	14392	148	16893	12	109	-2383
September 28, 2019	17	14.12	14597	145	16998	12	60	-2340
September 28, 2019	18	12.76	14587	131	16944	12	68	-2325
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September 28, 2019	20	14.51	14485	135	16871	12	49	-2273
September 28, 2019	21	5.84	13834	128	16000	12	251	-2287
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September 29, 2019	3	-0.03	10586	162	13803	12	109	-3134
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September 29, 2019	6	-0.27	10913	128	14010	12	164	-3063
September 29, 2019	7	-1.25	11314	120	14217	12	84	-2760
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September 29, 2019	9	0	12007	145	14939	12	101	-2757
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September 29, 2019	12	-0.03	12456	180	15259	13	140	-2692
September 29, 2019	13	0	12562	178	15415	12	119	-2773
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September 29, 2019	17	6.06	14203	163	16639	13	72	-2231
September 29, 2019	18	7.19	14399	145	16663	13	60	-2185
September 29, 2019	19	15.14	14772	177	16920	12	305	-2290
September 29, 2019	20	30.15	14511	161	16999	14	100	-2335
September 29, 2019	21	9.07	13892	179	16335	15	148	-2304
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September 29, 2019	23	0.92	12187	153	15051	13	160	-2715
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September 30, 2019	11	12.22	14447	106	16333	17	126	-1938
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September 30, 2019	14	20.07	14641	189	16618	12	121	-1900
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September 30, 2019	18	19.95	16012	215	17400	12	668	-1914
September 30, 2019	19	15.99	16392	228	17738	13	711	-1754
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October 6, 2019	9	0	13316	122	15969	13	9	-2634
October 6, 2019	10	0	13624	115	16389	13	9	-2679
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October 8, 2019	18	17.64	15628	182	16416	14	869	-1400

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October 8, 2019	20	7.64	15750	188	16204	14	950	-1161
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October 9, 2019	10	41.98	14189	224	16239	14	167	-1985
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October 18, 2019	10	9.46	15054	169	16974	12	282	-1955
October 18, 2019	11	4.68	14600	200	16655	13	189	-1976
October 18, 2019	12	5.75	14307	225	16516	14	183	-2148
October 18, 2019	13	7.13	14183	230	16523	14	125	-2236
October 18, 2019	14	8.95	14051	263	16326	14	202	-2159
October 18, 2019	15	14.37	13997	264	16231	14	278	-2150
October 18, 2019	16	17.19	14392	242	16605	15	121	-2158
October 18, 2019	17	14.29	15016	219	16689	15	694	-2154
October 18, 2019	18	15.03	15601	240	17159	15	817	-2182
October 18, 2019	19	23.23	15992	182	17400	15	1087	-2331
October 18, 2019	20	23.24	15734	188	16995	15	856	-1940
October 18, 2019	21	19.64	15196	202	16519	15	874	-1939
October 18, 2019	22	18.15	14350	239	15828	15	809	-1957
October 18, 2019	23	13.1	13313	245	15272	15	349	-1957
October 18, 2019	24	9.41	12534	178	14460	15	304	-1988
October 19, 2019	1	8.68	12078	126	14260	15	109	-2098
October 19, 2019	2	5.64	11815	154	14205	15	184	-2373
October 19, 2019	3	4.98	11687	190	14256	14	223	-2548
October 19, 2019	4	8.14	11712	158	14375	14	238	-2722

October 19, 2019	5	10.91	12018	196	14589	14	277	-2642
October 19, 2019	6	10.67	12613	196	14990	13	209	-2368
October 19, 2019	7	15.7	13375	155	15583	14	236	-2239
October 19, 2019	8	9.44	13667	200	15935	15	236	-2174
October 19, 2019	9	5.71	13451	172	15692	14	236	-2261
October 19, 2019	10	2.28	13172	154	15509	13	249	-2305
October 19, 2019	11	0	12968	169	15498	13	297	-2608
October 19, 2019	12	2.74	12756	174	15135	14	247	-2375
October 19, 2019	13	0.39	12581	171	15163	14	288	-2618
October 19, 2019	14	0.4	12566	149	15398	14	212	-2850
October 19, 2019	15	4.39	12826	159	15306	14	230	-2550
October 19, 2019	16	4.69	13287	244	15548	14	407	-2398
October 19, 2019	17	7.89	14015	222	16369	14	299	-2458
October 19, 2019	18	12.41	14515	222	16824	14	337	-2426
October 19, 2019	19	11.99	14673	221	17000	13	337	-2428
October 19, 2019	20	8.57	14354	217	16720	13	337	-2429
October 19, 2019	21	3.45	13848	181	16250	13	281	-2422
October 19, 2019	22	2.72	13316	138	15688	13	283	-2424
October 19, 2019	23	1.81	12546	129	15341	14	199	-2702
October 19, 2019	24	0	11834	164	14706	14	299	-2940
October 20, 2019	1	-0.65	11417	234	14406	14	115	-2885
October 20, 2019	2	-0.21	11190	241	14122	13	102	-2776
October 20, 2019	3	-0.2	11039	216	13936	14	127	-2794
October 20, 2019	4	-3.48	11100	240	13934	13	127	-2781
October 20, 2019	5	-0.04	11246	213	14054	13	127	-2806
October 20, 2019	6	1.19	11677	234	14099	13	86	-2285
October 20, 2019	7	5.71	12298	235	14758	13	9	-2231
October 20, 2019	8	5.69	12755	237	15349	14	9	-2247
October 20, 2019	9	9.44	13004	177	15354	14	194	-2339
October 20, 2019	10	7.95	12990	195	15479	14	123	-2360
October 20, 2019	11	5.72	12841	187	15351	14	109	-2315
October 20, 2019	12	5.74	12706	197	15123	14	172	-2273
October 20, 2019	13	5.63	12624	200	15054	14	218	-2376
October 20, 2019	14	7.16	12547	169	15114	14	74	-2360
October 20, 2019	15	9.42	12767	230	15264	14	59	-2297
October 20, 2019	16	14.44	13419	240	15841	14	59	-2245
October 20, 2019	17	17.53	14296	213	16553	13	181	-2234
October 20, 2019	18	18.64	14945	224	16797	14	542	-2165
October 20, 2019	19	18.51	15222	229	16784	14	861	-2160
October 20, 2019	20	17.41	14758	242	16833	15	372	-2160
October 20, 2019	21	16.25	14108	187	16609	16	129	-2250
October 20, 2019	22	11.45	13253	234	15641	15	129	-2257
October 20, 2019	23	6.03	12399	234	15023	14	9	-2308
October 20, 2019	24	1.78	11801	218	14272	14	110	-2306
October 21, 2019	1	-0.07	11475	243	14340	14	110	-2696
October 21, 2019	2	-0.78	11311	200	14211	14	210	-2834
October 21, 2019	3	-2.55	11331	150	14130	14	210	-2817
October 21, 2019	4	-3.46	11461	158	14023	14	223	-2568
October 21, 2019	5	-0.03	12035	150	14158	14	184	-2010
October 21, 2019	6	-0.27	13315	150	15219	14	317	-1877

October 21, 2019	7	0	14784	135	16562	13	499	-2067
October 21, 2019	8	0	14900	134	16916	13	209	-2116
October 21, 2019	9	0	14585	131	16559	14	275	-2115
October 21, 2019	10	0	14305	150	16471	13	209	-2191
October 21, 2019	11	-0.04	14030	173	16021	19	213	-1970
October 21, 2019	12	-0.11	13895	197	16021	21	103	-1964
October 21, 2019	13	-0.36	13998	231	15946	14	181	-1841
October 21, 2019	14	-3	14007	233	15934	14	174	-1766
October 21, 2019	15	0	14232	222	16175	15	9	-1719
October 21, 2019	16	0	14747	207	16788	15	59	-1862
October 21, 2019	17	0	15244	219	17272	14	59	-1825
October 21, 2019	18	0	15692	224	17925	15	59	-2007
October 21, 2019	19	0	15829	244	18104	15	69	-2016
October 21, 2019	20	0	15477	241	17724	14	59	-2008
October 21, 2019	21	0	14756	229	16990	14	126	-2052
October 21, 2019	22	0	13725	233	15937	14	102	-2000
October 21, 2019	23	-0.08	12707	242	14933	14	149	-2014
October 21, 2019	24	-1.98	11919	206	14413	14	40	-2199
October 22, 2019	1	-3	11461	267	14333	13	52	-2544
October 22, 2019	2	-3	11206	223	14210	13	139	-2827
October 22, 2019	3	-3	11129	239	14355	13	186	-3019
October 22, 2019	4	-3	11278	245	14299	13	246	-2962
October 22, 2019	5	-2.01	11860	214	14339	13	148	-2379
October 22, 2019	6	-0.03	13057	252	15363	15	105	-2013
October 22, 2019	7	3.31	14642	243	16701	14	9	-1827
October 22, 2019	8	2.24	15044	256	17172	13	103	-1983
October 22, 2019	9	3.22	15141	248	17252	13	300	-2168
October 22, 2019	10	0	15259	240	17286	13	375	-2141
October 22, 2019	11	0	15172	223	17154	13	314	-2064
October 22, 2019	12	0	14929	256	17037	13	290	-2051
October 22, 2019	13	0	14781	248	16895	13	334	-2049
October 22, 2019	14	0	14642	230	16767	14	195	-2035
October 22, 2019	15	0	14763	244	16826	13	294	-2090
October 22, 2019	16	0	15093	231	17171	13	84	-1900
October 22, 2019	17	0	15346	258	17426	13	143	-1937
October 22, 2019	18	0	15603	252	17567	13	118	-1758
October 22, 2019	19	0	15717	215	17767	13	170	-1990
October 22, 2019	20	0	15383	189	17491	13	9	-1903
October 22, 2019	21	0	14682	185	16549	13	158	-1803
October 22, 2019	22	-0.01	13745	187	15797	13	155	-1915
October 22, 2019	23	-0.21	12668	200	15178	13	169	-2272
October 22, 2019	24	-3.09	11888	215	14892	13	274	-2881
October 23, 2019	1	-3	11497	205	14701	13	276	-3072
October 23, 2019	2	-3	11259	207	14500	13	275	-3104
October 23, 2019	3	-3	11120	185	14274	13	374	-3140
October 23, 2019	4	-3	11264	177	14247	13	355	-3010
October 23, 2019	5	-2.86	11789	180	14187	13	244	-2262
October 23, 2019	6	-0.53	13109	219	15130	13	379	-2048
October 23, 2019	7	0	14580	208	16425	13	260	-1832
October 23, 2019	8	0	14699	211	16717	13	238	-1957

October 23, 2019	9	-1	14225	131	16247	13	330	-1933
October 23, 2019	10	-3	13964	172	16208	13	347	-2414
October 23, 2019	11	-3	13896	137	16111	13	237	-2304
October 23, 2019	12	-1.13	13907	114	16093	13	173	-2232
October 23, 2019	13	-3	13930	192	16136	13	334	-2301
October 23, 2019	14	-2.93	13953	217	16278	13	140	-2195
October 23, 2019	15	-2.28	14148	216	16427	15	122	-2177
October 23, 2019	16	-0.01	14727	186	16680	15	109	-1868
October 23, 2019	17	0	15215	182	16960	13	132	-1709
October 23, 2019	18	0	15673	191	17299	13	357	-1756
October 23, 2019	19	4.25	15998	186	17784	13	133	-1718
October 23, 2019	20	5.81	15639	266	17502	14	127	-1722
October 23, 2019	21	0	14914	245	16598	14	167	-1406
October 23, 2019	22	-0.01	13852	244	15575	13	391	-1757
October 23, 2019	23	-1.4	12784	218	14832	14	276	-1983
October 23, 2019	24	-2.14	12084	217	14859	14	305	-2794
October 24, 2019	1	-2.39	11704	193	14718	14	194	-2901
October 24, 2019	2	-3	11496	228	14521	14	66	-2753
October 24, 2019	3	-3	11342	208	14327	14	118	-2707
October 24, 2019	4	-3	11428	174	14397	13	113	-2774
October 24, 2019	5	-2.76	11912	179	14534	13	126	-2407
October 24, 2019	6	-0.54	13236	208	15325	14	95	-1896
October 24, 2019	7	2.39	14792	191	16723	13	100	-1919
October 24, 2019	8	4.85	15154	190	17061	14	116	-1874
October 24, 2019	9	14.38	15004	161	16941	14	159	-1886
October 24, 2019	10	14.03	14966	199	16881	14	43	-1747
October 24, 2019	11	4.21	14724	205	16490	13	336	-1780
October 24, 2019	12	0	14457	177	16267	13	215	-1595
October 24, 2019	13	0.08	14277	282	16383	13	182	-1813
October 24, 2019	14	0	14275	275	16632	13	316	-2166
October 24, 2019	15	3.84	14379	256	16161	13	219	-1703
October 24, 2019	16	13.73	14781	205	16545	13	241	-1806
October 24, 2019	17	21.15	15346	185	17065	13	389	-1950
October 24, 2019	18	28.88	15978	264	17403	13	726	-1853
October 24, 2019	19	16.94	16143	220	17421	14	666	-1614
October 24, 2019	20	12.5	15840	252	17394	14	445	-1629
October 24, 2019	21	14.6	15219	222	16923	14	252	-1632
October 24, 2019	22	20.3	14169	265	15982	14	440	-1870
October 24, 2019	23	6.91	13155	249	15037	14	153	-1630
October 24, 2019	24	5.69	12413	256	14517	14	393	-2133
October 25, 2019	1	-0.27	12016	272	14499	14	169	-2256
October 25, 2019	2	2.84	11806	271	14436	14	158	-2387
October 25, 2019	3	-0.03	11732	207	14294	14	145	-2389
October 25, 2019	4	0.09	11824	276	14346	14	174	-2355
October 25, 2019	5	5.57	12361	198	14578	15	155	-2075
October 25, 2019	6	4.11	13684	250	15293	15	527	-1889
October 25, 2019	7	16.51	15182	271	16119	13	996	-1632
October 25, 2019	8	19.18	15613	257	16371	13	1092	-1544
October 25, 2019	9	30.47	15623	249	16710	14	771	-1597
October 25, 2019	10	25.53	15458	253	16506	14	859	-1556

October 25, 2019	11	17.98	15165	246	16408	14	851	-1683
October 25, 2019	12	14.36	14932	261	16198	14	690	-1550
October 25, 2019	13	14.36	14903	231	16179	14	690	-1550
October 25, 2019	14	15.44	14700	232	16320	28	479	-1769
October 25, 2019	15	15.24	14841	223	16190	15	362	-1369
October 25, 2019	16	18.72	15202	252	16262	14	497	-1251
October 25, 2019	17	15.77	15599	214	16575	14	999	-1714
October 25, 2019	18	17.45	15916	232	16974	14	813	-1590
October 25, 2019	19	17.22	15871	234	16976	14	801	-1558
October 25, 2019	20	15.26	15501	260	16916	13	609	-1675
October 25, 2019	21	18.64	14914	212	16097	14	730	-1567
October 25, 2019	22	16.76	13985	252	15243	14	821	-1656
October 25, 2019	23	8.89	12951	255	14697	14	441	-1759
October 25, 2019	24	1.91	12167	226	14249	14	132	-1830
October 26, 2019	1	-3.28	11705	251	14128	14	124	-2172
October 26, 2019	2	-3.85	11455	271	14099	14	253	-2516
October 26, 2019	3	-4.12	11228	210	14165	14	313	-2649
October 26, 2019	4	-0.97	11472	297	14248	15	246	-2660
October 26, 2019	5	-2.51	11711	238	14212	15	286	-2446
October 26, 2019	6	4.79	12353	228	14270	15	310	-1945
October 26, 2019	7	9.42	13141	179	14894	15	407	-1911
October 26, 2019	8	8.81	13556	204	15365	15	447	-1861
October 26, 2019	9	4.34	13513	217	15236	15	265	-1698
October 26, 2019	10	4.68	13249	250	14988	15	213	-1669
October 26, 2019	11	0	13075	231	14866	15	348	-1809
October 26, 2019	12	-0.02	12964	221	14735	15	359	-1793
October 26, 2019	13	-0.11	12785	184	14671	15	254	-1767
October 26, 2019	14	-0.07	12784	199	14850	15	304	-2015
October 26, 2019	15	0	12971	242	14946	15	267	-1849
October 26, 2019	16	0	13491	226	15337	15	279	-1754
October 26, 2019	17	1.81	14282	141	15900	15	253	-1676
October 26, 2019	18	0	14664	166	16316	15	475	-1829
October 26, 2019	19	0	14444	159	16046	15	599	-1934
October 26, 2019	20	0	14000	143	15839	15	428	-1954
October 26, 2019	21	-0.02	13542	148	15371	14	351	-1941
October 26, 2019	22	-0.99	12875	176	14935	14	308	-2050
October 26, 2019	23	-2.28	12103	175	14703	14	208	-2506
October 26, 2019	24	-3	11526	211	14268	13	65	-2423
October 27, 2019	1	-3.73	11180	174	14168	13	77	-2709
October 27, 2019	2	-3	10963	186	14126	13	48	-2834
October 27, 2019	3	-4.1	10873	191	13869	13	27	-2686
October 27, 2019	4	-3.55	10786	200	13903	14	46	-2883
October 27, 2019	5	-3.09	10861	184	13965	13	36	-2869
October 27, 2019	6	-3.09	11135	167	14253	13	47	-2858
October 27, 2019	7	-3	11719	155	14800	13	44	-2883
October 27, 2019	8	-3.56	12471	153	14946	13	9	-2286
October 27, 2019	9	-0.3	13159	149	15549	13	92	-2289
October 27, 2019	10	-0.02	13711	150	16048	13	13	-2209
October 27, 2019	11	0	13988	143	16132	13	119	-2022
October 27, 2019	12	0	14148	160	16586	13	118	-2267

October 27, 2019	13	0	14055	101	16341	14	199	-2252
October 27, 2019	14	0	14006	107	16260	13	139	-2180
October 27, 2019	15	0	14116	101	16508	13	9	-2266
October 27, 2019	16	0	14489	114	16981	13	9	-2372
October 27, 2019	17	5.08	14926	103	17186	13	42	-2159
October 27, 2019	18	9.93	15119	110	17268	13	9	-1874
October 27, 2019	19	3.36	14987	105	17072	13	24	-1736
October 27, 2019	20	5.77	14602	114	16577	13	120	-1841
October 27, 2019	21	2.26	13959	107	15971	13	89	-1835
October 27, 2019	22	3.82	13285	206	15333	13	126	-1896
October 27, 2019	23	-0.63	12377	217	14751	13	111	-2019
October 27, 2019	24	-3.28	11845	214	14504	13	23	-2380
October 28, 2019	1	-1.78	11645	126	14329	13	59	-2606
October 28, 2019	2	0	11418	186	14179	13	158	-2705
October 28, 2019	3	2.11	11405	159	14068	13	59	-2565
October 28, 2019	4	-0.95	11576	151	14298	13	85	-2619
October 28, 2019	5	1.5	12161	165	14367	13	9	-2024
October 28, 2019	6	8.49	13562	148	15271	13	593	-2121
October 28, 2019	7	12.16	15056	148	16359	13	384	-1476
October 28, 2019	8	13.36	15190	175	16492	13	213	-1329
October 28, 2019	9	14.83	14814	155	15998	13	522	-1540
October 28, 2019	10	19.08	14616	164	15901	13	635	-1683
October 28, 2019	11	10.68	14314	117	15912	18	326	-1734
October 28, 2019	12	0	14021	171	15534	18	417	-1694
October 28, 2019	13	1.26	13994	148	15694	13	119	-1621
October 28, 2019	14	1.23	13926	162	15863	13	87	-1833
October 28, 2019	15	2.36	14107	174	15978	13	109	-1764
October 28, 2019	16	5.54	14721	166	16158	13	601	-1881
October 28, 2019	17	10.92	15474	150	16476	13	1084	-1929
October 28, 2019	18	15.86	16066	132	16732	13	1332	-1765
October 28, 2019	19	15.93	16262	167	17034	13	1271	-1837
October 28, 2019	20	25.44	15908	121	16647	13	1053	-1596
October 28, 2019	21	28.91	15233	152	16198	13	1030	-1761
October 28, 2019	22	17.2	14184	209	15835	14	411	-1711
October 28, 2019	23	9.04	13097	173	14768	14	343	-1685
October 28, 2019	24	6.16	12346	191	14142	16	419	-1942

TAB I

This is Exhibit **"I"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

Demand Response

Markets require both a supply side and a demand side to function effectively. The demand side of wholesale electricity markets is underdeveloped. Wholesale power markets will be more efficient when the demand side of the electricity market becomes fully functional without depending on special programs as a proxy for full participation.

Overview

- **Demand Response Jurisdiction.** In a panel decision issued May 23, 2014, the U.S. Court of Appeals for the District of Columbia Circuit vacated in its entirety Order No. 745, which provided for payment of demand-side resources at full LMP.[1] The decision calls into question the jurisdictional foundation for all demand response programs currently subject to FERC oversight, and, in particular, for those programs that involve FERC regulated payments to demand resources. *EPSA v. FERC* is now subject to a stay pending the Supreme Court's review of the decision in its October 2015 term. The Supreme Court granted certiorari on May 4, 2015.

  FirstEnergy filed an amended complaint on September 22, 2014, that seeks to extend *EPSA v. FERC* to the PJM capacity markets, and would, if granted, eliminate tariff provisions that provide for the compensation of Demand Resources as a form of supply effective May 23, 2014, and require a rerun of the 2017/2018 Base Residual Auction.[2]

  On March 31, 2015, the FERC rejected as premature certain tariff revisions filed by PJM on January 14, 2015, which had been intended to adapt the PJM demand response rules depending on the outcomes and timing of the outcomes on potential review of EPSA v. FERC and PJM's pending capacity performance proposal.[3]

- **Demand Response Activity.** Demand response includes the economic program and the emergency program. Emergency program revenue includes both capacity and energy revenue. The capacity market is still the primary source of revenue to participants in PJM demand response programs, including both capacity market revenue and the associated emergency energy revenue. In the first six months of 2015, capacity market revenue increased by $70.0 million, or 24.4 percent, from $287.4 million in the first six months of 2014 to $357.4 million in the first six months of 2015.[4] Emergency energy revenue decreased by $42.5 million, from $43.0 million in the first six months of 2014 to $0.5 million in the first six months of 2015. Economic program revenue is energy revenue only. Economic program credits decreased by $9.3 million, from $14.3 million in the first six mo nths of 2014 to $5.0 million in the first six months of 2015, a 65.2 percent decrease.[5] Total revenue in the first six months of 2015 increased by 4.9 percent from $348.8 million in the first six months of 2014 to $365.9 million in the first six months of 2015. Not all DR activities in the first six months of 2015 have been reported to PJM at the time of this report.

  All demand response energy payments are uplift. LMP does not cover demand response energy payments. Emergency demand response energy costs are paid by PJM market participants in proportion to their net purchases in the real-time market. Economic demand response energy costs are paid by real-time exports from the PJM Region and real-time loads in each zone for which the load-weighted average real-time LMP for the hour during which the reduction occurred is greater than the price determined under the net benefits test for that month.[6]

- **Demand Response Market Concentration.** Economic demand response was highly concentrated in the first six months of 2014 and 2015. The HHI for economic demand response reductions increased from 7522 in the first six months of 2014 to 7852 in the first six months of 2015. Emergency demand response was moderately concentrated in the first six months of 2015. The HHI for emergency demand response registrations was 1760. In 2015, the four largest companies contributed 65.3 percent of all registered emergency demand response resources.

1 Electric Power Supply Association v. FERC, No. 11-1486, *petition for en banc review denied*; *see Demand Response Compensation in Organized Wholesale Energy Markets*, Order No. 745, FERC Stats. & Regs. ¶ 31,322 (2011); *order on reh'g*, Order No. 745-A, 137 FERC ¶ 61,215 (2011); *order on reh'g*, Order No. 745-B, 138 FERC 61,148 (2012).
2 See FirstEnergy Service Company complaint, FERC Docket No. EL14-55-000, amending the complaint filed May 23, 2014.
3 150 FERC ¶ 61,251.
4 The total credits and MWh numbers for demand resources were calculated as of July 27, 2015 and may change as a result of continued PJM billing updates.
5 Economic credits are synonymous with revenue received for reductions under the economic load response program.
6 PJM: "Manual 28: Operating Agreement Accounting," Revision 64 (April 11, 2014), p 70.

- **Locational Dispatch of Demand Resources.** Beginning with the 2014/2015 Delivery Year, demand resources are dispatchable for mandatory reduction on a subzonal basis, defined by zip codes, only if the subzone is defined at least one day before dispatched. More locational dispatch of demand resources in a nodal market improves market efficiency. The goal should be nodal dispatch of demand resources with no advance notice required.

Recommendations

The MMU recognizes the substantial uncertainty related to the treatment of demand response in wholesale power markets which depends on Supreme Court review and on FERC treatment of PJM's Capacity Performance filing. The MMU recognizes that PJM has incorporated some of these recommendations in the Capacity Performance filing. The status of each recommendation reflects the status at June 30, 2015.

- The MMU recommends that the tariff rules for demand response clarify that a resource and its CSP, if any, must notify PJM of material changes affecting the capability of the resource to perform as registered and to terminate registrations that are no longer capable of responding to PJM dispatch directives, such as in the case of bankrupt and out of service facilities. (Priority: Medium. New recommendation. Status: Not adopted.)
- The MMU recommends that, if demand response remains in the PJM market, there be only one demand response product, with an obligation to respond when called for all hours of the year, and that the demand response be on the demand side of the capacity market. (Priority: High. First reported 2013. Status: Not Adopted.[7] Pending before FERC.)
- The MMU recommends that, if demand response remains in the PJM market, the emergency load response program be classified as an economic program, responding to economic price signals and not an emergency program responding only after an emergency is called and not triggering the definition of an emergency. (Priority: High. First reported 2012. Status: Partially adopted.)
- The MMU recommends that, if demand response remains in the PJM market, a daily energy market must offer requirement apply to demand resources, comparable to the rule applicable to generation capacity resources.[8] (Priority: High. First reported 2013. Status: Not adopted. Pending before FERC.)
- The MMU recommends that, if demand response remains in the PJM market, demand response programs adopt an offer cap equal to the offer cap applicable to energy offers from generation capacity resources, currently $1,000 per MWh.[9] (Priority: High. First reported 2013. Status: Not adopted. Pending before FERC.)
- The MMU recommends that, if demand response remains in the PJM market, the lead times for demand resources be shortened to 30 minutes with an hour minimum dispatch for all resources. (Priority: Medium. First reported 2013. Status: Adopted in full, Q1, 2014.)
- The MMU recommends that, if demand response remains in the PJM market, demand resources be required to provide their nodal location on the electricity grid. (Priority: High. First reported 2011. Status: Not adopted.)
- The MMU recommends that, if demand response remains in the PJM market, measurement and verification methods for demand resources be further modified to more accurately reflect compliance. (Priority: Medium. First reported 2009. Status: Not adopted.)
- The MMU recommends that, if demand response remains in the PJM market, compliance rules be revised to include submittal of all necessary hourly load data, and that negative values be included when calculating event compliance across hours and registrations. (Priority: Medium. First reported 2012. Status: Not adopted.)
- The MMU recommends that, if demand response remains in the PJM market, PJM adopt the ISO-NE five-minute metering requirements in order to ensure that dispatchers have the necessary information for reliability and that market payments to demand resources be calculated

7 PJM's Capacity Performance proposal includes this change. See "Reforms to the Reliability Pricing Market ("RPM") and Related Rules in the PJM Open Access Transmission Tariff ("Tariff") and Reliability Assurance Agreement Among Load Serving Entities ("RAA")," Docket No. ER15-632-000 and "PJM Interconnection, L.L.C." Docket No. EL15-29-000.

8 See "Complaint and Motion to Consolidate of the Independent Market Monitor for PJM," Docket No. EL14-20-000 (January 27, 2014) at 1.

9 *Id* at 1.

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based on interval meter data at the site of the demand reductions.[10] (Priority: Medium. First reported 2013. Status: Not adopted.)

- The MMU recommends that, if demand response remains in the PJM market, demand response event compliance be calculated for each hour and the penalty structure reflect hourly compliance. (Priority: Medium. First reported 2013. Status: Not adopted. Pending before FERC.)
- The MMU recommends that, if demand response remains in the PJM market, demand resources whose load drop method is designated as "Other" explicitly record the method of load drop. (Priority: Low. First reported 2013. Status: Adopted in full, Q2, 2014.)
- The MMU recommends that, if demand response remains in the PJM market, load management testing be initiated by PJM with limited warning to CSPs in order to more accurately represent the conditions of an emergency event. (Priority: Low. First reported 2012. Status: Not adopted.)
- The MMU recommends, as a preferred alternative to having PJM demand side programs, that demand response be on the demand side of the markets and that customers be able to avoid capacity and energy charges by not using capacity and energy at their discretion and that customer payments be determined only by metered load. (Priority: High. First reported 2014. Status: Not adopted. Pending before FERC.)

Conclusion

A fully functional demand side of the electricity market means that end use customers or their designated intermediaries will have the ability to see real-time energy price signals in real time, will have the ability to react to real time prices in real time and will have the ability to receive the direct benefits or costs of changes in real-time energy use. In addition, customers or their designated intermediaries will have the ability to see current capacity prices, will have the ability to react to capacity prices and will have the ability to receive the direct benefits or costs of changes in the demand for capacity. A functional demand side of these markets means that customers will have the ability to make decisions about levels of power consumption based both on the value of the uses of the power and on the actual cost of that power.

With exception of large wholesale customers in some areas, most customers in PJM are not on retail rates that directly expose them to the wholesale price of energy or capacity. As a result, most customers in PJM do not have the direct ability to see, respond to or benefit from a response to price signals in PJM's markets. PJM's demand side programs are generally designed to allow customers (or their intermediaries in the form of load serving entities (LSEs) or curtailment service providers (CSPs)) to either directly, or through intermediaries, be paid as if they were directly paying the wholesale price of energy and capacity and avoiding those prices when reducing load. PJM's demand side programs are designed to provide direct incentives for load resources to respond, via load reductions, to wholesale market price signals and/or system emergency events.

If retail markets reflected hourly wholesale locational prices and customers or their intermediaries received direct savings associated with reducing consumption in response to real-time prices, there would not be a need for a PJM economic load response program, or for extensive measurement and verification protocols. In the transition to that point, however, as long as there are demand side programs, there is a need for robust measurement and verification techniques to ensure that transitional programs incent the desired behavior. The baseline methods used in PJM programs today are not adequate to determine and quantify deliberate actions taken to reduce consumption.

If demand resources are to continue competing directly with generation capacity resources in the PJM Capacity Market, the product must be defined such that it can actually serve as a substitute for generation. That is a prerequisite to a functional market design.

In order to be a substitute for generation, demand resources should be defined in PJM rules as an economic resource, as generation is defined. Demand resources should be required to offer in the Day-Ahead Energy Market and

10 See ISO-NE Tariff, Section III, Market Rule 1, Appendix E1 and Appendix E2, "Demand Response," <http://www.iso-ne.com/regulatory/tariff/sect_3/mr1_append-e.pdf>. (Accessed February 17, 2015) ISO-NE requires that DR have an interval meter with five minute data reported to the ISO and each behind the meter generator is required to have a separate interval meter. After June 1, 2017, demand response resources in ISO-NE must also be registered at a single node.

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should be called when the resources are required and prior to the declaration of an emergency. Demand resources should be available for every hour of the year and not be limited to a small number of hours.

In order to be a substitute for generation, demand resources should provide a nodal location and should be dispatched nodally to enhance the effectiveness of demand resources and to permit the efficient functioning of the energy market.

In order to be a substitute for generation, compliance by demand resources to PJM dispatch instructions should include both increases and decreases in load. The current method applied by PJM simply ignores increases in load and thus artificially overstates compliance.

In order to be a substitute for generation, any demand resource and its CSP, if any, should be required to notify PJM of material changes affecting the capability of the resource to perform as registered and to terminate registrations that are no longer capable of responding to PJM dispatch directives, such as in the case of bankrupt and out of service facilities. Generation resources are required to inform PJM of any change in availability status, including outages and shutdown status.

As a preferred alternative, demand response would be on the demand side of the Capacity Market rather than on the supply side. Rather than complex demand response programs with their attendant complex and difficult to administer rules, customers would be able to avoid capacity and energy charges by not using capacity and energy at their discretion.

The long term appropriate end state for demand resources in the PJM markets should be comparable to the demand side of any market. Customers should use energy as they wish and that usage will determine the amount of capacity and energy for which each customer pays. There would be no counterfactual measurement and verification.

Under this approach, customers that wish to avoid capacity payments would reduce their load during expected high load hours. Capacity costs would be assigned to LSEs and by LSEs to customers, based on actual load on the system during these critical hours. Customers wishing to avoid high energy prices would reduce their load during high price hours. Customers would pay for what they actually use, as measured by meters, rather than relying on flawed measurement and verification methods. No M&V estimates are required. No promises of future reductions which can only be verified by M&V are required. To the extent that customers enter into contracts with CSPs or LSEs to manage their payments, M&V can be negotiated as part of a bilateral commercial contract between a customer and its CSP or LSE.

This approach provides more flexibility to customers to limit usage at their discretion. There is no requirement to be available year round or every hour of every day. There is no 30 minute notice requirement. There is no requirement to offer energy into the day-ahead market. All decisions about interrupting are up to the customers only and they may enter into bilateral commercial arrangements with CSPs at their sole discretion. Customers would pay for capacity and energy depending solely on metered load.

A transition to this end state should be defined in order to ensure that appropriate levels of demand side response are incorporated in PJM's load forecasts and thus in the demand curve in the capacity market for the next three years. That transition should be defined by the PRD rules, modified as suggested by the Market Monitor.

This approach would work under the current RPM design and this approach would work under the CP design. This approach is entirely consistent with any Supreme Court decision on *EPSA* as it does not require FERC to have jurisdiction over the demand side. This approach will allow the Commission to more fully realize its overriding policy objective to create competitive and efficient wholesale energy markets.

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PJM Demand Response Programs

All demand response programs in PJM can be grouped into economic and emergency programs.[11] Table 6-1 provides an overview of the key features of PJM demand response programs. Demand response program is used here to refer to both emergency and economic programs. Demand resource is used here to refer to both resources participating in the capacity market and resources participating in the energy market. In both the economic and emergency programs, CSPs are companies that seek to sign up end-use customers, participants, that have the ability to reduce load. After a demand response event occurs, PJM compensates CSPs for their participants' load reductions and CSPs in turn compensates their participants. Only CSPs are eligible to participate in the PJM Demand Response program, but a participant can register as a PJM special member and become a CSP without any additional cost of entry.

Table 6-1 Overview of demand response programs

	Emergency Load Response Program			Economic Load Response Program
	Load Management (LM)			
Market	Capacity Only	Capacity and Energy	Energy Only	Energy Only
Capacity Market	DR cleared in RPM	DR cleared in RPM	Not included in RPM	Not included in RPM
Dispatch Requirement	Mandatory Curtailment	Mandatory Curtailment	Voluntary Curtailment	Dispatched Curtailment
Penalties	RPM event or test compliance penalties	RPM event or test compliance penalties	NA	NA
Capacity Payments	Capacity payments based on RPM clearing price	Capacity payments based on RPM price	NA	NA
Energy Payments	No energy payment.	Energy payment based on submitted higher of "minimum dispatch price" and LMP. Energy payment during PJM declared Emergency Event mandatory curtailments.	Energy payment based on submitted higher of "minimum dispatch price" and LMP. Energy payment only for voluntary curtailments.	Energy payment based on full LMP. Energy payment for hours of dispatched curtailment.

In a panel decision issued May 23, 2014, the U.S. Court of Appeals for the District of Columbia Circuit vacated in its entirety Order No. 745, which provided for payment of demand-side resources at full LMP.[12] The court found Order No. 745 arbitrary and capricious on its merits.[13] More importantly, the court found that the FERC lacked jurisdiction to issue Order No. 745 because the "rule entails direct regulation of the retail market - a matter exclusively within state control."[14] The decision calls into question the jurisdictional foundation for all demand response programs currently subject to FERC oversight, and, in particular, for those programs that involve FERC regulated payments to demand resources. *EPSA v. FERC* is now subject to a stay pending the Supreme Court's review of the decision in the October 2015 term. The Supreme Court granted certiorari on May 4, 2015.

FirstEnergy filed an amended complaint on September 22, 2014, that seeks to extend the finding in *EPSA v. FERC* to the PJM capacity market, and would, if granted, eliminate tariff provisions that provide for the compensation of Demand Resources as a form of capacity supply effective May 23, 2014.[15] The complaint also seeks to void the results of the 2017/2018 Base Residual Auction conducted in May 2014 and to rerun the auction excluding Demand Resources. The Market Monitor issued a report on July 10, 2014, analyzing the worst case effects in the event that such relief were granted.[16] The report concludes that "should a legal or policy decision be made to eliminate Demand

11 Throughout this document, emergency demand response refers to both emergency and pre emergency demand response.
12 Electric Power Supply Association v. FERC, No. 11-1486.
13 *Id.*, slip. op. at 14.
14 *Id.*
15 See FirstEnergy Service Company complaint, FERC Docket No. EL14-55-000, amending the complaint filed May 23, 2014.
16 See Monitoring Analytics, LLC, The 2017/2018 RPM Base Residual Auction: Sensitivity Analyses, which can be accessed at: <http://www.monitoringanalytics.com/reports/Reports/2014/IMM_20172018_RPM_BRA_Sensitivity_Analyses_20140710.pdf>.

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Resources from its current participation as supply in the PJM capacity market, PJM markets could adapt."[17] The proceeding is pending before the Commission.

On March 31, 2015, the FERC rejected as premature certain tariff revisions filed by PJM on January 14, 2015, which had been intended to adapt the PJM demand response rules depending on the outcomes and timing of the outcomes on potential review of *EPSA v. FERC* and PJM's pending capacity performance proposal.[18,19]

EPSA presents an opportunity to reform the rules for demand response to make them consistent with the functioning of an efficient and competitive market. The current rules for demand response have evolved to create a negative impact on market efficiency and pose obstacles to the growth of an effective demand component to the market. This negative impact is not the result of demand side resources which are an invaluable part of the markets but is a result of current PJM rules. These flaws have been well documented, and some are the subject of pending litigation at the Commission.[20] Now is an appropriate time for decisive steps away from the flawed approach of treating demand as a form of supply and toward treating demand response as changes in demand.

17 *Id.* at 10.
18 150 FERC ¶ 61,251.
19 See Comments of the Independent Market Monitor for PJM, ER15-852-000 (February 13, 2015).
20 The Market Monitor has documented in numerous reports the price suppressing effects and market design flaws attributable to the current treatment of Demand Resources in the PJM Capacity Market, including:
- The failure to require performance from Demand Resources that is comparable to the performance provided by Generation Capacity Resources and that would therefore make Demand Resources substitutes for Generation Resources while providing substantially the same compensation to both. *See, e.g.,* Monitoring Analytics, LLC, 2013 State of the Market Report for PJM (March 13, 2013) ("2013 SOM") at 197, 203; *see also*, Monitoring Analytics, LLC, Analysis of the 2016/2017 RPM Base Residual Auction (April 18, 2014) at 3, 35–27 ("2016/2017 BRA Report"), which can be accessed at: <http://www.monitoringanalytics.com/reports/Reports/2014/IMM_Analysis_of_the_20162017_RPM_Base_Residual_Auction_20140418.pdf>.
- The failure to remove inferior Demand Resource products from the capacity markets which cannot, by definition of the products, be substitutes for Generation Resources and the failure to require demand resource products to respond year round during any hour.
- The failure to eliminate the 2.5 shift in the demand curve used in RPM Base Residual Actions. *See, e.g.,* 2013 SOM at 157, 160; 2016/2017 BRA Report at 4–5.
- The failure to require Demand Resources to make physical offers. *See, e.g.,* 2013 SOM at 160, 171–172; Monitoring Analytics, LLC, Analysis of Replacement Capacity for RPM Commitments: June 1, 2007 to June 1, 2013 (September 13, 2013), which can be accessed at: <http://www.monitoringanalytics.com/reports/Reports/2013/IMM_Report_on_Capacity_Replacement_Activity_2_20130913.pdf>; Comments of the Independent Market Monitor for PJM, Docket No. ER14-1461 (April 1, 2014).
- The failure to require Demand Resources to make daily offers into the Day-Ahead Energy Market as required of Generation Capacity Resources. *See, e.g.,* 2013 SOM at 197, 203; Complaint and Motion to Consolidate of the Independent Market Monitor for PJM, Docket No. EL14-20 (January 27, 2014).
- The failure to apply a uniform system offer cap to Demand Resources and Generation Capacity Resources. *Id.*
- The failure to develop measurement and verification rules sufficient to ensure that Demand Resources do not consume capacity when it is needed by those who pay for it. *See, e.g.,* 2013 SOM at 197–198, 210; Comments of the Independent Market Monitor for PJM, Docket No. ER14-822 (January 1, 2014).

Participation in Demand Response Programs

On April 1, 2012, FERC Order No. 745 was implemented in the PJM economic program, requiring payment of full LMP for dispatched demand resources when a net benefit test (NBT) price threshold is exceeded. This approach replaced the payment of LMP minus the charges for wholesale power and transmission already included in customers' tariff rates.

Figure 6-1 shows all revenue from PJM demand response programs by market for the first six months of each year for the period 2008 through 2015. Since the implementation of the RPM capacity market on June 1, 2007, demand response that participated through the capacity market, which includes emergency energy revenue, has been the primary source of revenue to demand response participants.[21]

In the first six months of 2015, emergency revenue, which includes capacity and emergency energy revenue, accounted for 97.9 percent of all revenue received by demand response providers, credits from the economic program were 1.3 percent and revenue from synchronized reserve was 0.8 percent.

Total emergency revenue increased by $27.5 million, or 8.3 percent, from $330.4 million in the first six months of 2014 to $358.0 in 2015. Of the total emergency revenue, capacity market revenue increased by $70.0 million, or 24.4 percent, from $287.4 million in the first six months of 2014 to $357.4 million in the first six months of 2015, due to higher clearing prices and volumes in the capacity market for the 2013/2014 and 2014/2015 delivery years. The weighted average RPM price increased 23.1 percent from $99.39 per MW-day to $122.32 per MW-day.[22] Emergency energy revenue decreased by $42.5 million, from $43.0 million in the first six months of 2014 to $0.5 million in the first six months of 2015. Total revenue in the first six months of 2015 increased by 4.9 percent from $348.8 million in the first six months of 2014 to $365.9 million in the first six months of 2015.

21 This includes both capacity market revenue and emergency energy revenue for capacity resources.
22 *2014 State of the Market Report for PJM, Volume II*, Section 5: Capacity, Table 5-13.

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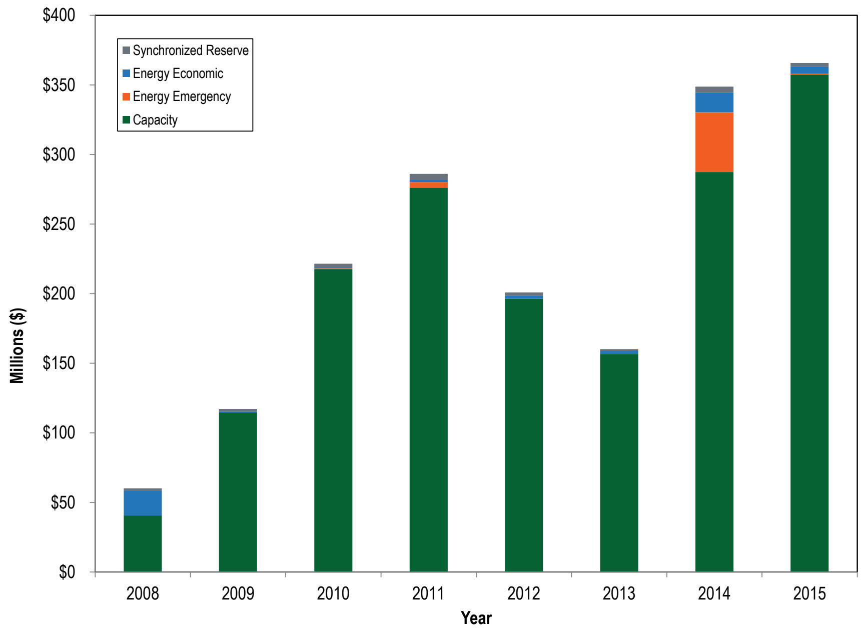
Total credits under the economic program decreased by $9.3 million from $14.3 million in the first six months of 2014 to $5.0 million in the first six months of 2015, a 65.2 percent decrease.

Figure 6-1 Demand response revenue by market: January through June 2008 through 2015



Economic Program

Table 6-2 shows registered sites and MW for the last day of each month for the period January 2010 through June 2015. Registration is a prerequisite for CSPs to participate in the economic program. The average number of registrations for economic demand response decreased and the average registered MW increased in the first six months of 2015 compared to the same time period in 2014. The average number of monthly registrations decreased by 42 from 1,068 in the first six months of 2014 to 1,026 in the first six months of 2015. The average monthly registered MW for the first six months of 2015 increased by 272 MW, or 10.5 percent, from 2,605 MW in the six months of 2014 to 2,877 MW in the first six months of 2015.

Several demand response resources are registered for both the economic and emergency demand response programs. There were 235 registrations and 1,409 nominated MW in the emergency program that were also registered in the economic program during the first six months of 2015.

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Table 6-2 Economic program registrations on the last day of the month: January 2010 through June 2015

	2010		2011		2012		2013		2014		2015	
Month	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW
Jan	1,841	2,623	1,609	2,432	1,993	2,385	841	2,314	1,180	2,325	1,078	2,960
Feb	1,842	2,624	1,612	2,435	1,995	2,384	843	2,327	1,174	2,330	1,076	2,956
Mar	1,845	2,623	1,612	2,519	1,996	2,356	788	2,284	1,185	2,692	1,075	2,949
Apr	1,849	2,587	1,611	2,534	189	1,318	970	2,346	1,194	2,827	1,076	2,938
May	1,875	2,819	1,687	3,166	371	1,669	1,375	2,414	745	2,511	980	2,846
Jun	813	1,608	1,143	1,912	803	2,347	1,302	2,144	928	2,943	871	2,614
Jul	1,192	2,159	1,228	2,062	942	2,323	1,315	2,443	1,036	3,006		
Aug	1,616	2,398	1,987	2,194	1,013	2,373	1,299	2,527	1,080	3,033		
Sep	1,609	2,447	1,962	2,183	1,052	2,421	1,280	2,475	1,077	2,919		
Oct	1,606	2,444	1,954	2,179	828	2,269	1,210	2,335	1,060	2,943		
Nov	1,605	2,444	1,988	2,255	824	2,267	1,192	2,307	1,063	2,995		
Dec	1,598	2,439	1,992	2,259	846	2,283	1,192	2,311	1,071	2,923		
Avg. (Jan-Jun)	1,678	2,481	1,546	2,500	1,225	2,077	1,020	2,305	1,068	2,605	1,026	2,877

Table 6-3 Sum of peak MW reductions for all registrations per month: January through June, 2010 through 2015

	Sum of Peak MW Reductions for all Registrations per Month					
Month	2010	2011	2012	2013	2014	2015
Jan	183	132	110	193	450	169
Feb	121	89	101	119	307	336
Mar	115	81	72	127	369	198
Apr	111	80	108	133	146	143
May	172	98	143	192	151	154
Jun	209	561	954	433	483	605
Annual (Jan - Jun)	297	701	1,078	562	869	1,107

The registered MW in the economic load response program are not a good measure of the MW available for dispatch in the energy market. Economic resources can dispatch more, less or the same amount of MW registered in the program. Table 6-3 shows the sum of maximum economic MW dispatched by registration each month for January 2010 through June 2015. The monthly maximum is the sum of each registration's monthly noncoincident peak dispatched MW and the six month annual maximum is the sum of each registration's noncoincident peak dispatched MW during the first six months of the respective year. This aggregated maximum dispatched MW for all economic demand response registered resources in the first six months of 2015 increased by 238 MW, from 869 MW in the first six months of 2014 to 1,107 MW in the first six months of 2015.[23]

All demand response energy payments are uplift rather than market payments. Economic demand response energy costs are assigned to real-time exports from the PJM Region and real-time loads in each zone for which the load-weighted average real-time LMP for the hour during which the reduction occurred is greater than the price determined under the net benefits test for that month.[24] The zonal allocation is shown in Table 6-13.

Table 6-4 shows the total MW reductions made by participants in the economic program and the total credits paid for these reductions in the first six months of 2010 through 2015. The average credits per MWh paid in the first six months of 2015 decreased by $75.71 per MWh, or 45.3 percent, from $167.17 per MWh in 2014 to $91.45 per MWh dispatched in 2015. The average real-time load weighted PJM LMP decreased by $27.62 per MWh, from $69.92 per MWh during the first six months of 2014 to $42.30 per MWh during the first six months of 2015. Curtailed energy for the economic program was 54,342 MWh in the first six months of 2015 and the total payments were $4,969,863. Total credits paid for economic DR in the first six months of 2015 decreased by $9.3 million or 65.2 percent, compared to the first six months of 2014.

23 As a result of the 60 day data lag from event date to settlement, not all settlements for June 2015 are incorporated in this report.
24 PJM, "Manual 28: Operating Agreement Accounting," Revision 71 (June 1, 2015) p. 78.

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Table 6-4 Credits paid to the PJM economic program participants: January through June 2010 through 2015

Year (Jan-Jun)	Total MWh	Total Credits	$/MWh
2010	20,225	$761,854	$37.67
2011	9,055	$1,456,324	$160.84
2012	38,714	$2,165,599	$55.94
2013	48,711	$2,559,832	$52.55
2014	85,530	$14,297,951	$167.17
2015	54,342	$4,969,863	$91.45

Economic demand response resources that are dispatched in both the economic and emergency programs at the same time are settled under emergency rules. For example, assume a demand resource has an economic strike price of $100 per MWh and an emergency strike price of $1,800 per MWh. If this resource were scheduled to reduce in the Day-Ahead Energy Market, the demand resource would receive $100 per MWh, but if an emergency event were called during the economic dispatch, the demand resource would receive its emergency strike price of $1,800 per MWh instead of the economic strike price of $100 per MWh. The rationale for this rule is not clear. All other resources that clear in the day-ahead market are financially firm at that clearing price.

Figure 6-2 shows monthly economic demand response credits and MWh, from January 2010 through June 2015. Higher energy prices and FERC Order No. 745 increased incentives to participate starting in April 2012. The high prices in the first three months of 2014 resulted in higher credits. Lower prices in the first three months of 2015 resulted in lower prices and lower credits.

Figure 6-2 Economic program credits and MWh by month: January 2010 through June 2015

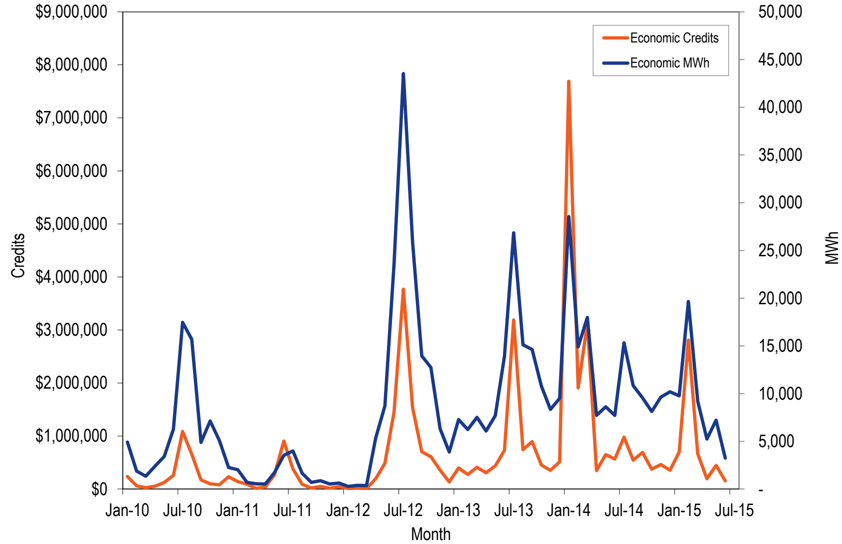

Table 6-5 shows performance for the first six months of 2014 and 2015 in the economic program by control zone and participation type. Total economic program reductions decreased 36.5 percent from 85,530 MW in the first six months of 2014 to 54,342 MW in the first six months of 2015. The economic credits decreased by 65.2 percent from $14,297,951 in the first six months of 2014, to $4,969,863 in the first six months of 2015.

Table 6-5 PJM economic program participation by zone: January through June of 2014 and 2015[25]

	Credits			MWh Reductions			Credits per MWh Reduction		
Zones	2014	2015	Percent Change	2014	2015	Percent Change	2014	2015	Percent Change
AECO, JCPL, PECO, Pepco, RECO	$2,288,088	$333,934	(85.4%)	7,887	1,618	(79.5%)	$290.10	$206.34	(28.9%)
AEP, AP	$287,039	$88,782	(69.1%)	2,867	953	(66.7%)	$100.13	$93.11	(7.0%)
ATSI, ComEd, DAY, DEOK, DLCO, EKPC	$872,696	$250,047	(71.3%)	6,568	5,365	(18.3%)	$132.87	$46.60	(64.9%)
BGE, DPL, Met-Ed, PENELEC	$648,738	$368,684	(43.2%)	4,965	6,416	29.2%	$130.67	$57.47	(56.0%)
Dominion	$7,901,371	$3,262,696	(58.7%)	51,310	31,442	(38.7%)	$153.99	$103.77	(32.6%)
PPL, PSEG	$2,300,020	$665,718	(71.1%)	11,933	8,547	(28.4%)	$192.74	$77.89	(59.6%)
Total	$14,297,951	$4,969,863	(65.2%)	85,530	54,342	(36.5%)	$167.17	$91.45	(45.3%)

Table 6-6 shows total settlements submitted for the first six months of 2009 through 2015. A settlement is counted for every day on which a registration is dispatched in the economic program.

Table 6-6 Settlements submitted by year in the economic program: January through June of 2009 through 2015

Year (Jan - Jun)	2009	2010	2011	2012	2013	2014	2015
Number of Settlements	1,156	1,345	317	1,154	659	1,482	739

Table 6-7 shows the number of curtailment service providers (CSPs), and the number of participants in their portfolios, submitting settlements by year through the first six months of 2009 through 2015. There were 76 fewer active participants in the first six months of 2015 than in the first six months of 2014. All participants must be included in a CSP.

Table 6-7 Participants and CSPs submitting settlements in the economic program by year: January through June of 2009 through 2015

	2009		2010		2011		2012		2013		2014		2015	
	Active CSPs	Active Participants	Active CSPs	Active Participants	Active CSPs	Active Participants	Active CSPs	Active Participants	Active CSPs	Active Participants	Active CSPs	Active Participants	Active CSPs	Active Participants
Total Distinct Active	13	175	10	131	9	129	18	331	12	85	17	144	12	68

Parent companies may own one CSP or multiple CSPs. All HHI calculations in this section are at the parent company level.

Economic demand response was highly concentrated in the first six months of both 2014 and 2015. Table 6-8 shows the monthly HHI and the HHI for the first six months of 2015. The table also lists the share of reductions provided by, and the share of credits claimed by the four largest DR companies in each year. In the first six months of 2015, 88.4 percent of all Economic DR reductions and 91.1 percent of Economic DR revenue were attributable to the four largest DR companies. The HHI for demand response reductions increased 330 points, from 7522 in the first six months of 2014 to 7852 in the first six months of 2015.

Table 6-8 HHI and market concentration in the economic program: January through June of 2014 and 2015

	HHI			Top Four Companies Share of Reduction			Top Four Companies Share of Credit		
Month	2014	2015	Percent Change	2014	2015	Change Percent	2014	2015	Change Percent
Jan	7018	8081	15.1%	88.0%	96.8%	8.8%	84.2%	98.6%	14.4%
Feb	6547	7358	12.4%	84.1%	91.4%	7.4%	77.5%	87.8%	10.3%
Mar	7751	7539	(2.7%)	87.7%	89.1%	1.4%	88.5%	84.4%	(4.2%)
Apr	8343	7216	(13.5%)	100.0%	97.8%	(2.2%)	100.0%	97.8%	(2.2%)
May	8090	7791	(3.7%)	98.8%	98.8%	0.1%	99.1%	99.4%	0.3%
Jun	8141	9344	14.8%	91.5%	100.0%	8.5%	87.9%	100.0%	12.1%
Total	7522	7852	4.4%	83.9%	88.4%	4.5%	85.5%	91.1%	5.6%

25 PJM and the MMU cannot publish more detailed information about the Economic Program Zonal Settlements as a result of confidentiality requirements.

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Table 6-9 shows average MWh reductions and credits by hour for the first six months of 2014 and 2015. In the first six months of 2014, 84.2 percent of reductions and 82.9 percent of credits occurred from hours ending 0700 to 2100, and in the first six months of 2015, 92.2 percent of reductions and 88.4 percent of credits occurred from 0700 to 2100.

Table 6-9 Hourly frequency distribution of economic program MWh reductions and credits: January through June 2014 and 2015

	MWh Reductions			Program Credits		
Hour Ending (EPT)	2014	2015	Percent Change	2014	2015	Percent Change
1	739	265	(64%)	$126,301	$37,651	(70%)
2	707	253	(64%)	$112,124	$33,089	(70%)
3	863	277	(68%)	$149,107	$40,472	(73%)
4	1,453	345	(76%)	$290,486	$45,609	(84%)
5	1,512	335	(78%)	$201,530	$46,170	(77%)
6	2,184	660	(70%)	$316,145	$98,896	(69%)
7	5,110	3,408	(33%)	$871,910	$435,079	(50%)
8	6,072	4,951	(18%)	$1,073,245	$555,844	(48%)
9	6,287	5,348	(15%)	$827,217	$376,300	(55%)
10	6,107	3,903	(36%)	$947,495	$332,666	(65%)
11	4,329	2,816	(35%)	$818,798	$249,323	(70%)
12	3,244	2,533	(22%)	$714,260	$223,854	(69%)
13	3,513	2,441	(31%)	$578,674	$182,058	(69%)
14	4,123	2,553	(38%)	$608,841	$179,950	(70%)
15	4,595	2,663	(42%)	$586,648	$163,299	(72%)
16	4,877	2,985	(39%)	$581,899	$191,929	(67%)
17	4,962	3,437	(31%)	$602,258	$234,214	(61%)
18	5,477	3,739	(32%)	$858,958	$307,919	(64%)
19	4,712	4,082	(13%)	$891,313	$375,457	(58%)
20	4,522	2,881	(36%)	$1,004,213	$305,493	(70%)
21	4,057	2,390	(41%)	$890,614	$278,512	(69%)
22	2,857	1,089	(62%)	$586,929	$139,627	(76%)
23	1,760	517	(71%)	$373,504	$71,336	(81%)
24	1,471	473	(68%)	$285,482	$65,117	(77%)
Total	85,530	54,342	(36%)	$14,297,951	$4,969,863	(65%)

Table 6-10 shows the distribution of economic program MWh reductions and credits by ranges of real-time zonal, load-weighted, average LMP in the first six months of 2014 and 2015. Reductions occurred at all price levels. In the first six months of 2015, 1.3 percent of MWh reductions and 5.6 percent of program credits occurred during the hours when the applicable zonal LMP was higher than $400 per MWh.

Table 6-10 Frequency distribution of economic program zonal, load-weighted, average LMP (By hours): January through June 2014 and 2015

	MWh Reductions			Program Credits		
LMP	2014	2015	Percent Change	2014	2015	Percent Change
$0 to $25	154	1,079	600%	$1,329	$17,379	1,208%
$25 to $50	19,531	23,009	18%	$941,744	$900,284	(4%)
$50 to $75	14,921	8,712	(42%)	$1,014,853	$566,437	(44%)
$75 to $100	9,116	6,231	(32%)	$937,453	$566,354	(40%)
$100 to $125	4,373	3,963	(9%)	$582,507	$447,184	(23%)
$125 to $150	4,061	2,334	(43%)	$630,531	$318,157	(50%)
$150 to $175	3,820	1,625	(57%)	$694,708	$256,922	(63%)
$175 to $200	3,515	1,703	(52%)	$748,308	$323,408	(57%)
$200 to $225	3,064	1,465	(52%)	$672,056	$299,097	(55%)
$225 to $250	3,039	921	(70%)	$697,859	$214,464	(69%)
$250 to $275	2,537	613	(76%)	$636,510	$151,050	(76%)
$275 to $300	1,944	611	(69%)	$545,908	$171,521	(69%)
$300 to $325	1,538	363	(76%)	$447,031	$106,033	(76%)
$325 to $350	1,229	233	(81%)	$359,764	$70,018	(81%)
$350 to $375	1,404	609	(57%)	$435,346	$213,604	(51%)
$375 to $400	1,080	194	(82%)	$333,491	$71,818	(78%)
> $400	10,197	677	(93%)	$4,618,554	$276,133	(94%)
Total	85,524	54,341	(36%)	$14,297,951	$4,969,863	(65%)

Following Order No. 745, each month the NBT threshold price is calculated above which the net benefits of DR are deemed to exceed the cost to load. Demand resource (DR) reductions have two effects on the per MWh energy payment by loads and exports. DR reduces LMP by reducing demand in the energy market. At the same time, DR payments cause an additional uplift charge. The NBT threshold price is a monthly estimate calculated from the supply curve of PJM, and it does not incorporate the real-time or day-ahead prices. When the LMP is above the NBT threshold price, the demand response resource receives credit for the full LMP. Demand resources are not paid for

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any load reductions during hours where the LMP is below the NBT threshold price. About 0.75 percent of DR dispatch occurred during hours with LMP lower than the NBT threshold price.

Table 6-11 shows the NBT threshold price from April 2012, when FERC Order No. 745 was implemented in PJM, through June of 2015.

Table 6-11 Result from net benefits tests: April 2012 through June 2015

	Net Benefits Test Threshold Price ($/MWh)			
Month	2012	2013	2014	2015
Jan		$25.72	$29.51	$29.63
Feb		$26.27	$30.44	$26.52
Mar		$25.60	$34.93	$24.99
Apr	$25.89	$26.96	$32.59	$24.92
May	$23.46	$27.73	$32.08	$23.79
Jun	$23.86	$28.44	$31.62	$23.80
Jul	$22.99	$29.42	$31.62	
Aug	$24.47	$28.58	$29.85	
Sep	$24.93	$28.80	$29.83	
Oct	$25.96	$29.13	$30.20	
Nov	$25.63	$31.63	$29.17	
Dec	$25.97	$28.82	$29.01	
Average	$24.80	$28.09	$30.91	$25.61

Table 6-12 shows the number of hours that at least one zone in PJM had day-ahead LMP or real-time LMP higher than the NBT threshold price. In the first six months of 2015, the highest zonal LMP in PJM was higher than the NBT threshold price 4,122 hours out of the entire 4,343 hours, or 94.9 percent of all hours. Reductions occurred in 3,660 hours, or 88.8 percent, of the 4,122 hours in the first six months of 2015. The last three columns illustrate how often economic demand response activity occurred when LMPs exceeded NBT threshold prices in the first six months 2014 and 2015.

Table 6-12 Hours with price higher than NBT and DR occurrences in those hours: January through June 2014 and 2015

	Number of Hours	Number of Hours with LMP Higher than NBT			Percent of NBT Hours with DR		
Month	2014/2015	2014	2015	Percent Change	2014	2015	Change Percent
Jan	744	742	669	(9.8%)	93.8%	83.0%	(10.8%)
Feb	672	672	670	(0.3%)	92.9%	93.1%	0.3%
Mar	743	732	719	(1.8%)	81.8%	90.8%	9.0%
Apr	720	661	713	7.9%	86.5%	96.6%	10.1%
May	744	694	692	(0.3%)	85.3%	92.2%	6.9%
Jun	720	557	659	18.3%	87.8%	76.0%	(11.8%)
Total	4,343	4,058	4,122	1.6%	88.0%	88.8%	0.8%

Following the implementation of FERC Order No. 745, DR in PJM is paid by real-time loads and real-time scheduled exports. Table 6-13 shows the sum of real-time DR charges and day-ahead DR charges for each zone and for exports. Real-time loads in AEP, Dominion, and ComEd paid the highest DR charges in the first six months of 2015.

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Table 6-13 Zonal DR charge: January through June 2015

Zone	January	February	March	April	May	June	Total
AECO	$8,144	$32,233	$7,885	$1,675	$6,616	$2,281	$58,833
AEP	$110,175	$460,039	$108,168	$35,842	$72,041	$23,686	$809,951
AP	$46,313	$186,348	$43,950	$14,169	$28,086	$8,842	$327,707
ATSI	$53,788	$218,608	$55,824	$19,925	$38,295	$12,312	$398,751
BGE	$31,720	$124,739	$28,379	$8,934	$19,607	$6,967	$220,346
ComEd	$58,545	$275,905	$69,202	$18,046	$41,958	$17,432	$481,087
DAY	$14,864	$56,946	$14,135	$4,813	$9,766	$3,325	$103,849
DEOK	$20,275	$89,027	$21,328	$6,816	$15,867	$5,592	$158,905
DLCO	$93,812	$388,679	$84,586	$26,191	$58,781	$21,378	$673,427
Dominion	$18,319	$75,492	$16,560	$3,070	$10,424	$3,893	$127,758
DPL	$9,970	$35,023	$11,012	$3,864	$9,042	$2,805	$71,716
EKPC	$11,403	$54,120	$11,522	$2,788	$6,373	$2,386	$88,592
JCPL	$18,592	$72,039	$17,775	$4,136	$13,391	$5,573	$131,507
Met-Ed	$13,736	$53,971	$13,034	$2,642	$8,469	$2,246	$94,097
PECO	$34,695	$137,349	$32,562	$6,487	$22,784	$6,665	$240,543
PENELEC	$15,541	$60,547	$15,391	$4,838	$9,408	$2,849	$108,575
Pepco	$29,008	$114,217	$26,061	$8,609	$19,672	$6,939	$204,505
PPL	$38,227	$153,234	$36,723	$6,891	$21,723	$5,373	$262,171
PSEG	$36,731	$133,282	$33,547	$8,416	$24,227	$9,509	$245,712
RECO	$1,231	$4,301	$1,110	$291	$1,053	$360	$8,347
Export	$33,144	$83,014	$19,015	$5,828	$9,331	$3,151	$153,484
Total	$698,233	$2,809,114	$667,768	$194,270	$446,913	$153,565	$4,969,863

Table 6-14 shows the total zonal DR charge per MWh of real-time load and exports during the first six months of 2015. On a dollar per MWh basis, real-time load and exports in EKPC paid the highest charges for economic demand response in the first six months of 2015. The highest average monthly per MWh charges for economic demand response occurred in February 2015, when real-time load and exports paid an average of $0.05/MWh.

Table 6-14 Zonal DR charge per MWh of Load and Exports: January through June 2015

Zone	January	February	March	April	May	June	Zonal Average
AECO	$0.016	$0.046	$0.013	$0.005	$0.010	$0.006	$0.016
AEP	$0.021	$0.046	$0.013	$0.005	$0.010	$0.004	$0.017
AP	$0.017	$0.045	$0.012	$0.005	$0.010	$0.004	$0.016
ATSI	$0.018	$0.043	$0.012	$0.005	$0.010	$0.004	$0.015
BGE	$0.016	$0.046	$0.012	$0.005	$0.010	$0.004	$0.016
ComEd	$0.024	$0.049	$0.014	$0.006	$0.010	$0.005	$0.018
DAY	$0.020	$0.044	$0.013	$0.005	$0.010	$0.004	$0.016
DEOK	$0.022	$0.049	$0.015	$0.006	$0.010	$0.004	$0.018
DLCO	$0.019	$0.048	$0.013	$0.005	$0.010	$0.004	$0.016
Dominion	$0.017	$0.048	$0.013	$0.005	$0.009	$0.006	$0.016
DPL	$0.019	$0.048	$0.012	$0.005	$0.010	$0.004	$0.017
EKPC	$0.024	$0.053	$0.016	$0.006	$0.010	$0.004	$0.019
JCPL	$0.017	$0.047	$0.013	$0.005	$0.011	$0.007	$0.017
Met-Ed	$0.017	$0.047	$0.013	$0.005	$0.010	$0.005	$0.016
PECO	$0.017	$0.047	$0.013	$0.005	$0.011	$0.005	$0.016
PENELEC	$0.016	$0.042	$0.012	$0.006	$0.010	$0.004	$0.015
Pepco	$0.017	$0.047	$0.012	$0.005	$0.010	$0.004	$0.016
PPL	$0.017	$0.047	$0.013	$0.005	$0.010	$0.005	$0.016
PSEG	$0.015	$0.041	$0.012	$0.005	$0.010	$0.006	$0.015
RECO	$0.016	$0.040	$0.012	$0.005	$0.011	$0.006	$0.015
Export	$0.012	$0.031	$0.009	$0.004	$0.005	$0.002	$0.011
Monthly Average	$0.018	$0.045	$0.013	$0.005	$0.010	$0.005	$0.016

Table 6-15 shows the monthly day-ahead and real-time DR charges and the per MWh DR charges in the first six months of 2014 and 2015. The day-ahead DR charges decreased by $4.70 million, or 78.1 percent, from $6.02 million in the first six months of 2014 to $1.32 million in the first six months of 2015. The real-time DR charges decreased $4.63 million, or 55.9 percent, from $8.28 million in the first six months of 2014 to $3.65 million in the first six months of 2015. The per MWh charge paid by all real-time load and exports for economic DR decreased $0.05/MWh, or 90.7 percent, from $0.06/MWh in the first six months of 2014 to $0.01/MWh in the first six months of 2015.

Table 6-15 Monthly day-ahead and real-time DR charge: January through June 2014 and 2015

	Day-ahead DR Charge			Real-time DR Charge			Per MWh Charge ($/MWh)		
Month	2014	2015	Percent Change	2014	2015	Percent Change	2014	2015	Percent Change
Jan	$3,580,411	$202,040	(94%)	$4,108,903	$496,193	(88%)	$0.131	$0.025	(81%)
Feb	$1,148,053	$647,566	(44%)	$760,591	$2,161,548	184%	$0.038	$0.059	56%
Mar	$762,224	$140,310	(82%)	$2,366,688	$527,458	(78%)	$0.075	$0.020	(73%)
Apr	$67,996	$58,036	(15%)	$282,918	$136,234	(52%)	$0.012	$0.008	(35%)
May	$151,962	$258,773	70%	$498,703	$188,139	(62%)	$0.024	$0.015	(38%)
Jun	$309,885	$12,097	(96%)	$259,651	$141,468	(46%)	$0.018	$0.006	(69%)
Total	$6,020,531	$1,318,823	(78%)	$8,277,454	$3,651,040	(56%)	$0.060	$0.006	(91%)

Emergency Program

The emergency load response program consists of the limited, extended summer and annual demand response product in the capacity market during the 2014/2015 Delivery Year. To participate as a limited demand resource, the provider must clear MW in an RPM auction. Emergency resources receive capacity revenue from the capacity market and also receive revenue from the energy market for reductions during a PJM initiated emergency event. The rules applied to demand resources in the current market design do not treat demand resources in a manner comparable to generation capacity resources, even though demand resources are sold in the same capacity market, are treated as a substitute for other capacity resources and displace other capacity resources in RPM auctions. The MMU recommends that if demand resources remain on the supply side of the capacity market, a daily must offer requirement in the Day-Ahead Energy Market apply to demand resources, comparable to the rule applicable to generation capacity resources. This will help to ensure comparability and consistency for demand resources. The MMU also recommends that demand resources have an offer cap equal to the offer cap applicable to energy offers from generation capacity resources, currently $1,000 per MWh.[26]

Emergency demand response was moderately concentrated in the first six months of 2015. The HHI for emergency demand response registrations was 1760 in 2014. In 2015 the four largest companies contributed 65.3 percent of all registered emergency demand response resources.

Table 6-16 shows zonal monthly capacity market revenue to demand resources for the first six months of 2015. Capacity market revenue increased in the first six months of 2015 by $70.0 million, or 24.4 percent, compared to the first six months of 2014, from $287.4 million to $357.4 million, as a result of higher RPM prices and more cleared DR in RPM for the 2013/2014 and 2014/2015 delivery years.

Table 6-16 Zonal monthly capacity revenue: January through June 2015

Zone	January	February	March	April	May	June	Total
AECO	$411,097	$371,313	$411,097	$805,435	$832,282	$985,380	$3,816,604
AEP, EKPC	$425,101	$383,962	$425,101	$6,203,447	$6,410,228	$6,659,173	$20,507,011
AP	$185,478	$167,528	$185,478	$3,380,132	$3,492,803	$3,174,034	$10,585,454
ATSI	$19,859	$17,937	$19,859	$3,717,154	$3,841,060	$18,481,726	$26,097,594
BGE	$5,430,108	$4,904,613	$5,430,108	$5,140,527	$5,311,878	$5,367,246	$31,584,480
ComEd	$405,926	$366,643	$405,926	$5,846,358	$6,041,237	$6,463,717	$19,529,806
DAY	$63,670	$57,508	$63,670	$872,987	$902,087	$736,289	$2,696,212
DEOK	$8,185	$7,393	$8,185	$330,654	$341,676	$1,277,237	$1,973,329
DLCO	$49,718	$44,907	$49,718	$840,774	$868,800	$849,964	$2,703,881
Dominion	$306,929	$277,226	$306,929	$5,165,946	$5,338,145	$5,066,825	$16,461,999
DPL	$1,547,049	$1,397,335	$1,547,049	$1,542,580	$1,593,999	$2,130,080	$9,758,093
JCPL	$1,495,628	$1,350,890	$1,495,628	$1,709,946	$1,766,944	$1,665,010	$9,484,045
Met-Ed	$1,044,281	$943,222	$1,044,281	$1,558,377	$1,610,323	$1,613,449	$7,813,933
PECO	$2,660,069	$2,402,643	$2,660,069	$3,249,878	$3,358,207	$3,700,859	$18,031,725
PENELEC	$1,144,857	$1,034,064	$1,144,857	$1,675,004	$1,730,838	$2,540,797	$9,270,417
Pepco	$1,906,591	$1,722,082	$1,906,591	$3,467,834	$3,583,429	$4,096,205	$16,682,731
PPL	$3,247,272	$2,933,020	$3,247,272	$5,215,729	$5,389,586	$5,411,083	$25,443,961
PSEG	$2,354,400	$2,126,555	$2,354,400	$5,460,187	$5,642,193	$3,738,271	$21,676,007
RECO	$14,896	$13,454	$14,896	$118,962	$122,927	$99,707	$384,842
Total	$22,721,111	$20,522,294	$22,721,111	$56,301,913	$58,178,643	$74,057,052	$254,502,124

Table 6-17 shows the amount of energy efficiency (EE) resources in PJM for 2012/2013 through 2015/2016 delivery years. Energy efficiency resources are offered in the PJM Capacity Market. The total MW of energy efficiency resources cleared in the capacity auction increased by 19.5 percent from 1,231.8 MW in the 2014/2015 delivery year to 1,471.4 MW in 2015/2016 Delivery Year.

26 See "Complaint and Motion to Consolidate of the Independent Market Monitor for PJM," Docket No. EL14-20-000 (January 28, 2014); "Comments of the Independent Market Monitor for PJM," Docket No. ER15-852-000 (February 13, 2015).

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Table 6-17 Energy efficiency resources by MW: 2012/2013 through 2015/2016 Delivery Year

	EE ICAP (MW)				EE UCAP (MW)			
	2012/2013	2013/2014	2014/2015	2015/2016	2012/2013	2013/2014	2014/2015	2015/2016
Total	609.7	991.0	1,231.8	1,471.4	631.2	1,029.2	1,282.4	1,525.5

Table 6-18 shows the number of customers and the nominated MW by product type and lead time for the 2014/2015 Delivery Year. The annual and extended summer products are new for the 2014/2015 Delivery Year. The quick lead time product, which is obligated to respond within 30 minutes compared to short lead at 60 minutes and long lead at 120 minutes, is also new for the 2014/2015 Delivery Year. The quick lead time product has 7.5 percent of all nominated MW with 704.0 MW and only 22 locations.

The quick lead time product was defined after the auctions cleared. FERC accepted PJM's proposed 30 minute lead time as a phased in approach on May 9, 2014.[27] PJM submitted a filing on October 20, 2014, to allow DR that is unable to respond within 30 minutes to exit the market without penalty before the mandatory 30 minute lead time with the 2015/2016 Delivery Year.[28]

Table 6-18 Lead time by product type: 2014/2015 Delivery Year

Lead Type	Product Type	Locations	Nominated MW
Long Lead (120 Minutes)	Annual and Extended Summer	2,079	1,130.9
	Limited	13,781	7,039.8
Short Lead (60 Minutes)	Annual, Extended Summer and Limited	55	485.7
Quick Lead (30 Minutes)	Annual and Limited	22	704.0
Total		15,937	9,360.3

Table 6-19 shows the number of customers and nominated MW by product type and lead time during the 2015/2016 Delivery Year. The quick lead time product is the default lead time for the 2015/2016 Delivery Year, unless a CSP submits an exception request for 60 or 120 minute notification time due to a physical constraint.[29] There were 3,174 locations which have 4,334.6 MW of nominated MW capacity approved by PJM to respond in 60 or 120 minutes.

27 See "Order Rejecting, in part, and Accepting, in part, Proposed Tariff Changes, Subject to Conditions," Docket No. ER14-822-001 (May 9, 2014).
28 See "PJM Interconnection, L.L.C.," Docket No. ER14-135-000 (October 20, 2014).
29 See "Manual 18: Capacity Market," Revision 2 (August 3, 2015), p. 57.

Table 6-19 Lead time by product type: 2015/2016 Delivery Year

Lead Type	Product Type	Locations	Nominated MW
Long Lead (120 Minutes)	Annual and Extended Summer	791	697
	Limited	1,957	3,058
Short Lead (60 Minutes)	Extended Summer and Limited	426	580
Quick Lead (30 Minutes)	Annual	191	174
	Extended Summer	3,723	2,043
	Limited	10,635	5,092
Total		17,723	11,643

Table 6-20 shows the MW registered by measurement and verification method and by load drop method for the 2014/2015 Delivery Year. Of the DR MW committed, 2.4 percent use the guaranteed load drop (GLD) measurement and verification method, 91.2 percent use the firm service level (FSL) method and 6.3 percent use direct load control (DLC).

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Table 6-20 Reduction MW by each demand response method: 2014/2015 Delivery Year

Program Type	On-site Generation MW	HVAC MW	Refrigeration MW	Lighting MW	Manufacturing MW	Water Heating or Other MW	Total	Percent by type
Firm Service Level	2,119.6	1,970.8	207.4	740.6	3,428.5	69.9	8,536.8	91.2%
Guaranteed Load Drop	25.2	152.9	1.8	12.2	33.9	0.5	226.6	2.4%
Non hourly metered sites (DLC)	0.0	551.1	0.0	0.0	0.0	41.0	592.1	6.3%
Total	2,144.7	2,674.8	209.2	752.8	3,462.4	111.4	9,355.4	100.0%
Percent by method	22.9%	28.6%	2.2%	8.0%	37.0%	1.2%	100.0%	

Table 6-21 shows the MW registered by measurement and verification method and by load drop method for the 2015/2016 Delivery Year. Of the DR MW committed, 1.6 percent use the guaranteed load drop (GLD) measurement and verification method, 94.3 percent use the firm service level (FSL) method and 4.1 percent use direct load control (DLC). FSL registrations increased by 2,437.9 MW while GLD registrations decreased by 38.8 MW and DLC registrations decreased by 111.9 MW from the 2014/2015 delivery year to the 2015/2016 delivery year.

Table 6-21 Reduction MW by each demand response method: 2015/2016 Delivery Year

Program Type	On-site Generation MW	HVAC MW	Refrigeration and Lighting MW	Manufacturing or Water Heating MW	Other, Batteries or Plug Load MW	Total MW	Percent by Type
Firm Service Level	2,636.7	2,541.3	1,162.8	4,575.0	58.8	10,974.6	94.3%
Guaranteed Load Drop	20.6	106.1	13.5	47.6	0.0	187.8	1.6%
Non hourly metered sites (DLC)	0.0	444.9	0.0	35.3	0.0	480.1	4.1%
Total	2,657.3	3,092.3	1,176.3	4,657.8	58.8	11,642.6	100.0%
Percent by method	22.8%	26.6%	10.1%	40.0%	0.5%	100.0%	

Table 6-22 shows the fuel type used in the on-site generators identified in Table 6-20 for the 2014/2015 Delivery Year. Of the 22.9 percent of emergency demand response identified as using on-site generation, 85.5 percent of MW are diesel, 11.7 percent are natural gas and 2.8 percent is coal, gasoline, kerosene, oil, propane or waste products.

Table 6-22 On-site generation fuel type by MW: 2014/2015 Delivery Year

Fuel Type	MW	Percent
Coal, Gasoline, Kerosene, Oil, Propane, Waste Products	59.6	2.8%
Diesel	1,834.1	85.5%
Natural Gas	251.0	11.7%
Total	2,144.7	100.0%

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Table 6-23 shows the fuel type used in the on-site generators identified in Table 6-21 for the 2015/2016 Delivery Year. Of the 22.8 percent of emergency demand response identified as using on-site generation, 84.7 percent of MW are diesel, 12.0 percent are natural gas and 3.3 percent is coal, gasoline, kerosene, oil, propane or waste products.

Table 6-23 On-site generation fuel type by MW: 2015/2016 Delivery Year

Fuel Type	MW	Percent
Coal, Gasoline, Kerosene, Oil, Propane, Waste Products	87.9	3.3%
Diesel	2,250.9	84.7%
Natural Gas	318.5	12.0%
Total	2,657.3	100.0%

Emergency Event Reported Compliance

PJM declared two events in 2015, one on April 21, 2015 and one on April 22, 2015. There were two events during the 2014/2015 Delivery Year, 13 events during the 2013/2014 Delivery Year, two events during the 2012/2013 Delivery Year and one event in the 2011/2012 Delivery Year. Since all of the events in 2015 were called in PENELEC and there were no annual Demand Resources there, none were considered in PJM's compliance assessment.[30] Table 6-24 shows the demand response cleared UCAP MW for PJM by Delivery Year. Total demand response cleared in PJM increased by 3.4 percent from 14,943 MW in the 2014/2015 Delivery Year to 15,453.7 MW in the 2015/2016 Delivery Year. The total percent of capacity resources in the 2015/2016 Delivery Year decreased by 0.4 percent from 9.3 percent in the 2014/2015 Delivery Year to 8.9 percent in the 2015/2016 Delivery Year.

Table 6-24 Demand response cleared MW UCAP for PJM: 2011/2012 through 2015/2016 Delivery Year

	2011/2012 Delivery Year		2012/2013 Delivery Year		2013/2014 Delivery Year		2014/2015 Delivery Year		2015/2016 Delivery Year	
	DR Cleared MW UCAP	DR Percent of Capacity MW UCAP	DR Cleared MW UCAP	DR Percent of Capacity MW UCAP	DR Cleared MW UCAP	DR Percent of Capacity MW UCAP	DR Cleared MW UCAP	DR Percent of Capacity MW UCAP	DR Cleared MW UCAP	DR Percent of Capacity MW UCAP
Total	1,826.6	1.4%	8,740.9	6.2%	10,779.6	6.7%	14,943.0	9.3%	15,453.7	8.9%

Table 6-25 lists PJM pre-emergency and emergency load management events declared in PJM in 2015 and the affected zones. Subzonal dispatch was mandatory for the 2014/2015 Delivery Year but only if the subzone is defined no later than the day before. The Erie subzone was not defined the day before the PJM event and therefore it could not be dispatched. The Erie subzone was defined on April 21, 2015, which made it eligible for the April 22, 2015, call. The PENELEC Zone was the only zone called for both events. All demand response events called in 2015 were voluntary, so no penalties are assessed for under compliance.

Table 6-25 PJM declared load management events: 2015

Event Date	Event Times	Compliance Hours	Minutes not Measured for Compliance	Lead Time	Geographical Area
21-Apr-15	20:20-21:30	None	70	Long Lead	PENELEC
	19:20-21:30	None	130	Short Lead	PENELEC
	18:50-21:30	None	160	Quick Lead	PENELEC
22-Apr-15	7:30-12:30	None	300	Long Lead	PENELEC
	6:30-12:30	None	360	Short Lead	PENELEC
	6:00-12:30	None	390	Quick Lead	PENELEC

Participants in the pre-emergency and emergency demand response program are paid based on the average performance by registration for the duration of a demand response event. Demand response should measure compliance hourly to accurately report reductions during demand response events. The current rules use the average reduction for the duration of an event. The average duration across multiple hours does not provide an accurate metric for each hour of the event. Measuring compliance hourly would provide accurate information to the PJM system. This would be consistent with the rules that apply to generation resources. The MMU recommends demand response event

30 Extended summer and limited demand response products do not need to respond in April.

compliance be calculated for each hour and the penalty structure reflect hourly compliance. With the new CP rules, demand response will be structured for hourly performance.

Subzonal dispatch by zip code is mandatory beginning on June 1, 2014, with the 2014/2015 Delivery Year only if the subzone is defined at least one day before dispatch. PJM allows compliance to be measured across zones within a compliance aggregation area (CAA). This changes the way CSPs dispatch resources when multiple electrically contiguous areas with the same RPM clearing prices are dispatched. The compliance rules determine how CSPs are paid and thus create incentives that CSPs will incorporate in their decisions about how to respond to PJM dispatch.[31] The multiple zone approach is less locational than the zonal and subzonal approach and creates larger mismatches between the locational need for the resources and the actual response. If multiple zones within a CAA are called by PJM, a CSP will dispatch the least cost resources across the zones to cover the CSP's obligation. This can result in more MW dispatched in one zone that are locationally distant from the need and 0 MW dispatched in another zone, yet the CSP could be considered 100 percent compliant and pay no penalties. More locational deployment of load management resources would improve efficiency. The MMU recommends that demand resources be required to provide their nodal location. Nodal dispatch of demand resources would be consistent with the nodal dispatch of generation.

Load increases are not netted against load decreases for dispatched demand resources across hours or across registrations within hours for compliance purposes, but are treated as zero. This skews the compliance results towards higher compliance since poorly performing demand resources are not used in the compliance calculation. When load is above the peak load contribution during a demand response event, the load reduction is negative; it is a load increase rather than a decrease. PJM ignores such negative reduction values and instead replaces the negative values with a zero MW reduction value. The PJM Tariff and PJM Manuals do not limit the compliance calculation value to a zero MW reduction value.[32] The compliance values PJM reports for demand response events are different than the actual compliance values accounting for both increases and decreases in load from demand resources that are called on and paid under the program.

31 See "Manual 18: Capacity Market," Revision 28 (August, 3, 2015) p. 152.
32 PJM. OATT Attachment K § PJM Emergency Load Response Program at Reporting and Compliance.

The MMU recommends that compliance rules be revised to include submittal of all necessary hourly load data, and that negative values be included when calculating event compliance across hours and registrations.

Emergency demand response customers that registered for economic demand response had an adjusted baseline for the emergency event days. The change of baseline resulted in a greater calculated load reduction for the PJM system emergency event days. The changes in reported load reductions reflect emergency resources registering as economic resources to have modified baselines for measurement during the emergency voluntary event days.

Table 6-26 shows the performance for the April 21, 2015, event. The nominated value column shows the reduction capability indicated for each registration. The nominated MW are used to fulfill the committed MW capacity obligation and may exceed the committed MW. The committed MW are the MW cleared in the RPM auction. The sixth column shows the reported load reduction in MW during the hours of an event. The reported load reduction is reported by PJM and does not include load increases. The seventh column shows the observed load reduction in MWh, which includes all reported reduction values, including load increases. The observed load reduction is calculated by the MMU. The observed load reduction is a conservative estimate of what occurred during the demand response events as load increases are not required to be reported. Compliance is calculated by comparing the load reduction during an event to the committed MW value. The average row is the average results across both events for the PENELEC Zone.

The PENELEC Zone did not have any annual demand resources, resulting in voluntary compliance from the limited and extended summer products. The reported compliance for the PENELEC Control Zone on April 21, 2015, was 9.7 percent, or 27.4 MW out of 281.5 MW committed. The observed compliance for the PENELEC Control Zone on April 21, 2015 was 9.1 percent,

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or 25.5 MW out of 281.5 MW committed. The reported compliance for the PENELEC Control Zone on April 22, 2015 was 13.6 percent, or 38.3 MW out of 281.5 MW committed. The observed compliance for the PENELEC Control Zone on April 22, 2015 was 13.0 percent, or 36.7 MW out of 281.5 MW committed. Overall, the reported compliance for the PENELEC Control Zone was 11.7 percent, or 32.9 MW out of 281.5 MW committed. The observed compliance was 11.0 percent, or 31.1 MW, a difference of 1.8 MW compared to the reported load reduction.

Table 6-26 Demand response event performance: April 21, 2015 and April 22, 2015

Event Date	Zone	Product Type	Nominated ICAP (MW)	Committed MW	Load Reduction Reported (MW)	Load Reduction Observed (MW)	Difference	Percent Compliance Reported	Percent Compliance Observed
21-Apr-15	PENELEC	Limited and Extended Summer	39.5	281.5	27.4	25.5	1.93	9.7%	9.1%
22-Apr-15	PENELEC	Limited and Extended Summer	40.8	281.5	38.3	36.7	1.67	13.6%	13.0%
Average	PENELEC	Limited and Extended Summer	40.1	281.5	32.9	31.1	1.80	11.7%	11.0%

Performance for specific customers varied significantly. Table 6-27 shows the distribution of participant event days by performance levels for the two events in the April 2015. Table 6-27 includes the participation for all resources dispatched for the emergency events. For these events, 45.9 percent of participant event days showed no reduction, load increased or participants did not report data. For these events, 61.4 percent of participants event days provided less than half of their nominated MW, while 58.7 percent of the nominated MW provided less than half of their nominated MW. There were 38.6 percent of participants that reduced more than 50 percent of their nominated MW, while 41.3 percent of the nominated MW reduced more than 50 percent of their nominated MW.

Table 6-27 Distribution of participant event days and nominated MW across ranges of performance levels across the events: 2015

Ranges of performance as a percent of nominated ICAP MW	Number of participant event days	Proportion of participant event days	Nominated MW	Proportion of Nominated MW
0%, load increase, or no reporting	101	45.9%	37.4	40.9%
0% - 50%	34	15.5%	16.4	17.9%
50% - 300%	85	38.6%	37.8	41.3%
Total	220	100.0%	91.6	100.0%

Definition of Compliance

Currently, the calculation methods of event and test compliance do not provide reliable results. PJM's interpretation of load management event rules allows over compliance to be reported when there is no actual over compliance. Settlement locations with a negative load reduction value (load increase) are not netted by PJM within registrations or within demand response portfolios. A resource that has load above their baseline during a demand response event has a calculated negative performance value. PJM limits compliance shortfall values at the nominated MW value for underperformance. This is not explicitly stated in the Tariff or supporting Manuals. According to the Tariff, the compliance formulas for FSL and GLD customers allow for negative compliance values.[33] For example, if a registration had two locations, one with a 50 MWh load increase when called, and another with a 75 MWh load reduction when called, compliance for that registration is calculated as a 75

33 PJM. OATT. PJM Emergency Load Response Program.

MWh load reduction for that event hour. Settlement MWh are not netted across hours or across registrations for compliance purposes. A location with a load increase is set to a zero MW reduction. For example, in a two hour event, if a registration showed a 15 MWh load increase in hour one, but a 30 MWh reduction in hour two, the registration would show a 0 MWh reduction in hour one and a 30 MWh reduction in hour two and an average hourly 15 MWh load reduction for that two hour event. Reported compliance is less than actual compliance, as locations with load increases, negative reductions, are treated as zero for compliance purposes.

Settlements that are not submitted to PJM are treated as zero compliance for the event. Registrations with negative compliance are treated as zero for the purposes of imposing penalties and reporting.

Changing a demand resource compliance calculation from a negative value to 0 MW inaccurately values event performance and capacity performance. Inflated compliance numbers for an event overstates the true value and capacity of demand resources. A demand response capacity resource that performs negatively is also displacing another capacity resource that could supply capacity during a delivery year. By setting the negative compliance value to 0 MW, PJM is inaccurately calculating the value of demand resources.

An extreme example makes clear the fundamental problems with the use of measurement and verification methods to define the level of power that would have been used but for the DR actions, and the payments to DR customers that result from these methods. The current rules for measurement and verification for Demand Resources make a bankrupt company, a customer that no longer exists due to closing of a facility or a permanently shut down company, or a company with a permanent reduction in peak load due to a partial closing of a facility, an acceptable demand response customer under some interpretations of the tariff, although it is the view of the MMU that such customers should not be permitted to be included as registered demand resources. Companies that remain in business but with a substantially reduced load can maintain their pre-bankruptcy FSL (firm service level to which the customer agrees to reduce in an event) commitment which can be greater than or equal to the post-bankruptcy total load. The customer agrees to reduce to a level which is greater than or equal to its new peak load after bankruptcy. When demand response events occur the customer would receive credit for 100 percent reduction, even though the customer took no action and could take no action to reduce load. This problem exists regardless of whether the customer is still paying for capacity. Such a customer no longer has the ability to reduce load in response to price or a PJM demand response event. CSPs in PJM have and continue to register bankrupt customers as DR customers. PJM finds acceptable the practice of CSPs maintaining the registration of customers with a bankruptcy related reduction in demand that are unable, as a result, to respond to emergency events.

Table 6-28 shows the number of locations that did not report during the April 2015 event days. In total, 37.7 percent of locations did not report during the event days in 2015 and were assigned zero load response and as a result there is no way to know whether the load at those locations increased. These locations accounted for 30.1 percent of all nominated MW for those events. Response was voluntary as there was not any Annual Demand Resources in the PENELEC Control Zone.

Table 6-28 Non-reporting locations and nominated ICAP: 2015 event days

	Locations not Reporting	Percent non Reporting	Nominated ICAP not Reporting	Percent non Reporting
Total	83	37.7%	34.6	30.1%

Emergency Energy Payments

For any PJM declared load management event in 2015, participants registered under the full option of the emergency load response program, which contains 99.6 percent of registrations, that were dispatched and demonstrated a load reduction were eligible to receive emergency energy payments. The emergency energy payments are equal to the higher of hourly zonal LMP or a strike price energy offer made by the participant, including a dollar per MWh minimum dispatch price and an associated shutdown cost. The new scarcity pricing rules increased the maximum DR energy price offer for the 2013/2014

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Delivery Year to $1,800 per MWh. The maximum offer decreased to $1,599 per MWh for the 2014/2015 Delivery Year and increased to $1,849 per MWh for the 2015/2016 Delivery Year. The maximum generator offer will remain at $1,000 per MWh.[34,35]

Participants may elect to be paid their emergency offer, regardless of the zonal LMP.

Shutdown costs for demand response resources are not adequately defined in Manual 15. PJM's Cost Development Subcommittee (CDS) approved changes to Manual 15 to eliminate shutdown costs for demand response resources participating in the Synchronized Reserve Market, but not the emergency or economic demand response program.[36]

Table 6-29 shows the distribution of registrations and associated MW in the emergency full option across ranges of minimum dispatch prices for the 2014/2015 Delivery Year. The majority of participants, 94.7 percent, have a minimum dispatch price between $1,000 and $1,100 per MWh, and 0.1 percent of participants have a dispatch price between $1,276 and $1,549 per MWh, which is the maximum price allowed for the 2014/2015 Delivery Year. Energy offers are further increased by submitted shutdown costs, which, in the 2014/2015 Delivery Year, range from $0 to more than $10,000. Depending on the size of the registration, the shutdown costs can significantly increase the effective energy offer. The shutdown cost of resources with $1,101 to $1,275 per MWh strike prices had the highest average at $160.05 per location and $141.56 per MW..

Table 6-29 Distribution of registrations and associated MW in the emergency full option across ranges of minimum dispatch prices: 2014/2015 Delivery Year[37]

Ranges of Strike Prices ($/MWh)	Locations	Percent of Total	Nominated MW (ICAP)	Percent of Total	Shutdown Cost per Location
$0-$1	570	3.6%	630.0	6.7%	$0.00
$1-$999	218	1.4%	160.9	1.7%	$28.54
$1,000-$1,100	15,101	94.7%	7,497.1	80.1%	$72.88
$1,101-$1,275	29	0.2%	368.7	3.9%	$160.05
$1,276-$1,549	21	0.1%	703.6	7.5%	$66.67
Total	15,939	100.0%	9,360.3	100.0%	$69.81

Table 6-30 shows the distribution of registrations and associated MW in the emergency full option across ranges of minimum dispatch prices for the 2015/2016 Delivery Year. The majority of participants, 77.0 percent, have a minimum dispatch price between $1,550 and $1,850 per MWh, which is the maximum price allowed for the 2015/2016 Delivery Year, and 3.4 percent of participants have a dispatch price between $0 and $1 per MWh. Energy offers are further increased by submitted shutdown costs, which, in the 2014/2015 Delivery Year, range from $0 to more than $10,000. Depending on the size of the registration, the shutdown costs can significantly increase the effective energy offer. The shutdown cost of resources with $1,000 to $1,100 per MWh strike prices had the highest average at $183.69 per location.

34 139 FERC ¶ 61,057 (2012).
35 FERC accepted proposed changes to have the maximum strike price for 30 minute demand response to be $1,000/MWh + 1*Shortage penalty - $1.00 from ER14-822-000.
36 PJM. "Manual 15: Cost Development Guidelines," Revision 26 (November 5, 2014), p. 54.

37 In this analysis nominated MW does not include capacity only resources, which do not receive energy market credits.

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Table 6-30 Distribution of registrations and associated MW in the emergency full option across ranges of minimum dispatch prices: 2015/2016 Delivery Year[38]

Ranges of Strike Prices ($/MWh)	Locations	Percent of Total	Nominated MW (ICAP)	Percent of Total	Shutdown Cost per Location	Shutdown Cost Per Nominated MW (ICAP)
$0-$1	609	3.4%	562.9	4.8%	$0.00	$0.00
$1-$999	192	1.1%	217.0	1.9%	$136.08	$120.42
$1,000-$1,100	2,850	16.1%	3,698.1	31.8%	$183.69	$141.56
$1,101-$1,275	0	0.0%	0.0	0.0%	$0.00	$0.00
$1,276-$1,549	422	2.4%	514.0	4.4%	$59.11	$48.53
$1,550-$1,850	13,650	77.0%	6,651.3	57.1%	$26.97	$55.35
Total	17,723	100.0%	11,643.2	100.0%	$53.19	$80.97

Table 6-31 includes the energy reduction MWh and average real time LMP during the two demand response event days. The first column shows the hour for each event day. The second column has the emergency demand response MWh reductions, which are calculated by comparing each resource's CBL to their actual load during the demand response event.[39] If a resource is registered for both the economic and emergency program, the economic CBL is used for the emergency CBL. If a resource is only registered under the emergency option, the CBL is the load during the hour before the reductions occur.[40] If a resource could reduce prior to their designated lead time, that resource was eligible for energy settlements. The average LMP columns show the average LMP for each hour of the event day based on the zones that were called. The hourly LMP during the demand response events peaked at $51.66 per MWh in the hour beginning 20 on April 21, 2015.

Table 6-31 Energy reduction MWh and average real-time LMP during demand response event days: 2015

	April 21, 2015		April 22, 2015	
Hour Beginning	MWh Reduction	Average LMP ($/MWh)	MWh Reduction	Average LMP ($/MWh)
0		23.02		25.71
1		23.07		24.53
2		21.10		22.90
3		21.81		22.32
4		23.85		23.79
5		26.28		24.18
6		30.72	30.9	48.87
7		30.01	42.3	37.34
8		30.07	50.3	27.57
9		26.12	53.8	28.64
10		28.01	50.9	29.87
11		28.22	52.1	31.96
12		26.83	44.0	30.09
13		27.34		33.10
14		27.02		29.43
15		27.11		30.45
16		29.29		27.44
17		29.62		30.83
18	7.6	27.76		27.32
19	11.8	27.32		30.38
20	19.6	51.66		43.51
21	34.9	31.02		38.22
22		23.28		25.84
23		18.88		23.84
Total	73.9	27.48	324.2	29.92

Table 6-32 shows emergency energy revenue for each event day in the first six months of 2015. Energy payments in the emergency program differ significantly from energy payments in the economic program and from capacity payments through the emergency load response program in that they are not based on or tied to any market price signal. Once an emergency demand response event is called for a zone or sub zone, payments are guaranteed if a resource is determined to have responded. Emergency demand response energy costs are paid by PJM market participants in proportion to their net purchases in the Real-Time Energy Market.[41] Emergency demand response energy costs are not

38 In this analysis nominated MW does not include capacity only resources, which do not receive energy market credits.
39 This table assumes that PJM's CBL calculation is correct.
40 See "PJM Manual 11: Energy & Ancillary Services," Revision 76 (August 3, 2015) p. 134.
41 PJM. "Manual 28: Operating Agreement Account," Revision 71 (June 1, 2015) p. 72.

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covered by LMP. All demand response energy payments and shutdown costs are out of market payments. These payments are 100 percent uplift.

The events in April were both voluntary events since there were not any annual demand resources in PENELEC. April 22, 2015 had the longest event and the most MWh reductions, resulting in total emergency revenue of $416,883. The total emergency revenue for the two voluntary emergency event days were $510,860.

Table 6-32 Emergency Revenue by event: 2015

Event Date	Total
April 21, 2015	$93,976
April 22, 2015	$416,883
Total	$510,860

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TAB J

This is Exhibit **"J"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

Demand Response

Markets require both a supply side and a demand side to function effectively. The demand side of wholesale electricity markets is underdeveloped. Wholesale power markets will be more efficient when the demand side of the electricity market becomes fully functional without depending on special programs as a proxy for full participation.

Overview

- **Demand Response Activity.** Demand response activity includes economic demand response (economic resources), emergency and pre-emergency demand response (demand resources), synchronized reserves and regulation. Economic demand response participates in the energy market. Emergency and pre-emergency demand response participates in the capacity market and energy market.[1] Demand response resources participate in the Synchronized Reserve Market. Demand response resources participate in the Regulation Market.

  In the first six months of 2019, total demand response revenue increased by $25.6 million, 9.4 percent, from $271.9 million in the first six months of 2018 to $297.5 million in the first six months of 2019. Emergency demand response revenue accounted for 99.0 percent of all demand response revenue, economic demand response for 0.2 percent, demand response in the Synchronized Reserve Market for 0.4 percent and demand response in the regulation market for 0.4 percent.

  Total emergency demand response revenue increased by $29.1 million, 10.9 percent, from $265.5 million in the first six months of 2018 to $294.6 million in the first six months of 2019. This increase consisted entirely of capacity market revenue.[2]

  Economic demand response revenue decreased by $1.0 million, 66.7 percent, from $1.6 million in the first six months of 2018 to $0.5 million in the first six months of 2019.[3] Demand response revenue in the Synchronized Reserve Market decreased by $2.0 million, 62.3 percent, from $3.2 million in the first six months of 2018 to $1.2 million in the first six months of 2019. Demand response revenue in the regulation market decreased by $0.5 million, 62.3 percent, from $1.6 million in the first six months of 2018 to $1.2 million in the first six months of 2019.

- **Demand Response Energy Payments are Uplift.** Energy payments to emergency and economic demand response resources are uplift. LMP does not cover energy payments although emergency and economic demand response can and does set LMP. Energy payments to emergency demand resources are paid by PJM market participants in proportion to their net purchases in the real-time market. Energy payments to economic demand resources are paid by real-time exports from PJM and real-time loads in each zone for which the load-weighted, average real-time LMP for the hour during which the reduction occurred is greater than or equal to the net benefits test price for that month.[4]

- **Demand Response Market Concentration.** The ownership of economic demand response resources was highly concentrated in 2018 and the first six months of 2019. The HHI for economic resource reductions increased by 373 points from 7541 in 2018 to 7914 in the first six months of 2019. The ownership of emergency demand response resources was moderately concentrated in the first six months of 2019. The HHI for emergency demand response committed MW was 1808 for the 2018/2019 Delivery Year and 1838 for the 2019/2020 Delivery Year. In the 2018/2019 Delivery Year, the four largest companies owned 78.1 percent of all committed demand response UCAP MW. In the 2019/2020 Delivery Year, the four largest companies owned 78.8 percent of all committed demand response UCAP MW.

- **Limited Locational Dispatch of Demand Resources.** Beginning with the 2014/2015 Delivery Year, demand resources that are not Capacity Performance, are dispatchable for mandatory reductions on a subzonal basis, defined by zip codes, but only if the subzone is defined at least one day before it is dispatched and only until PJM removes the definition of the subzone. Nodal dispatch of demand resources in a nodal market would

1 Emergency demand response refers to both emergency and pre-emergency demand response. With the implementation of the Capacity Performance design, there is no functional difference between the emergency and pre-emergency demand response resource.
2 The total credits and MWh numbers for demand resources were calculated as of July 23, 2019 and may change as a result of continued PJM billing updates.
3 Economic credits are synonymous with revenue received for reductions under the economic load response program.
4 "PJM Manual 28: Operating Agreement Accounting," § 11.2.2, Rev. 82 (July 25, 2019).

improve market efficiency. The goal should be nodal dispatch of demand resources with no advance notice required, as is the case for generation resources. With full implementation of the Capacity Performance rules in the capacity market starting with the 2020/2021 Delivery Year, PJM will be able to individually dispatch demand resources with no advanced notice, although PJM does not know the nodal location of demand resources.

Recommendations

The MMU recognizes that PJM incorporated some of the recommendations related to demand response in the Capacity Performance filing. The status of each recommendation reflects the status at June 30, 2019.

- The MMU recommends, as a preferred alternative to including demand resources as supply in the capacity market, that demand resources be on the demand side of the markets, that customers be able to avoid capacity and energy charges by not using capacity and energy at their discretion, that customer payments be determined only by metered load, and that PJM forecasts immediately incorporate the impacts of demand side behavior. (Priority: High. First reported 2014. Status: Not adopted.)
- The MMU recommends that the option to specify a minimum dispatch price (strike price) for demand resources be eliminated and that participating resources receive the hourly real-time LMP less any generation component of their retail rate. (Priority: Medium. First reported 2010. Status: Not adopted.)
- The MMU recommends that the maximum offer for demand resources be the same as the maximum offer for generation resources. (Priority: Medium. First reported 2013. Status: Not adopted.)
- The MMU recommends that the demand resources be treated as economic resources, responding to economic price signals like other capacity resources. The MMU recommends that demand resources not be treated as emergency resources, not trigger a PJM emergency and not trigger a Performance Assessment Interval. (Priority: High. First reported 2012. Status: Not adopted.)
- The MMU recommends that the Emergency Program Energy Only option be eliminated because the opportunity to receive the appropriate energy market incentive is already provided in the economic program. (Priority: Low. First reported 2010. Status: Not adopted.)
- The MMU recommends that, if demand resources remain in the capacity market, a daily energy market must offer requirement apply to demand resources, comparable to the rule applicable to generation capacity resources.[5] (Priority: High. First reported 2013. Status: Not adopted.)
- The MMU recommends that demand resources be required to provide their nodal location, comparable to generation resources. (Priority: High. First reported 2011. Status: Not adopted.)
- The MMU recommends that PJM require nodal dispatch of demand resources with no advance notice required or, if nodal location is not required, subzonal dispatch of demand resources with no advance notice required. (Priority: High. First reported 2015. Status: Not adopted.)
- The MMU recommends that PJM not remove any defined subzones and maintain a public record of all created and removed subzones. (Priority: Low. First reported 2016. Status: Not adopted.)
- The MMU recommends that PJM eliminate the measurement of compliance across zones within a compliance aggregation area (CAA). The multiple zone approach is less locational than the zonal and subzonal approach and creates larger mismatches between the locational need for the resources and the actual response. (Priority: High. First reported 2015. Status: Not adopted.)
- The MMU recommends that measurement and verification methods for demand resources be modified to reflect compliance more accurately. (Priority: Medium. First reported 2009. Status: Not adopted.)
- The MMU recommends that compliance rules be revised to include submittal of all necessary hourly load data, and that negative values be included when calculating event compliance across hours and registrations. (Priority: Medium. First reported 2012. Status: Not adopted.)

5 See "Complaint and Motion to Consolidate of the Independent Market Monitor for PJM," Docket No. EL14-20-000 (January 27, 2014) at 1.

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- The MMU recommends that PJM adopt the ISO-NE five-minute metering requirements in order to ensure that operators have the necessary information for reliability and that market payments to demand resources be calculated based on interval meter data at the site of the demand reductions.[6] (Priority: Medium. First reported 2013. Status: Not adopted.)
- The MMU recommends limited, extended summer and annual demand response event compliance be calculated on an hourly basis for noncapacity performance resources and on a five minute basis for all capacity performance resources and that the penalty structure reflect five minute compliance. (Priority: Medium. First reported 2013. Status: Partially adopted.)
- The MMU recommends that load management testing be initiated by PJM with limited warning to CSPs in order to more accurately represent the conditions of an emergency event. (Priority: Low. First reported 2012. Status: Not adopted.)
- The MMU recommends that shutdown cost be defined as the cost to curtail load for a given period that does not vary with the measured reduction or, for behind the meter generators, be the start cost defined in Manual 15 for generators. (Priority: Low. First reported 2012. Status: Not adopted.)
- The MMU recommends that the Net Benefits Test be eliminated and that demand response resources be paid LMP less any generation component of the applicable retail rate. (Priority: Low. First reported 2015. Status: Not adopted.)
- The MMU recommends that the tariff rules for demand response clarify that a resource and its CSP, if any, must notify PJM of material changes affecting the capability of the resource to perform as registered and must terminate or modify registrations that are no longer capable of responding to PJM dispatch directives at defined levels because load has been reduced or eliminated, as in the case of bankrupt and/or out of service facilities. (Priority: Medium. First reported 2015. Status: Not adopted.)
- The MMU recommends that there be only one demand response product in the capacity market, with an obligation to respond when called for any hour of the delivery year. (Priority: High. First reported 2011. Status: Partially adopted.[7])
- The MMU recommends that the lead times for demand resources be shortened to 30 minutes with an hour minimum dispatch for all resources. (Priority: Medium. First reported 2013. Status: Partially adopted.)
- The MMU recommends setting the baseline for measuring capacity compliance under winter compliance at the customers' PLC, similar to GLD, to avoid double counting. (Priority: High. First reported 2010. Status: Partially adopted.)
- The MMU recommends the Relative Root Mean Squared Test be required for all demand resources with a CBL. (Priority: Low. First reported 2017. Status: Partially adopted.)
- The MMU recommends that PRD be required to respond during a PAI to be consistent with all CP resources. (Priority: High. First reported 2017. Status: Not adopted.)
- The MMU recommends that the limits imposed on the pre-emergency and emergency demand response share of the Synchronized Reserve Market be eliminated. (Priority: Medium. First reported 2018. Status: Not adopted.)
- The MMU recommends that 30 minute pre-emergency and emergency demand response be considered to be 30 minute reserves. (Priority: Medium. First reported 2018. Status: Not adopted.)
- The MMU recommends that energy efficiency MW not be included in the PJM capacity market and that PJM should ensure that the impact of EE measures on the load forecast is incorporated immediately rather than with the existing lag. (Priority: Medium. First reported 2018. Status: Not adopted.)
- The MMU recommends that demand reductions based entirely on behind the meter generation be capped at the lower of economic maximum or actual generation output. (Priority: High. New recommendation. Status: Not adopted.)

6 See ISO-NE Tariff, Section III, Market Rule 1, Appendix E1 and Appendix E2, "Demand Response," <http://www.iso-ne.com/regulatory/tariff/sect_3/mr1_append-e.pdf>. (Accessed October 17, 2017) ISO-NE requires that DR have an interval meter with five-minute data reported to the ISO and each behind the meter generator is required to have a separate interval meter. After June 1, 2017, demand response resources in ISO-NE must also be registered at a single node.

7 PJM's Capacity Performance design requires resources to respond when called for any hour of the delivery year.

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Conclusion

A fully functional demand side of the electricity market means that end use customers or their designated intermediaries will have the ability to see real-time energy price signals in real time, will have the ability to react to real-time prices in real time and will have the ability to receive the direct benefits or costs of changes in real-time energy use. In addition, customers or their designated intermediaries will have the ability to see current capacity prices, will have the ability to react to capacity prices and will have the ability to receive the direct benefits or costs of changes in the demand for capacity in the same year in which demand for capacity changes. A functional demand side of these markets means that customers will have the ability to make decisions about levels of power consumption based both on how customers value the power and on the actual cost of that power.

In the energy market, if there is to be a demand side program, demand resources should be paid the value of energy, which is LMP less any generation component of the applicable retail rate. There is no reason to have the net benefits test. The necessity for the net benefits test is an illustration of the illogical approach to demand side compensation embodied in paying full LMP to demand resources. The benefit of demand side resources is not that they suppress market prices, but that customers can choose not to consume at the current price of power, that individual customers benefit from their choices and that the choices of all customers are reflected in market prices. If customers face the market price, customers should have the ability to not purchase power and the market impact of that choice does not require a test for appropriateness.

If demand resources are to continue competing directly with generation capacity resources in the PJM Capacity Market, the product must be defined such that it can actually serve as a substitute for generation. This is a prerequisite to a functional market design. The Capacity Performance demand response product definition in the PJM Capacity Performance capacity market design is a significant step in that direction, although performance obligations are still not identical to other capacity resources. Demand resources do not have a must offer requirement into the day-ahead energy market, are able to offer above $1,000 per MWh without providing a fuel cost policy, or any rationale for the offer. PJM automatically triggers a PAI when demand resources are dispatched and demand resources do not have telemetry requirements similar to other Capacity Performance resources.

In order to be a substitute for generation, demand resources should be defined in PJM rules as an economic resource, as generation is defined. Demand resources should be required to offer in the Day-Ahead Energy Market and should be called when the resources are required and prior to the declaration of an emergency. Demand resources should be available for every hour of the year. The fact that PJM currently defines demand resources as emergency resources and the fact that calling on demand resources triggers a performance assessment interval (PAI) under the Capacity Performance design, both serve as a significant disincentive to calling on demand resources and mean that demand resources are underused. Demand resources should be treated as economic resources like any other capacity resource. Demand resources should be called when economic and paid the LMP rather than an inflated strike price up to $1,849 per MWh that is set by the seller.

In order to be a substitute for generation, demand resources should be subject to robust measurement and verification techniques to ensure that transitional DR programs incent the desired behavior. The methods used in PJM programs today are not adequate to determine and quantify deliberate actions taken to reduce consumption.

In order to be a substitute for generation, demand resources should provide a nodal location and should be dispatched nodally to enhance the effectiveness of demand resources and to permit the efficient functioning of the energy market. Both subzonal and multi-zone compliance should be eliminated because they are inconsistent with an efficient nodal market.

In order to be a substitute for generation, compliance by demand resources with PJM dispatch instructions should include both increases and decreases in load. The current method applied by PJM simply ignores increases in load and thus artificially overstates compliance.

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In order to be a substitute for generation, reductions should be calculated hourly for dispatched DR. The current rules use the average reduction for the duration of an event. The average reduction across multiple hours does not provide an accurate metric for each hour of the event and is inconsistent with the measurement of generation resources. Measuring compliance hourly would provide accurate information to the PJM system. Under the new CP rules, the performance of demand response during Performance Assessment Interval (PAI) will be measured on a five-minute basis.

In order to be a substitute for generation, any demand resource and its Curtailment Service Provider (CSP), should be required to notify PJM of material changes affecting the capability of the resource to perform as registered and to terminate or modify registrations that are no longer capable of responding to PJM dispatch directives at the specified level, such as in the case of bankrupt and out of service facilities. Generation resources are required to inform PJM of any change in availability status, including outages and shutdown status.

As a preferred alternative, demand response resources should be on the demand side of the capacity market rather than on the supply side. Rather than detailed demand response programs with their attendant complex and difficult to administer rules, customers would be able to avoid capacity and energy charges by not using capacity and energy at their discretion and the level of usage paid for would be defined by metered usage rather than a complex and inaccurate measurement protocol.

The MMU peak shaving proposal at the Summer-Only Demand Response Senior Task Force (SODRSTF) is an example of how to create a demand side product that is on the demand side of the market and not on the supply side.[8] The MMU proposal was based on the BGE load forecasting program and Pennsylvania Act 129 Utility Program.[9] [10] Under the MMU proposal, participating load would inform PJM prior to an RPM auction of the MW participating, the months and hours of participation and the temperature humidity index (THI) threshold at which load would be reduced. PJM would reduce the load forecast used in the RPM auction based on the designated reductions. Load would agree to curtail demand to at or below a defined FSL, less than the customer PLC, when the THI exceeds a defined level or load exceeds a specified threshold. By relying on metered load and the PLC, load can reduce its demand for capacity and that reduction can be verified without complicated and inaccurate metrics to estimate load reductions. Under PJM's weakened version of the program, performance will be measured under the current economic demand response CBL rules which means relying on load estimates rather than actual metered load.[11] PJM's proposal includes only a THI curtailment trigger and not an overall load curtailment trigger.

The long term appropriate end state for demand resources in the PJM markets should be comparable to the demand side of any market. Customers should use energy as they wish and that usage will determine the amount of capacity and energy for which each customer pays. There would be no counterfactual measurement and verification.

Under this approach, customers that wish to avoid capacity payments would reduce their load during expected high load hours. Capacity costs would be assigned to LSEs and by LSEs to customers, based on actual load on the system during these critical hours. Customers wishing to avoid high energy prices would reduce their load during high price hours. Customers would pay for what they actually use, as measured by meters, rather than relying on flawed measurement and verification methods. No M&V estimates are required. No promises of future reductions which can only be verified by M&V are required. To the extent that customers enter into contracts with CSPs or LSEs to manage their payments, M&V can be negotiated as part of a bilateral commercial contract between a customer and its CSP or LSE.

This approach provides more flexibility to customers to limit usage at their discretion. There is no requirement to be available year round or every hour of every day. There is no 30 minute notice requirement. There is no requirement

8 See the MMU package within the *SODRSTF Matrix*, <http://www.pjm.com/-/media/committees-groups/task-forces/sodrstf/20180802/20180802-item-04-sodrstf-matrix.ashx>.

9 *Advance signals that can be used to foresee demand response days*, BGE, <https://www.pjm.com/-/media/committees-groups/task-forces/sodrstf/20180309/20180309-item-05-bge-load-curtailment-programs.ashx> (Accessed March 6, 2019).

10 *Pennsylvania ACT 129 Utility Program*, CPower, <https://www.pjm.com/-/media/committees-groups/task-forces/sodrstf/20180413/20180413-item-03-pa-act-129-program.ashx> (Accessed March 6, 2019).

11 The PJM proposal from the SODRSTF weakened the proposal but was approved at the October 25, 2018 Members Committee meeting and PJM filed Tariff changes on December 7, 2018. See "Peak Shaving Adjustment Proposal," Docket No. ER19-511-000 (December 7, 2018).

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to offer energy into the day-ahead market. All decisions about interrupting are up to the customers only and they may enter into bilateral commercial arrangements with CSPs at their sole discretion. Customers would pay for capacity and energy depending solely on metered load.

A transition to this end state should be defined in order to ensure that appropriate levels of demand side response are incorporated in PJM's load forecasts and thus in the demand curve in the capacity market for the next three years. That transition should be defined by the PRD rules, modified as proposed by the MMU.

This approach would work under the CP design in the capacity market. This approach is entirely consistent with the Supreme Court decision in *EPSA* as it does not depend on whether FERC has jurisdiction over the demand side. This approach will allow FERC to more fully realize its overriding policy objective to create competitive and efficient wholesale energy markets. The decision of the Supreme Court addressed jurisdictional issues and did not address the merits of FERC's approach. The Supreme Court's decision has removed the uncertainty surrounding the jurisdictional issues and created the opportunity for FERC to revisit its approach to demand side.

PJM Demand Response Programs

All PJM demand response programs can be grouped into economic, emergency and pre-emergency programs, or Price Responsive Demand (PRD). Under current rules, there is no functional difference between pre-emergency and emergency demand resources. Table 6-1 provides an overview of the key features of PJM demand response programs.

The current PRD rules do not align with the definition of capacity under the Capacity Performance construct despite PJM's attempt to create alignment.[12] The PJM proposed rule changes do not require reductions during PAI unless LMP is above the specified price threshold. PJM incorrectly values PRD capacity and measured performance.[13] Similar to emergency and pre-emergency demand response, PJM would limit the nominated MW for PRD resources to the lower of the Peak Load Contribution (PLC) minus the Firm Service Level (FSL) times the loss factor (LF) or the Winter Peak Load (WPL) multiplied by the Zonal Winter Weather Adjustment Factor (ZWWAF) minus the winter Firm Service Level (wFSL) times the loss factor for each zone.

$$PRD\ Value = Min\{(PLC - FSL * LF), (WPL * ZWWAF - wFSL)\} * zonal\ loss\ factor$$

Use of the WPL would artificially limit the amount of MW that can participate as PRD if the WPL is less than the PLC. The Commission rejected PJM's filing regarding PRD on June 27, 2019 for these reasons.[14]

Demand response activity includes economic demand response (economic resources), emergency and pre-emergency demand response (demand resources), synchronized reserves and regulation. Economic demand response participates in the energy market. Emergency and pre-emergency demand response participate in the capacity market and energy market.[15] Demand response resources participate in the Synchronized Reserve Market. Demand response resources participate in the regulation market.

All demand resources must register as pre-emergency unless the participant relies on behind the meter generation and the resource has environmental restrictions that limit the resource's ability to operate only in emergency conditions.[16] Under current rules, PJM will declare an emergency if pre-emergency or emergency demand response is dispatched. In all demand response programs, CSPs are companies that sign up customers that have the ability to reduce load. After a demand response event occurs, PJM compensates CSPs for their participants' load reductions and CSPs in turn compensate their participants. Only CSPs are eligible to participate in the PJM demand response programs, but a participant can register as a PJM special member and become a CSP without any additional cost.

12 See "Proposed Amendments to Price Response Demand Rules," Docket No. ER19-1012-000 (February 7, 2019).
13 See "Comments of the Independent Market Monitor for PJM," Docket No. ER19-1012 (February 28, 2019).
14 See 167 FERC ¶ 61,268 (June 27, 2019).
15 Emergency demand response refers to both emergency and pre-emergency demand response. With the implementation of the Capacity Performance design, there is no functional difference between the emergency and pre-emergency demand response resource.
16 OA Schedule 1 § 8.5.

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PRD does not receive direct capacity or energy payments. PRD reduces the amount of capacity that must be purchased by the LSE and therefore reduces the LSE's payments for capacity. When PRD load is not on the system, that load also avoids paying for the associated energy. PRD meets its obligation by responding when LMP is at or above price thresholds defined in the PRD plan.[17] PRD does not have to respond during performance assessment intervals (PAI) and therefore is inferior to other capacity resources and is not a substitute for other capacity resources in the capacity performance construct. The MMU recommends that PRD be required to respond during a PAI to be consistent with all CP resources. PRD first cleared the capacity market in the BRA for the 2020/2021 Delivery Year, and cleared for the 2021/2022 Delivery Year.[18]

Non-PJM Demand Response Programs

Within the PJM footprint, states may have additional demand response programs as part of a Renewable Portfolio Standard (RPS) or a separate program. Indiana, Ohio, Pennsylvania and North Carolina include demand response in their RPS. If demand response is dispatched by a state run program, the demand response resources are ineligible to receive payments from PJM during the state dispatch.

Table 6-1 Overview of demand response programs

	Emergency and Pre-Emergency Load Response Program			Economic Load Response Program	Price Responsive Demand
	Load Management (LM)				
Market	Capacity Only	Capacity and Energy	Energy Only	Energy Only	Capacity Only
Capacity Market	DR cleared in RPM	DR cleared in RPM	Not included in RPM	Not included in RPM	PRD cleared in RPM
Dispatch Requirement	Mandatory Curtailment	Mandatory Curtailment	Voluntary Curtailment	Dispatched Curtailment	Price Threshold
Penalties	RPM event or test compliance penalties	RPM event or test compliance penalties	NA	NA	RPM event or test compliance penalties
Capacity Payments	Capacity payments based on RPM clearing price	Capacity payments based on RPM clearing price	NA	NA	Avoided capacity costs
Energy Payments	No energy payment	Energy payment based on submitted higher of "minimum dispatch price" and LMP. Energy payment during PJM declared Emergency Event mandatory curtailments.	Energy payment based on submitted higher of "minimum dispatch price" and LMP. Energy payment only for voluntary curtailments.	Energy payment based on full LMP. Energy payment for hours of dispatched curtailment.	NA

17 The Demand Response Subcommittee (DRS) is currently working to align PRD with the CP designed products.

18 There were a total of 558 MW of cleared PRD in the 2020/2021 Delivery Year. See PJM Auction Results <https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2020-2021-base-residual-auction-results.ashx?la=en>.

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Participation in Demand Response Programs

On April 1, 2012, FERC Order No. 745 was implemented in the PJM economic program, requiring payment of full LMP for dispatched demand resources when a net benefits test (NBT) price threshold is exceeded. This approach replaced the payment of LMP minus the charges for wholesale power and transmission included in customers' tariff rates.

Order No. 719 required PJM and other RTOs to amend their market rules to accept bids from aggregators of retail customers of utilities unless the laws or regulations of the relevant electric retail regulatory authority ("RERRA") do not permit the customers aggregated in the bid to participate.[19] PJM implemented rules that require PJM to verify with EDCs that no law or regulation of a RERRA prohibits an end use customers' participation.[20] EDCs and their end use customers are categorized as small and large based on whether the EDC distributed more or less than 4 million MWh in the previous fiscal year. End use customers within a large EDC must provide verification of any other contractual obligations or laws or regulations that prohibit participation, but end use customers within a small EDC do not need to provide additional verification.[21] RERRAs have permitted EDCs, in a number of cases, to participate in the PJM Economic Load Response Program. There are 188 active RERRAs within PJM.

Figure 6-1 shows all revenue from PJM demand response programs by market for the first six months of 2008 through 2019. Since the implementation of the RPM Capacity Market on June 1, 2007, the capacity market (demand resources) has been the primary source of demand response revenue.[22] In the first six months of 2019, total demand response revenue increased by $25.6 million, 9.4 percent, from $272.0 million in the first six months of 2018 to $297.5 million in the first six months of 2019. Total emergency demand response revenue increased by $29.1 million, 10.9 percent, from $265.5 million in the first six months of 2018 to $294.6 million in the first six months of 2019. This increase consisted entirely of capacity market revenue.[23] In the first six months of 2019, demand resource revenue, which includes capacity and emergency energy revenue, accounted for 99.0 percent of all revenue received by demand response providers, the economic program for 0.2 percent, synchronized reserve for 0.4 percent and the regulation market for 0.4 percent.

Economic demand response revenue decreased by $1.0 million, 66.7 percent, from $1.6 million in the first six months of 2018 to $0.5 million in the first six months of 2019.[24] Demand response revenue in the Synchronized Reserve Market decreased by $2.0 million, 62.3 percent, from $3.2 million in the first six months of 2018 to $1.2 million in the first six months of 2019. Demand response revenue in the regulation market decreased by $0.5 million, 28.8 percent, from $1.6 million in the first six months of 2018 to $1.2 million in the first six months of 2019.

Higher demand resource revenues were in part a result of higher capacity market prices in the 2018/2019 RPM auction clearing price. The capacity revenue in 2018 is from 2017/2018 RPM auction clearing prices and the capacity revenue in 2019 is from 2018/2019 RPM auction clearing prices. The annual capacity market prices increased $13.20 per MW-day from $151.50 in the 2017/2018 Delivery Year to $164.77 in the 2018/2019 Delivery Year, a 8.7 percent increase.

19 *Wholesale Competition in Regions with Organized Electric Markets*, Order No. 719, FERC Stats. & Regs. ¶ 31,281 at P 154 (2008), *order on reh'g*, Order No. 719-A, FERC Stats. & Regs. ¶ 31,292, *order on reh'g*, Order No. 719-B, 129 FERC ¶ 61,252 (2009).

20 The evidence supplied by LDCs must take the form of an order, resolution or ordinance of the RERRA, an opinion of the RERRA's legal counsel attesting to existence of an order, resolution, or ordinance, or an opinion of the state attorney general on behalf of the RERRA attesting to existence of an order, resolution or ordinance.

21 PJM Operating Agreement Schedule 1 § 1.5A.3.1.

22 This includes both capacity market revenue and emergency energy revenue for capacity resources.

23 The total credits and MWh for demand resources were calculated as of July 17, 2019 and may change as a result of continued PJM billing updates. There was no emergency energy revenue in the first six months of 2019.

24 Economic credits are synonymous with revenue received for reductions under the economic load response program.

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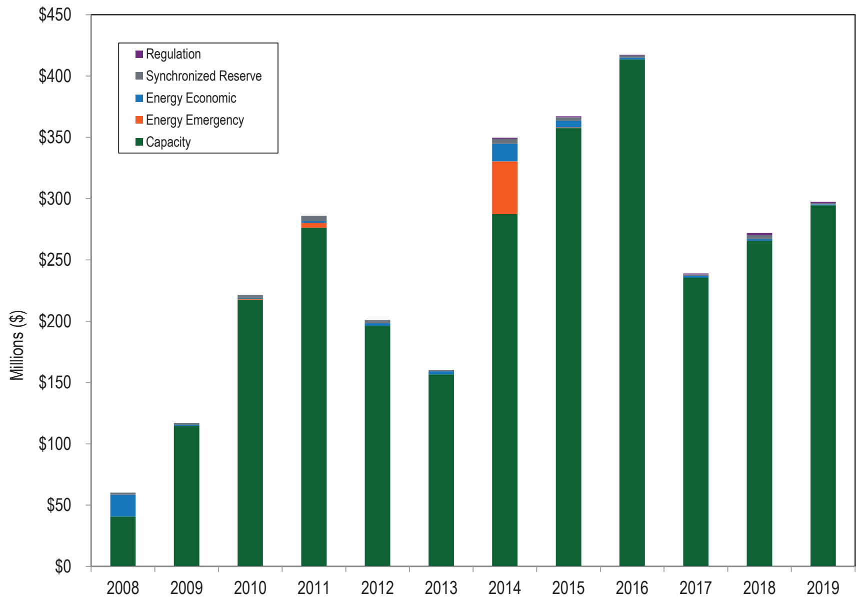
Figure 6-1 Demand response revenue by market: January through June, 2008 through 2019



Economic Program

FERC Order No. 831 requires all energy offers above $1,000 per MWh to provide supporting documentation.[25] Economic resources offer into the energy market and must provide supporting documentation to offer above $1,000 per MWh. FERC stated, "[t]he offer cap reforms, however, do not apply to capacity-only demand response resources that do not submit incremental energy offers into energy markets."[26] Demand resources participate in both the capacity and energy markets and are not capacity only resources. It is not clear whether FERC intended to exclude demand resources with high strike prices from the requirements of Order No. 831. Demand resources should not be permitted to make offers above $1,000 per MWh without the same verification requirements applied to economic resources or generation resources. The MMU recommends that the rules for maximum offer for the emergency and pre-emergency program match the maximum offer for generation resources.

Table 6-2 shows registered sites and MW for the last day of each month for the period January 1, 2015, through June 30, 2019. Registration is a prerequisite for CSPs to participate in the economic program. The monthly average number of registrations for economic demand response decreased and the monthly average registered MW increased in the first six months of 2019 compared to the first six months of 2018. Average monthly registrations decreased by 121, 24.4 percent, from 494 in the first six months of 2018 to 373 in the first six months of 2019. Average monthly registered MW increased by 192 MW, 7.4 percent, from 2,609 MW in the first six months of 2018 to 2,801 MW in the first six months of 2019.

Most economic demand response resources are registered in the emergency demand response program. Resources registered in both programs do not need to register for the same amount of MW. There are 144 registrations and 991 nominated MW in the economic program, or 183 registrations and 573 nominated MW in the emergency program.

25 157 FERC ¶ 61,115 (2016).
26 *Id.* at 8.

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Table 6-2 Economic program registrations on the last day of the month: 2015 through 2019[27]

	2015		2016		2017		2018		2019	
Month	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW	Registrations	Registered MW
Jan	1,078	2,960	838	2,557	871	2,603	537	2,570	375	2,702
Feb	1,076	2,956	835	2,557	842	2,578	537	2,628	371	2,690
Mar	1,075	2,949	834	2,556	850	2,576	519	2,641	379	2,698
Apr	1,076	2,938	832	2,556	897	2,574	501	2,624	367	2,645
May	980	2,846	829	2,545	977	2,626	471	2,615	374	3,248
Jun	871	2,614	518	2,500	577	1,305	397	2,576	372	2,823
Jul	870	2,609	519	2,421	589	1,548	374	2,591		
Aug	869	2,609	805	2,569	590	1,541	382	2,609		
Sep	867	2,608	831	2,608	588	1,663	378	2,580		
Oct	858	2,568	822	2,564	574	1,660	382	2,584		
Nov	851	2,566	820	2,564	559	1,662	381	2,581		
Dec	850	2,566	807	2,561	556	1,659	392	2,671		
Avg	974	2,788	774	2,547	706	2,000	438	2,606	373	2,801

The registered MW in the economic load response program are not a good measure of the MW available for dispatch in the energy market. Economic resources can dispatch up to the amount of MW registered in the program, but are not required to offer any MW. Table 6-3 shows the sum of peak economic MW dispatched by registration each month from January 1, 2010, through June 30, 2019. The monthly peak is the sum of each registration's monthly noncoincident peak dispatched MW and annual peak is the sum of each registration's annual noncoincident peak dispatched MW. The peak dispatched MW for all economic demand response registered resources decreased by 97 MW, 49.7 percent, from 195 MW in the first six months of 2018 to 98 MW in the first six months of 2019.[28] The peak dispatched MW in the first six months of 2019, 98 MW, were 2,703 MW less than the average MW registered in the first six months of 2019, 2,801 MW.

Table 6-3 Sum of peak MW reductions for all registrations per month: 2010 through June 2019

	Sum of Peak MW Reductions for all Registrations per Month									
Month	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Jan	183	132	110	193	446	169	139	123	142	88
Feb	121	89	101	119	307	336	128	83	70	58
Mar	115	81	72	127	369	198	120	111	71	38
Apr	111	80	108	133	146	143	118	54	71	41
May	172	98	143	192	151	161	131	169	70	21
Jun	209	561	954	433	483	833	121	240	105	5
Jul	999	561	1,631	1,088	665	1,362	1,316	936	518	
Aug	794	161	952	497	358	272	249	141	581	
Sep	276	84	451	530	795	816	263	140	112	
Oct	118	81	242	168	214	136	150	88	69	
Nov	111	86	165	155	166	127	116	81	54	
Dec	114	88	98	168	155	122	147	83	11	
Annual	1,202	840	1,942	1,486	1,739	1,858	1,451	1,217	758	98

27 Data for years 2010 through 2014 are available in the *2018 State of the Market Report for PJM.*
28 The total credits and MWh numbers for demand resources were calculated as of July 17, 2019 and may change as a result of continued PJM billing updates.

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Emergency and economic demand response energy payments are uplift and not compensated by LMP revenues. Economic demand response energy costs are assigned to real-time exports from the PJM Region and real-time loads in each zone for which the load-weighted average real-time LMP for the hour during which the reduction occurred is greater than the price determined under the net benefits test for that month.[29] The zonal allocation is shown in Table 6-13.

Table 6-4 shows the total MW reductions made by participants in the economic program and the total credits paid for these reductions in the first six months of 2010 through 2019. The average credits per MWh paid decreased by $10.24 per MWh, 19.1 percent, from $53.74 per MWh in the first six months of 2018 to $43.50 per MWh in the first six months of 2019. The PJM real-time, load-weighted, average LMP was 35.2 percent lower in the first six months of 2019 than in the first six months of 2018, $27.49 per MWh versus $42.44 per MWh. Curtailed energy for the economic program decreased by 17,167 MWh, 58.9 percent, from 29,155 MWh in the first six months of 2018 to 11,988 MWh in the first six months of 2019. Total credits paid for economic DR in the first six months of 2018 decreased by $1.0 million, 66.7 percent, from $1.6 million in the first six months of 2018 to $0.5 million in the first six months of 2019.

Table 6-4 Credits paid to the PJM economic program participants: January through June, 2010 through 2019

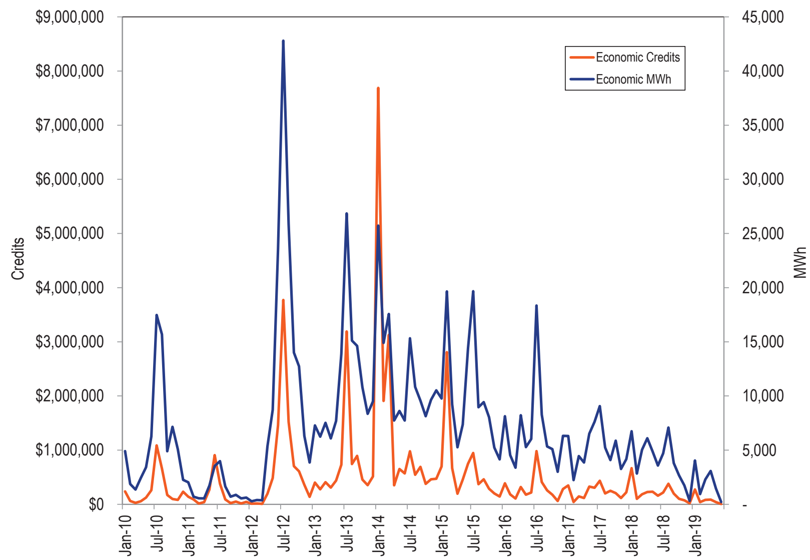
(Jan-Jun)	Total MWh	Total Credits	$/MWh
2010	20,225	$761,854	$37.67
2011	9,055	$1,456,324	$160.84
2012	38,692	$2,172,454	$56.15
2013	48,711	$2,559,831	$52.55
2014	82,273	$14,298,502	$173.79
2015	65,653	$5,576,152	$84.93
2016	35,559	$1,381,972	$38.86
2017	30,954	$1,281,762	$41.41
2018	29,155	$1,566,879	$53.74
2019	11,988	$521,491	$43.50

29 "PJM Manual 28: Operating Agreement Accounting," § 11.2.2, Rev. 82 (July 25, 2019).

Economic demand response resources that are dispatched by PJM in both the economic and emergency programs are paid the higher price defined in the emergency rules.[30] For example, assume a demand resource has an economic offer price of $100 per MWh and an emergency strike price of $1,800 per MWh. If this resource were scheduled to reduce in the Day-Ahead Energy Market, the demand resource would receive $100 per MWh, but if an emergency event were called during the economic dispatch, the demand resource would receive its emergency strike price of $1,800 per MWh instead. The rationale for this rule is not clear.[31] All other resources that clear in the day-ahead market are financially firm at the clearing price. Payment at a guaranteed strike price and the ability to set energy market prices at the strike price effectively grant the seller the right to exercise market power.

Figure 6-2 shows monthly economic demand response credits and MWh, from January 1, 2010 through June 30, 2019.

Figure 6-2 Economic program credits and MWh by month: 2010 through June 2019



30 PJM. "Manual 11: Energy & Ancillary Services Market Operations," § 10.4.5, Rev. 106 (May 30, 2019).
31 FERC Order No. 831.

Table 6-5 shows performance for the first six months of 2018 and 2019 in the economic program by control zone. Total reductions under the economic program decreased by 17,167 MWh, 58.9 percent, from 29,155 MW in the first six months of 2018 to 11,988 MW in the first six months of 2019. Total revenue under the economic program decreased by $1.0 million, 66.7 percent, from $1.6 million in the first six months of 2018 to $0.5 million in the first six months of 2019.[32]

Table 6-5 PJM economic program participation by zone: January through June, 2018 and 2019

	Credits			MWh Reductions			Credits per MWh Reduction		
Zones	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change
AECO	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
AEP	$0.00	$1,057.59	NA	0	17	NA	NA	$63.38	NA
APS	$43,300.32	$70.19	(99.8%)	710	1	(99.9%)	$60.97	$87.88	44.1%
ATSI	$589,795.33	$0.00	NA	10,691	0	NA	$55.17	NA	NA
BGE	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
ComEd	$147,867.75	$246.50	(99.8%)	4,024	15	(99.6%)	$36.74	$16.08	(56.3%)
DAY	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
DEOK	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
Dominion	$37,747.59	$267.33	(99.3%)	162	4	(97.7%)	$232.46	$71.78	(69.1%)
DPL	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
DLCO	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
JCPL	$137,431.03	$0.00	NA	1,711	0	NA	$80.35	NA	NA
Met-Ed	$10,761.24	$15,173.32	41.0%	209	295	41.4%	$51.56	$51.41	(0.3%)
OVEC	$0.00	$0.00	NA	0	0	NA	NA	NA	NA
PECO	$37,866.04	$117,734.28	210.9%	542	1,914	253.0%	$69.85	$61.52	(11.9%)
PENELEC	$120,679.73	$63,832.92	(47.1%)	4,000	2,050	(48.8%)	$30.17	$31.15	3.2%
Pepco	$0.00	$842.53	NA	0	14	NA	NA	$58.46	NA
PPL	$116,662.68	$125,578.93	7.6%	920	1,936	110.3%	$126.76	$64.87	(48.8%)
PSEG	$324,767.12	$196,687.75	(39.4%)	6,185	5,743	(7.2%)	$52.51	$34.25	(34.8%)
Total	$1,566,878.84	$521,491.34	(66.7%)	29,155	11,988	(58.9%)	$53.74	$43.50	(19.1%)

Table 6-6 shows total settlements submitted for the first six months of 2010 through 2019. A settlement is counted for every day on which a registration is dispatched in the economic program.

Table 6-6 Settlements submitted in the economic program: January through June, 2010 through 2019

(Jan-Jun)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of Settlements	1,345	317	1,348	820	1,806	1,091	652	800	737	426

Table 6-7 shows the number of CSPs, and the number of participants in their portfolios, submitting settlements for the first six months of 2010 through 2019. The number of active participants decreased by six, 20.0 percent, from 30 in the first six months of 2018 to 24 in the first six months of 2019. All participants must be registered through a CSP.

32 Economic demand response reductions that are submitted to PJM for payment but have not received payment are not included in Table 6-5. Payments for Economic demand response reductions are settled monthly.

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Table 6-7 Participants and CSPs submitting settlements in the economic program by year: January through June, 2010 through 2019

(Jan-Jun)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Active CSPs	10	9	18	12	17	12	6	8	11	9
Active Participants	131	129	331	85	144	68	20	42	30	24

The ownership of economic demand response resources was highly concentrated in 2018 through June 2019.[33] Table 6-8 shows the average hourly HHI for each month and the average hourly HHI for January 1, 2018 through June 30, 2019. Table 6-8 also lists the share of reductions provided by, and the share of credits claimed by the four largest companies in each year. In the first six months of 2019, 91.4 percent of all economic DR reductions and 87.0 percent of economic DR revenue were attributable to the four largest companies. The HHI for economic demand response increased by 373 from 7541 for the first six months of 2018 to 7914 for the first six months of 2019.

Table 6-8 Average hourly MWh HHI and market concentration in the economic program: January 2018 through June 2019[34]

	Average Hourly MWh HHI			Top Four Companies Share of Reduction			Top Four Companies Share of Credit		
Month	2018	2019	Percent Change	2018	2019	Change in Percent	2018	2019	Change in Percent
Jan	6576	6884	4.7%	92.3%	82.1%	10.2%	88.6%	78.1%	10.5%
Feb	8304	9382	13.0%	99.2%	94.7%	4.5%	99.1%	90.7%	8.4%
Mar	7498	7758	3.5%	96.1%	99.3%	(3.3%)	95.7%	99.1%	(3.4%)
Apr	6828	7457	9.2%	97.3%	99.4%	(2.1%)	97.2%	99.8%	(2.6%)
May	6688	8410	25.7%	98.3%	99.9%	(1.6%)	97.9%	99.9%	(2.0%)
Jun	8375	9817	17.2%	97.4%			96.2%		
Jul	8256			90.2%			82.7%		
Aug	7588			90.0%			87.0%		
Sep	9306			97.4%			97.2%		
Oct	6805			95.6%			93.9%		
Nov	7038			91.6%			91.8%		
Dec	8082								
Total	7541	7914	5.0%	84.9%	91.4%	6.5%	83.0%	87.0%	3.9%

Table 6-9 shows average MWh reductions and credits by hour for the first six months of 2018 and 2019. In the first six months of 2018, 84.7 percent of reductions and 80.5 percent of credits occurred in hours ending 0900 to 2100, and in the first six months of 2019, 83.5 percent of reductions and 78.0 percent of credits occurred in hours ending 0900 to 2100.

Table 6-9 Hourly frequency distribution of economic program MWh reductions and credits: January through June, 2018 and 2019

	MWh Reductions			Program Credits		
Hour Ending (EPT)	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change
1 through 6	1,161	522	(55%)	$90,825	$31,808	(65%)
7	834	264	(68%)	$59,819	$17,158	(71%)
8	1,349	471	(65%)	$88,784	$29,210	(67%)
9	1,652	731	(56%)	$90,224	$31,811	(65%)
10	1,756	722	(59%)	$83,119	$29,203	(65%)
11	1,848	722	(61%)	$88,347	$30,837	(65%)
12	1,932	734	(62%)	$89,095	$27,179	(69%)
13	1,908	734	(62%)	$89,811	$25,938	(71%)
14	1,984	731	(63%)	$89,446	$25,236	(72%)
15	1,913	712	(63%)	$89,385	$22,225	(75%)
16	1,908	721	(62%)	$89,760	$22,289	(75%)
17	1,967	763	(61%)	$101,573	$28,154	(72%)
18	2,062	831	(60%)	$121,824	$40,782	(67%)
19	2,121	842	(60%)	$122,001	$38,946	(68%)
20	2,008	901	(55%)	$109,663	$40,187	(63%)
21	1,620	866	(47%)	$96,513	$43,745	(55%)
22	713	437	(39%)	$41,820	$22,273	(47%)
23 through 24	419	284	(32%)	$24,868	$14,510	(42%)
Total	29,155	11,988	(59%)	$1,566,879	$521,491	(67%)

Table 6-10 shows the distribution of economic program MWh reductions and credits by ranges of real-time zonal, load-weighted, average LMP in the first six months of 2018 and 2019. In the first six months of 2019, 1.4 percent of MWh reductions and 5.2 percent of program credits occurred during hours when the applicable zonal LMP was higher than $175 per MWh.

33 All HHI calculations in this section are at the parent company level. Parent companies may own one CSP or multiple CSPs.
34 December 2018 and June 2019 reduction and credit share percent are redacted based on confidentiality rules.

Table 6-10 Frequency distribution of economic program zonal, load-weighted, average LMP (By hours): January through June, 2018 and 2019

	MWh Reductions			Program Credits		
LMP	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change	2018 (Jan-Jun)	2019 (Jan-Jun)	Percent Change
$0 to $25	3,287	3,053	(7%)	$60,329	$70,492	17%
$25 to $50	16,675	6,139	(63%)	$581,930	$217,350	(63%)
$50 to $75	3,504	1,473	(58%)	$196,110	$97,130	(50%)
$75 to $100	1,725	620	(64%)	$144,758	$53,732	(63%)
$100 to $125	1,223	350	(71%)	$122,616	$35,097	(71%)
$125 to $150	869	81	(91%)	$103,389	$10,207	(90%)
$150 to $175	420	99	(76%)	$59,225	$10,274	(83%)
> $175	1,452	173	(88%)	$298,522	$27,209	(91%)
Total	29,155	11,988	(59%)	$1,566,879	$521,491	(67%)

Following Order No. 745, all ISO/RTOs are required to calculate an NBT threshold price each month above which the net benefits of DR are deemed to exceed the cost to load. PJM calculates the NBT price threshold by first taking the generation offers from the same month of the previous year. For example, the NBT price calculation for February 2017 was calculated using generation offers from February 2016. PJM then adjusts these offers to account for changes in fuel prices and uses these adjusted offers to create an average monthly supply curve. PJM estimates a function that best fits this supply curve and then finds the point on this curve where the elasticity is equal to one.[35] The price at this point is the NBT threshold price.

The NBT test is a crude tool that is not based in market logic. The NBT threshold price is a monthly estimate calculated from a monthly supply curve that does not incorporate real-time or day-ahead prices. In addition, it is a single threshold price used to trigger payments to economic demand response resources throughout the entire RTO, regardless of their location and regardless of locational prices.

The necessity for the NBT test is an illustration of the illogical approach to demand side compensation embodied in paying full LMP to demand resources. The benefit of demand side resources is not that they suppress market prices, but that customers can choose not to consume at the current price of power, that individual customers benefit from their choices and that the choices of all customers are reflected in market prices. If customers face the market price, customers should have the ability to not purchase power and the market impact of that choice does not require a test for appropriateness.

When the zonal LMP is above the NBT threshold price, economic demand response resources that reduce their power consumption are paid the full zonal LMP. When the zonal LMP is below the NBT threshold price, economic demand response resources are not paid for any load reductions.

Table 6-11 shows the NBT threshold price for the historical test from August 2010 through July 2011, and April 2012, when Order No. 745 was implemented in PJM, through June 2019. The NBT threshold price has never exceeded the lowest historical test result of $34.07 per MWh.

Table 6-11 Net benefits test threshold prices: August 2010 through June 2019

	Historical Test ($/MWh)	Net Benefits Test Threshold Price ($/MWh)								
Month	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Jan		$40.27		$25.72	$29.51	$29.63	$23.67	$32.60	$26.27	$29.44
Feb		$40.49		$26.27	$30.44	$26.52	$26.71	$31.57	$24.65	$23.49
Mar		$38.48		$25.60	$34.93	$24.99	$22.10	$30.56	$25.50	$22.15
Apr		$36.76	$25.89	$26.96	$32.59	$24.92	$19.93	$30.45	$25.56	$22.36
May		$34.68	$23.46	$27.73	$32.08	$23.79	$20.69	$29.77	$25.52	$21.01
Jun		$35.09	$23.86	$28.44	$31.62	$23.80	$20.62	$27.14	$23.59	$20.20
Jul		$36.78	$22.99	$29.42	$31.62	$23.03	$20.73	$24.42	$23.57	
Aug	$35.57		$24.47	$28.58	$29.85	$23.17	$23.24	$22.75	$23.53	
Sep	$34.07		$24.93	$28.80	$29.83	$21.69	$24.70	$21.51	$22.23	
Oct	$38.10		$25.96	$29.13	$30.20	$21.48	$26.50	$21.70	$23.84	
Nov	$36.83		$25.63	$31.63	$29.17	$22.28	$29.27	$26.41	$23.89	
Dec	$37.04		$25.97	$28.82	$29.01	$22.31	$29.71	$29.16	$26.35	
Average	$36.32	$37.51	$24.80	$28.09	$30.91	$23.97	$23.99	$27.34	$24.54	$23.11

Table 6-12 shows the number of hours that at least one zone in PJM had day-ahead LMP or real-time LMP higher than the NBT threshold price. In the first six months of 2019, the highest zonal LMP in PJM was higher than the NBT threshold price 3,422 hours out of 4,343 hours, or 78.8 percent of all hours. Reductions occurred in 1,309 hours, 38.3 percent, of those 3,422 hours in the

35 "PJM Manual 11: Energy & Ancillary Services Market Operations," §10.3.1, Rev. 106 (May 30, 2019).

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first six months of 2019. The last three columns illustrate how often economic demand response activity occurred when LMPs exceeded NBT threshold prices for January 1, 2018 through June 30, 2019. There are no economic payments when demand response occurs and zonal LMP is below the NBT threshold. Demand response reductions occurred in 0.08 percent (1 hour) of the hours in which LMP was below the NBT threshold price in the first six months of 2019, and none of the hours in which LMP was below the NBT threshold price in 2018.

Table 6-12 Hours with price higher than NBT and DR occurrences in those hours: 2018 through June 2019

	Number of Hours		Number of Hours with LMP Higher than NBT			Percent of NBT Hours with DR		
Month	2018	2019	2018	2019	Percent Change	2018	2019	Percent Change
Jan	744	744	665	503	(24.4%)	62.9%	51.9%	(11.0%)
Feb	672	672	485	582	20.0%	44.7%	22.9%	(21.9%)
Mar	743	743	713	711	(0.3%)	58.3%	40.5%	(17.8%)
Apr	720	720	663	559	(15.7%)	73.8%	55.1%	(18.7%)
May	744	744	611	579	(5.2%)	62.7%	42.5%	(20.2%)
Jun	720	720	503	488	(3.0%)	64.0%	15.0%	(49.1%)
Jul	744		549			74.0%		
Aug	744		560			72.5%		
Sep	720		643			64.2%		
Oct	744		699			50.9%		
Nov	721		702			43.9%		
Dec	744		627			12.1%		
Total	8,760	4,343	7,420	3,422	(53.9%)	56.7%	38.3%	(18.5%)

Economic DR revenues are paid by real-time loads and real-time scheduled exports as an uplift charge. Table 6-13 shows the sum of real-time DR charges and day-ahead DR charges paid in each zone and paid by exports. Real-time loads in AEP paid the highest DR charges in the first six months of 2019.

Table 6-13 Zonal DR charge: January through June, 2019

Zone	January	February	March	April	May	June	Total
AECO	$3,107	$402	$813	$712	$276	$65	$5,374
AEP	$43,073	$6,115	$12,606	$14,331	$6,825	$803	$83,754
APS	$18,269	$2,567	$5,104	$5,370	$2,610	$310	$34,229
ATSI	$20,920	$3,150	$6,706	$7,709	$3,483	$392	$42,360
BGE	$12,438	$1,635	$3,148	$3,355	$1,634	$227	$22,436
ComEd	$18,936	$4,237	$8,395	$9,312	$4,522	$593	$45,994
DAY	$6,000	$837	$1,776	$2,122	$932	$117	$11,784
DEOK	$7,798	$1,224	$2,557	$2,943	$1,463	$183	$16,169
Dominion	$36,308	$4,935	$9,651	$10,745	$5,710	$722	$68,069
DPL	$7,438	$901	$1,691	$1,522	$508	$118	$12,178
DLCO	$4,108	$623	$1,264	$1,464	$752	$90	$8,301
EKPC	$4,559	$614	$1,299	$1,289	$634	$76	$8,472
JCPL	$7,427	$911	$1,989	$1,863	$667	$145	$13,003
Met-Ed	$5,815	$775	$1,522	$1,530	$638	$102	$10,382
OVEC	$38	$6	$13	$13	$6	$1	$78
PECO	$14,213	$1,755	$3,650	$3,583	$1,110	$239	$24,550
PENELEC	$5,304	$860	$1,751	$1,940	$848	$103	$10,807
Pepco	$11,147	$1,511	$2,897	$3,118	$1,629	$218	$20,520
PPL	$15,052	$2,006	$4,004	$3,848	$1,327	$237	$26,472
PSEG	$15,476	$1,711	$3,783	$3,709	$1,323	$274	$26,276
RECO	$424	$59	$125	$136	$50	$11	$804
Exports	$14,962	$1,827	$4,862	$5,507	$2,436	$255	$29,849
Total	$272,811	$38,661	$79,605	$86,121	$39,382	$5,280	$521,861

Table 6-14 shows the total zonal DR charge per MWh of real-time load and exports in the first six months of 2019.

Table 6-14 Zonal DR charge per MWh of load and exports: January through June 2019

Zone	January	February	March	April	May	June	Zonal Average
AECO	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
AEP	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
APS	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
ATSI	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
BGE	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
ComEd	$0.002	$0.002	$0.002	$0.002	$0.002	$0.002	$0.002
DAY	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
DEOK	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
Dominion	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
DPL	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
DLCO	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
EKPC	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
JCPL	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
Met-Ed	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
OVEC	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
PECO	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
PENELEC	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003	$0.003
Pepco	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
PPL	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
PSEG	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
RECO	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
Exports	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004
Monthly Average	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004	$0.004

Table 6-15 shows the monthly day-ahead and real-time DR charges and the per MWh DR charges for 2018 through June 2019. The day-ahead DR charges decreased by $0.2 million, 38.1 percent, from $0.6 million in the first six months of 2018 to $0.4 million in the first six months of 2019. The real-time DR charges decreased $0.8 million, 84.4 percent, from $1.0 million in the first six months of 2018 to $0.2 million in the first six months of 2019.

Table 6-15 Monthly day-ahead and real-time economic DR charge: 2018 through June 2019

	Day-ahead DR Charge			Real-time DR Charge		
Month	2018	2019	Percent Change	2018	2019	Percent Change
Jan	$287,093	$150,139	(47.7%)	$381,071	$122,303	(67.9%)
Feb	$22,479	$22,811	1.5%	$77,584	$15,850	(79.6%)
Mar	$58,245	$71,143	22.1%	$125,482	$8,462	(93.3%)
Apr	$85,711	$84,808	(1.1%)	$140,688	$1,313	(99.1%)
May	$87,376	$35,897	(58.9%)	$143,598	$3,485	(97.6%)
Jun	$56,538	$5,280	(90.7%)	$101,014	$0	(100.0%)
Jul	$63,540			$153,191		
Aug	$70,708			$308,315		
Sep	$44,648			$152,727		
Oct	$57,842			$40,317		
Nov	$32,131			$42,017		
Dec	$9,890			$6,369		
Total	$876,201	$370,078	(57.8%)	$1,672,373	$151,413	(90.9%)

Emergency and Pre-Emergency Programs

The emergency and pre-emergency load response programs consist of the limited, extended summer, annual and capacity performance demand response products. Full implementation of the Capacity Performance design in the 2020/2021 Delivery Year will require all emergency or pre-emergency demand resource to be registered as an annual capacity resource. Summer period demand response resources are allowed to aggregate with winter period capacity resources to fulfill the annual requirement of the CP design.[36] With the implementation of Capacity Performance, a performance assessment interval (PAI) occurs when emergency or pre-emergency is dispatched. PJM effectively eliminated the difference between pre-emergency and emergency by making both trigger a PAI. To participate as an emergency or pre-emergency demand resource, the CSP must clear MW in an RPM auction. Emergency and pre-emergency resources receive capacity revenue from the capacity market and also receive energy revenue at a predefined strike price from the energy market for reductions during a PJM initiated emergency or pre-emergency event. The rules applied to demand resources in the current market design do not treat demand resources in a manner comparable to

36 Summer period demand response has the same obligations as extended summer demand response. It must be available for June through October and the following May between 10:00AM and 10:00PM. *See* PJM OATT RAA Article 1.

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generation capacity resources, even though demand resources are sold in the same capacity market, are treated as a substitute for other capacity resources and displace other capacity resources in RPM auctions.

The MMU recommends that if demand resources remain on the supply side of the capacity market, a daily must offer requirement in the Day-Ahead Energy Market apply to demand resources, comparable to the rule applicable to generation capacity resources. This will help to ensure comparability and consistency for demand resources.

The MMU recommends that the option to specify a minimum dispatch price under the Emergency and Pre-Emergency Program Full option be eliminated and that participating resources receive the hourly real-time LMP less any generation component of their retail rate.[37]

The HHI for demand resources showed that ownership was highly concentrated for the 2018/2019 and 2019/2020 delivery years, with an HHI value of 1807 and 1838. In the 2018/2019 Delivery Year, the four largest companies contributed 78.1 percent of all committed demand resources UCAP MW and 78.8 percent of all committed demand resources UCAP MW in the 2019/2020 Delivery Year.

Table 6-16 shows the HHI value for committed UCAP MW by LDA by delivery year. The HHI values are calculated by the committed UCAP MW in each delivery year for demand resources.

Table 6-16 HHI value for committed UCAP MW by LDA by delivery year: 2018/2019 and 2019/2020 delivery years[38]

Delivery Year	LDA	Committed UCAP MW	HHI Value	HHI Concentration
2018/2019	RTO	3,387.6	2018	High
	MAAC	447.5	2473	High
	EMAAC	1,315.5	2156	High
	PSEG	143.4	2252	High
	PS-NORTH	95.6	2924	High
	PEPCO	533.7	5464	High
	ATSI	622.8	2573	High
	ATSI-CLEVELAND	150.5	4050	High
	COMED	1,938.6	2438	High
	BGE	493.2	5597	High
	PPL	496.2	2264	High
	DPL-SOUTH	500.4	8707	High
2019/2020	RTO	3,576.3	2018	High
	MAAC	463.8	2473	High
	EMAAC	900.3	2156	High
	PSEG	149.8	2252	High
	PS-NORTH	89.9	2924	High
	PEPCO	479.8	5464	High
	ATSI	705.9	2573	High
	ATSI-CLEVELAND	210.8	4050	High
	COMED	2,016.5	2438	High
	BGE	208.2	5597	High
	PPL	532.5	2264	High
	DPL-SOUTH	50.4	8707	High

Table 6-17 shows the committed demand response UCAP MW by delivery year. Total committed demand response UCAP MW in PJM increased by 257.6 MW, or 3.0 percent, from 8,727.0 MW in the 2018/2019 Delivery Year to 8,984.6 MW in the 2019/2020 Delivery Year. The DR percent of capacity increased by 0.1 percent, from 4.9 percent in the 2018/2019 Delivery Year to 5.0 percent in the 2019/2020 Delivery Year.

37 See "Complaint and Motion to Consolidate of the Independent Market Monitor for PJM," Docket No. EL14-20-000 (January 28, 2014), "Comments of the Independent Market Monitor for PJM," Docket No. ER15-852-000 (February 13, 2015).

38 The RTO LDA refers to the rest of RTO.

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Table 6-17 Committed demand response UCAP MW for PJM: 2011/2012 through 2019/2020 delivery year

Delivery Year	DR Cleared MW UCAP	DR Percent of Capacity MW UCAP
2011/2012	2,509.1	1.4%
2012/2013	7,632.4	4.4%
2013/2014	8,218.3	4.6%
2014/2015	8,665.9	4.8%
2015/2016	11,340.2	6.4%
2016/2017	8,862.6	5.0%
2017/2018	8,458.4	4.6%
2018/2019	8,727.0	4.9%
2019/2020	8,984.6	5.0%

Table 6-18 shows zonal monthly capacity market revenue to demand resources for the first six months of 2019. Capacity market revenue increased in the first six months of 2019 by $29.1 million, 10.9 percent, from $265.5 million in the first six months of 2018 to $294.6 million in the first six months of 2019. Higher demand resource revenues were in part a result of higher capacity market prices in the 2018/2019 RPM auction clearing price. The capacity revenue in the first quarter of 2018 is from 2017/2018 RPM auction clearing prices and the capacity revenue in the first quarter of 2019 is from 2018/2019 RPM auction clearing prices. The annual capacity market prices increased $13.20 per MW-day from $151.50 in the 2017/2018 Delivery Year to $164.77 in the 2018/2019 Delivery Year, a 8.7 percent increase.

Table 6-18 Zonal monthly capacity revenue: January through June, 2019

Zone	January	February	March	April	May	June	Total
AECO	$1,063,052	$960,176	$1,063,052	$1,028,760	$1,063,052	$436,515	$5,614,605
AEP, EKPC	$7,363,738	$6,651,118	$7,363,738	$7,126,198	$7,363,738	$3,867,902	$39,736,430
APS	$4,638,234	$4,189,373	$4,638,234	$4,488,614	$4,638,234	$2,285,119	$24,877,807
ATSI	$4,254,499	$3,842,773	$4,254,499	$4,117,257	$4,254,499	$2,344,392	$23,067,919
BGE	$1,471,812	$1,329,378	$1,471,812	$1,424,334	$1,471,812	$630,148	$7,799,295
ComEd	$11,763,628	$10,625,212	$11,763,628	$11,384,156	$11,763,628	$9,639,882	$66,940,134
DAY	$1,082,665	$977,891	$1,082,665	$1,047,740	$1,082,665	$533,882	$5,807,508
DEOK	$996,130	$899,730	$996,130	$963,997	$996,130	$608,291	$5,460,409
DLCO	$3,841,793	$3,470,007	$3,841,793	$3,717,864	$3,841,793	$1,760,122	$20,473,372
Dominion	$2,760,840	$2,493,662	$2,760,840	$2,671,780	$2,760,840	$1,133,435	$14,581,397
DPL	$1,229,930	$1,110,904	$1,229,930	$1,190,255	$1,229,930	$599,460	$6,590,408
JCPL	$1,324,124	$1,195,983	$1,324,124	$1,281,410	$1,324,124	$605,867	$7,055,632
Met-Ed	$1,527,708	$1,379,865	$1,527,708	$1,478,427	$1,527,708	$775,740	$8,217,157
OVEC	$0	$0	$0	$0	$0	$0	$0
PECO	$3,342,110	$3,018,680	$3,342,110	$3,234,300	$3,342,110	$1,582,953	$17,862,263
PENELEC	$1,811,449	$1,636,148	$1,811,449	$1,753,015	$1,811,449	$830,090	$9,653,600
Pepco	$806,881	$728,796	$806,881	$780,853	$806,881	$142,570	$4,072,863
PPL	$2,314,965	$2,090,936	$2,314,965	$2,240,289	$2,314,965	$1,801,961	$13,078,082
PSEG	$2,521,890	$2,277,836	$2,521,890	$2,440,539	$2,521,890	$1,157,439	$13,441,484
RECO	$48,971	$44,232	$48,971	$47,392	$48,971	$30,889	$269,427
Total	$54,164,419	$48,922,701	$54,164,419	$52,417,179	$54,164,419	$30,766,656	$294,599,792

Table 6-19 shows the amount of energy efficiency (EE) resources in PJM on June 1 for the 2012/2013 through 2018/2019 delivery years. EE resources may participate in PJM without restrictions imposed by a state unless the Commission authorizes a state to impose restrictions.[39] Only Kentucky has been authorized by the Commission.[40] Energy efficiency resources are offered in the PJM Capacity Market. The total MW of energy efficiency resources committed increased by 20.2 percent from 2,117.9 MW in the 2017/2018 Delivery Year to 2,545.1 MW in the 2018/2019 Delivery Year.[41]

39 *See* 161 FERC ¶ 61,245 at P 57 (2017); 107 FERC ¶ 61,272 at P 8 (2008).
40 The Commission made an exception for Kentucky when it determined that RERRAs must obtain FERC approval prior to excluding EE, explaining that "the Commission accepted such condition at the time the Kentucky Commission approved the integration of Kentucky Power into PJM." 161 FERC ¶ 61,245 at P 67.
41 See the *2018 State of the Market Report for PJM*, Vol. 2, Section 5: Capacity Market, Table 5-13.

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Table 6-19 Energy efficiency resources (MW): June 1, 2012 to June 1, 2018

	UCAP (MW)
	RPM Commitments
01-Jun-12	631.2
01-Jun-13	1,024.8
01-Jun-14	1,282.4
01-Jun-15	1,525.5
01-Jun-16	1,784.3
01-Jun-17	2,117.9
01-Jun-18	2,545.1

Figure 6-3 shows the amount of installed EE MW in PJM by technology for the 2018/2019 and 2019/2020 delivery years. An installed EE resource may participate as a capacity resource for up to a maximum of four consecutive delivery years.[42] The lighting category consists of more efficient lighting technology installed, HVAC consists of more efficient HVAC technology installed, new construction consists of more efficient equipment than the industry average for individual components, appliances consists of more efficient appliances and prescriptive consists of more efficient equipment procured by an incentive program for lighting, HVAC or appliances. Prescriptive energy efficiency MW have an assumed savings calculated by an expected installation rate dependent on units sold and the difference between the current average electricity usage of what is being replaced and the new product. For example, if 100 lights are sold, an expected installation rate could be that 95 are installed and replacing a light that consumes more electricity. Instead of measuring each light replaced, the EE provider takes the difference between the industry average and the new light. Prescriptive energy efficiency MW comprise 87.2 percent of all energy efficiency MW in the 2018/2019 Delivery Year and 86.5 percent in the 2019/2020 Delivery Year. The measurement and verification method for prescriptive energy efficiency projects relies on unverified assumptions and is too imprecise to rely on as a source of capacity comparable to capacity from a power plant.

All EE resources must submit pre and post installation M&V plans that include the variables that affect the project's electrical demand, baseline consumption, post installation consumption, and specifications of the equipment or types of equipment used in the project. The nonprescriptive measurement and verification methods do not use full metering but rely on samples and assumptions and only for limited periods.[43] The nominated EE value is the expected average demand reduction during: the peak hours ending 15:00 EPT through 18:00 EPT for June 1 through August 31; and the peak hours ending 8:00 EPT through 9:00 EPT and 19:00 EPT through 20:00 EPT for all days between January 1 and February 28, of the relevant delivery year.[44] The calculated MW are offered in PJM's Capacity Market as EE. The installed EE resources for the 2018/2019 Delivery Year include any installed EE resource between June 1, 2014 and May 31, 2018, and installed EE resources for the 2019/2020 Delivery Year include any installed EE resources between June 1, 2015 and May 31, 2019.

The MMU recommends that energy efficiency MW not be included in the PJM capacity market. The measurement and verification protocols for energy efficiency are too imprecise to rely on as a source of capacity. Energy efficiency measures reduce energy usage and capacity usage directly. The reduced market payments are the appropriate compensation. PJM should ensure that the impact of EE measures on the load forecast is incorporated immediately rather than with the existing lag.

42 PJM. "Manual 18: Capacity Market," § 4.4, Rev. 41 (Jan. 1, 2019).

43 PJM. "Manual 18B: Energy Efficiency Measurement & Verification," § 2.2 Rev. 3 (November 17, 2016).

44 PJM. "Manual 18B: Energy Efficiency Measurement & Verification," § 1.1 Rev. 3 (November 17, 2016).

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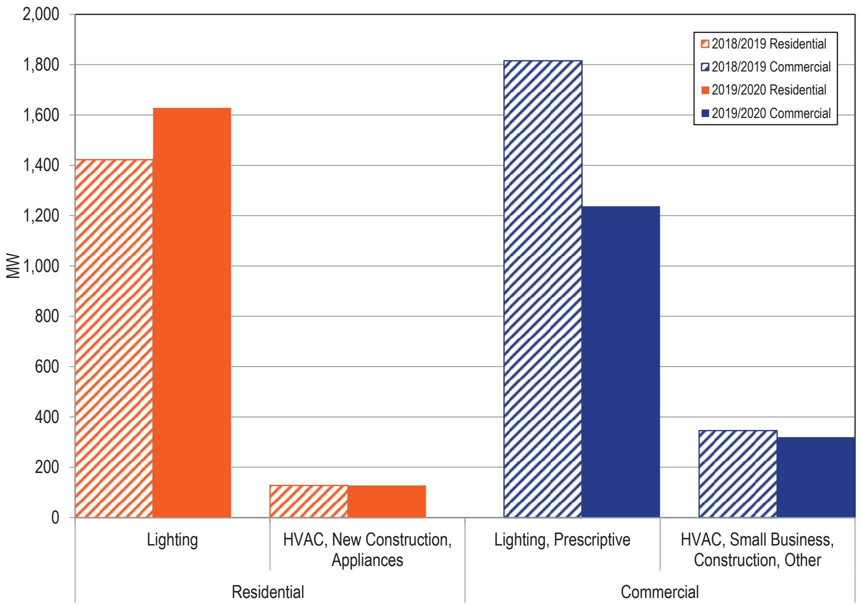
Figure 6-3 Installed energy efficiency MW by type: 2018/2019 and 2019/2020 delivery years



FERC accepted PJM's proposed 30 minute lead time as a phased in approach on May 9, 2014, effective on June 1, 2015.[45] The quick lead time demand response was defined after demand resources cleared in the RPM base residual auctions for the 2014/2015, 2015/2016, 2016/2017 and 2017/2018 delivery years. PJM submitted a filing on October 20, 2014, to allow DR that is unable to respond within 30 minutes to exit the market without penalty before the mandatory 30 minute lead time with the 2015/2016 Delivery Year.[46] The quick lead time is the default lead time starting June 1, 2015, unless a CSP submits an exception request for 60 or 120 minute notification time due to a physical constraint.[47] The exception requests must clearly state why the resource is unable to respond within 30 minutes based on the defined reasons for exception listed in Manual 18.[48] Once a location is granted a longer lead time, the resource does not need to resubmit for a longer lead time each delivery year. Resources that request longer lead times without a physical constraint are rejected.

Table 6-20 shows the amount of nominated MW and locations by product type and lead time for the 2018/2019 Delivery Year. PJM approved 3,022 locations, or 20.6 percent of all locations, which have 3,944.1 nominated MW, or 43.9 percent of all nominated MW, for exceptions to the 30 minute lead time rule for the 2018/2019 Delivery Year.[49]

45 See 147 FERC ¶ 61,103 (2014).
46 See PJM Interconnection, L.L.C., Docket No. ER14-135-000 (October 20, 2014).
47 See "PJM Manual 18: Capacity Market," § 4.3.1, Rev. 41 (Jan. 1, 2019).
48 "PJM Manual 18: PJM Capacity Market," § 4.3.1, Rev. 41 (January 1, 2019).
49 For analysis of the 2017/2018 Delivery Year, *see 2018 Quarterly State of the Market Report: January through September*, Section 6 Demand Response, at Emergency and Pre-Emergency Programs. <http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018/2018q3-som-pjm-sec6.pdf>.

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Table 6-20 Nominated MW and locations by product type and lead time: 2018/2019 Delivery Year

	Pre-Emergency MW					Emergency MW					
Lead Type	Limited	Annual	Base	Capacity Performance	Pre-Emergency Total	Limited	Annual	Base	Capacity Performance	Emergency Total	Total
Quick Lead (30 Minutes)	311.9	6.8	4,179.5	305.2	4,803.3	0.2	0.0	221.6	18.9	240.7	5,044.0
Short Lead (60 Minutes)	23.2	0.0	367.8	65.5	456.5	0.0	0.0	26.4	0.0	26.4	483.0
Long Lead (120 Minutes)	122.8	0.0	2,666.4	527.7	3,316.9	0.0	0.0	144.2	0.0	144.2	3,461.1
Total	457.8	6.8	7,213.6	898.4	8,576.7	0.2	0.0	392.3	18.9	411.4	8,988.1
	Pre-Emergency Locations					Emergency Locations					
Lead Type	Limited	Annual	Base	Capacity Performance	Pre-Emergency Total	Limited	Annual	Base	Capacity Performance	Emergency Total	Total
Quick Lead (30 Minutes)	167	2	10,154	732	11,055	4	0	518	57	579	11,634
Short Lead (60 Minutes)	12	0	297	30	339	0	0	42	0	42	381
Long Lead (120 Minutes)	33	0	2,010	379	2,422	0	0	219	0	219	2,641
Total	212	2	12,461	1,141	13,816	4	0	779	57	840	14,656

Table 6-21 shows the amount of nominated MW and locations by product type and lead time for the 2019/2020 Delivery Year. PJM approved 3,106 locations, or 20.9 percent of all locations, which have 3,902.1 nominated MW, or 40.6 percent of all nominated MW, for exceptions to the 30 minute lead time rule for the 2019/2020 Delivery Year.

Table 6-21 Nominated MW and locations by product type and lead time: 2019/2020 Delivery Year

	Pre-Emergency MW			Emergency MW			
Lead Type	Base	Capacity Performance	Pre-Emergency Total	Base	Capacity Performance	Emergency Total	Total
Quick Lead (30 Minutes)	5,298.4	159.1	5,457.5	238.4	17.7	256.1	5,713.6
Short Lead (60 Minutes)	326.7	36.3	363.0	27.2	0.0	27.2	390.3
Long Lead (120 Minutes)	2,933.8	428.2	3,362.0	148.3	1.4	149.8	3,511.8
Total	8,558.9	623.6	9,182.6	414.0	19.1	433.1	9,615.7
	Pre-Emergency Locations			Emergency Locations			
Lead Type	Base	Capacity Performance	Pre-Emergency Total	Base	Capacity Performance	Emergency Total	Total
Quick Lead (30 Minutes)	10,886	356	11,242	514	26	540	11,782
Short Lead (60 Minutes)	288	8	296	53	0	53	349
Long Lead (120 Minutes)	2,048	425	2,473	281	3	284	2,757
Total	13,222	789	14,011	848	29	877	14,888

There are two different ways to measure load reductions of demand resources. The Firm Service Level (FSL) method, applied to the summer, measures the difference between a customer's peak load contribution (PLC) and real-time load, multiplied by the loss factor (LF).[50] The Guaranteed Load Drop (GLD) method measures the minimum of: the comparison load minus real-time load multiplied by the loss factor; or the PLC minus the real-time load multiplied by the loss factor. The comparison load estimates what the load would have been if PJM did not declare a Load Management Event, similar to a CBL, by using a comparable day, same day, customer baseline, regression analysis or backup generation method. Limiting the GLD method to the minimum of the two calculations ensures

50 Real-time load is hourly metered load.

reductions occur below the PLC, thus avoiding double counting of load reductions.[51] With the introduction of the Winter Peak Load (WPL) concept, effective for the 2017/2018 Delivery Year, both the FSL and GLD methods are modified for the non-summer period. The FSL method measures compliance during the non-summer period as the difference between a customer's WPL multiplied by the Zonal Winter Weather Adjustment Factor (ZWWAF) and the LF, rather than the PLC, and real-time load, multiplied by the LF. PJM calculates and posts on the PJM website the ZWWAF as the zonal winter weather normalized peak divided by the zonal average of the five coincident peak loads in December through February.[52] The Winter Peak Load is adjusted up for transmission and distribution line loss factors because one MW of load would be served by more than one MW of generation to account for transmission losses. The Winter Peak Load is normalized based on the winter conditions during the five coincident peak loads in winter using the ZWWAF to account for an extreme temperatures or a mild winter. The GLD method measures compliance during the non-summer period as the minimum of: the comparison load minus real-time load multiplied by the loss factor; or the WPL multiplied by the ZWWAF and the LF, rather than the PLC, minus the real-time load multiplied by the LF.[53]

The Capacity Market is an annual market. A Capacity Performance resource has an annual commitment. Load is allocated capacity obligations based on the annual peak load which is a summer load. The amount of MW allocated to load does not vary based on winter demand. The principle is that a customer's actual use of capacity should be compared to the level of capacity that a customer is required to pay for. Capacity costs are allocated to LSEs by PJM based on the single coincident peak load method. In PJM, the single coincident peak occurs in the summer.[54] LSEs generally allocate capacity costs to customers based on the five coincident peak method.[55] The allocation of capacity costs to customers uses each customer's PLC. Customers pay for capacity based on the PLC, not the WPL. The MMU recommends setting the baseline for measuring capacity compliance under summer and winter compliance at the customer's PLC, similar to GLD, to avoid double counting, to avoid under counting and to ensure that a customer's purchase of capacity is calculated correctly. The FSL and GLD equations for calculating load reductions are:

$$FSL\ Compliance_{Summer} = PLC - (Load \cdot LF)$$

$$FSL\ Compliance_{Non-Summer} = (WPL \cdot ZWWAF \cdot LF) - (Load \cdot LF)$$

$$GLD\ Compliance_{Summer} = Minimum\{(comparison\ load - Load) \cdot LF; PLC - (Load \cdot LF)\}$$

$$GLD\ Compliance_{Non-Summer} = Minimum\{(comparison\ load - Load) \cdot LF; (WPL \cdot ZWWAF \cdot LF) - (Load \cdot LF)\}$$

Table 6-22 shows the MW registered by measurement and verification method and by technology type for the 2018/2019 Delivery Year. For the 2018/2019 Delivery Year, 99.7 percent use the FSL method and 0.3 percent use the GLD measurement and verification method.

51 135 FERC ¶ 61,212.
52 "PJM Manual 18: PJM Capacity Market," § 4.3.7, Rev. 41 (January 1, 2019).
53 "PJM Manual 18: PJM Capacity Market," § 8.7A, Rev.41 (January 1, 2019).
54 OATT Attachment DD.5.11.
55 OATT Attachment M-2.

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Table 6-22 Reduction MW by each demand response method: 2018/2019 Delivery Year

	Technology Type								
Measurement and Verification Method	On-site Generation MW	HVAC MW	Refrigeration MW	Lighting MW	Manufacturing MW	Water Heating MW	Batteries and Plug Load MW	Total	Percent by type
Firm Service Level	1,056.4	2,857.5	178.8	849.5	3,856.2	116.6	45.7	8,960.6	99.7%
Guaranteed Load Drop	0.8	8.8	0.0	0.7	16.4	0.1	0.5	27.4	0.3%
Total	1,057.2	2,866.3	178.8	850.2	3,872.6	116.6	46.2	8,988.0	100.0%
Percent by method	11.8%	31.9%	2.0%	9.5%	43.1%	1.3%	0.5%	100.0%	

Table 6-23 shows the MW registered by measurement and verification method and by technology type for the 2019/2020 Delivery Year. For the 2019/2020 Delivery Year, 99.7 percent use the FSL method and 0.3 percent use the GLD measurement and verification method.

Table 6-23 Reduction MW by each demand response method: 2019/2020 Delivery Year

	Technology Type								
Measurement and Verification Method	On-site Generation MW	HVAC MW	Refrigeration MW	Lighting MW	Manufacturing MW	Water Heating MW	Other, Batteries or Plug Load MW	Total	Percent by type
Firm Service Level	1,053.1	3,239.0	187.8	940.3	3,923.8	122.5	51.1	9,517.6	99.7%
Guaranteed Load Drop	0.4	12.3	0.0	1.4	15.1	0.1	0.3	29.5	0.3%
Total	1,053.5	3,251.2	187.8	941.8	3,938.8	122.6	51.4	9,547.1	100.0%
Percent by method	11.0%	34.1%	2.0%	9.9%	41.3%	1.3%	0.5%	100.0%	

Table 6-24 shows the fuel type used in the onsite generators for the 2018/2019 Delivery Year in the emergency and pre-emergency programs. During the 2018/2019 Delivery Year, 1,057.2 MW of the 8,988.0 MW of nominated MW, 11.8 percent, used onsite generation. Of the 1,057.2 MW, 82.7 percent of MW are diesel and 17.3 percent of MW are natural gas, gasoline, oil, propane or waste products. For the 2018/2019 Delivery Year, there was 354.5 MW of the 411.4 MW, 86.2 percent, registered with an onsite generator in the emergency program.

Table 6-24 Onsite generation fuel type (MW): 2018/2019 Delivery Year

	2018/2019	
Fuel Type	MW	Percent
Diesel	874.4	82.7%
Natural Gas, Gasoline, Oil, Propane, Waste Products	182.8	17.3%
Total	1,057.2	100.0%

Table 6-25 shows the fuel type used in the onsite generators for the 2019/2020 Delivery Year in the emergency and pre-emergency programs. During the 2019/2020 Delivery Year, 1,053.5 MW of the 9,547.1 MW of nominated MW, 11.0 percent, used onsite generation. Of the 1,053.5 MW, 85.9 percent of MW are diesel and 14.1 percent of MW are natural gas, gasoline, oil, propane or waste products. For the 2019/2020 Delivery Year, there were 284.9 MW of the 433.1 MW, 65.7 percent, registered with an onsite generator in the emergency program.

Table 6-25 Onsite generation fuel type (MW): 2019/2020 Delivery Year

	2019/2020	
Fuel Type	MW	Percent
Diesel	905.3	85.9%
Natural Gas, Gasoline, Oil, Propane, Waste Products	148.2	14.1%
Total	1,053.5	100.0%

Emergency and Pre-Emergency Event Reported Compliance

Subzonal dispatch became mandatory for emergency demand resources in the 2014/2015 Delivery Year, if the subzone was defined by PJM no later than the day before the dispatch.[56] PJM does not measure compliance when demand response is dispatched in a subzone created on the same day as the dispatch. There are thirteen dispatchable subzones in PJM effective September 21, 2018: AEP_CANTON, ATSI_CLE, DPL_SOUTH, PS_NORTH, ATSI_NEWCASOE, PPL_WESCO, ATSI_BLKRIVER, PENELEC_ERIC, APS_EAST, DOM_CHES, DOM_YORKTOWN, AECO_ENGLAND, JCPL_REDBANK.[57] Effective with the 2020/2021 Delivery Year, PJM will procure a single capacity product, Capacity Performance, which does not require predefined subzones for mandatory dispatch.[58]

PJM can remove a defined subzone, and make changes to the subzone, at their discretion. Subzones should not be removed once defined, as the subzone may need to be dispatched again in the future. The METED_EAST, PENELEC_EAST, PPL_EAST and DOM_NORFOLK subzones were removed by PJM. More subzones may have been removed by PJM but PJM does not keep a record of created and removed subzones. The MMU recommends that PJM not remove any defined subzones and maintain a public record of all created and removed subzones.

The subzone design and closed loop interfaces are related. PJM implemented closed loop interfaces with the stated purpose of improving the incorporation of reactive constraints into energy prices and to allow emergency DR to set price.[59] PJM applies closed loop interfaces so that it can use units needed for reactive support to set the energy price when they would not otherwise set price under the LMP algorithm. PJM also applies closed loop interfaces so that it can use emergency DR resources to set the real-time LMP when DR resources would not otherwise set price under the fundamental LMP logic. Of the 20 closed loop interface definitions, 11 (55 percent) were created for the purpose of allowing emergency DR to set price.[60] The closed loop interfaces created for the purpose of allowing emergency DR to set price are located in the RTO, MAAC, EMAAC, SWMAAC, DPL-SOUTH, ATSI, ATSI-CLEVELAND and BGE LDAs.

Demand resources can be dispatched for voluntary compliance during any hour of any day, but dispatched resources are not measured for compliance outside of the mandatory compliance window for each demand product. A demand response event during a product's mandatory compliance window also may not result in a compliance score. When limited, extended summer and annual demand response events occur for partial hours under 30 minutes or for a subzone dispatch that was not defined one business day before dispatch, the events are not measured for compliance.

Capacity Performance demand resources currently estimate five minute compliance with an hourly interval meter during PAIs. To accurately measure compliance on a five minute basis, a five minute interval meter is required. All other Capacity Performance resources require five minute interval meters, and demand resources should be no different. Limited, extended summer and annual demand resources are paid based on the average performance by registration for the duration of a demand response event. Each capacity performance demand response product should measure compliance on a five minute basis to accurately report reductions during demand response

56 OATT Attachment DD, Section 11.

57 See "Load Management Subzones," <http://www.pjm.com/~/media/markets-ops/demand-response/subzone-definition-workbook.ashx> (Accessed February 25, 2019).

58 OATT Attachment DD, Section 10A.

59 See PJM/Alstom. "Approaches to Reduce Energy Uplift and PJM Experiences," presented at the FERC Technical Conference: Increasing Real-Time and Day-Ahead Market Efficiency Through Improved Software in Docket No. AD10-12-006 <http://www.ferc.gov/june-tech-conf/2015/presentations/m2-3.pdf> (June 23, 2015).

60 See the *2018 State of the Market Report for PJM*, Volume 2, Section 4, Energy Uplift, for additional information regarding all closed loop interfaces and the impacts to the PJM markets.

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events. The current rules for limited, extended summer and annual demand response use the average reduction for the duration of an event. The average duration across multiple hours does not provide an accurate metric for each five minute interval of the event and is inconsistent with the measurement of generation resources. Measuring compliance on a five minute basis would provide accurate information to the PJM system. The MMU recommends limited, extended summer and annual demand response event compliance be calculated on an hourly basis for noncapacity performance resources and on a five minute basis for all capacity performance resources and that the penalty structure reflect five minute compliance.[61]

Annual and capacity performance demand response currently assign annual reduction capability by registration, which is measured as the lower of the summer and winter reduction capability. Starting with the 2019/2020 Delivery Year, CSPs will assign the annual reduction capability by portfolio rather than registration, which is measured as the lower of the summer and winter reduction capability by portfolio.[62] Allowing CSPs to aggregate to the portfolio level further weakens the locational aspect of registered demand resources and artificially inflates the level of demand response. For example, imagine a CSP has two registrations in a zonal portfolio, with one registration capable of reducing 5 MW in summer and 2 MW in winter, and the second registration capable of reducing 1 MW in summer and 5 MW in winter. Before the 2019/2020 Delivery Year, the first registration would have an annual capability of 2 MW and the second registration would have an annual capability of 1 MW resulting in a 3 MW total reduction capability. After the 2019/2020 Delivery Year, individual registration capability is ignored resulting in the portfolio capability of 6 MW in summer and 7 MW in winter. This creates a 6 MW total reduction capability within the zone. Without any change to either registration, the CSP was able to add 3 MW to their annual reduction capability. The locational availability of demand resources, at a nodal level, will vary. This treatment is unique to demand resources.

Under the capacity performance design of the PJM Capacity Market, compliance for potential penalties will be measured for DR only during performance assessment intervals (PAI).[63] When pre-emergency or emergency demand response is dispatched, a PAI is triggered for PJM. PJM cannot dispatch pre-emergency or emergency demand response without triggering a PAI and measuring compliance. Before PJM created PAI to measure compliance, pre-emergency demand response could be dispatched without calling an emergency event. As a result, PJM now effectively classifies all demand response as an emergency resource.

The MMU recommends that demand response resources be treated as economic resources like all other capacity resources and therefore that the dispatch of demand response resources not automatically trigger a performance assessment interval (PAI) for CP compliance. Emergencies should be triggered only when PJM has exhausted all economic resources including demand response resources. Table 6-26 shows the amount of nominated demand response MW, the required reserve margin and actual reserve margin as of June 1, for 2017, 2018 and 2019. There are 8,988.1 nominated MW of demand response for the 2018/2019 Delivery Year, which is 40.0 percent of the required reserve margin and 28.1 percent of the actual reserve margin on June 1, 2018.[64] There are 9,547.1 nominated MW of demand response for the 2019/2020 Delivery Year, which is 42.8 percent of the required reserve margin and 24.2 percent of the actual reserve margin on June 1, 2019.

61 "PJM Manual 18: Capacity Market," § 8.7A, Rev. 41 (Jan. 1, 2019).
62 The seasonal DR registration aggregation received endorsement at the September 27, 2018 MRC meeting, <https://www.pjm.com/-/media/committees-groups/committees/mc/20180927/20180927-consent-agenda-item-b-seasonal-dr-registration-aggregation-draft-oatt-revisions.ashx>.

63 OATT § 1 (Performance Assessment Hour).
64 *2018 State of the Market Report for PJM*, Volume 2, Section 5: Capacity, Table 5-7.

Table 6-26 Demand response nominated MW compared to reserve margin: June 1, 2017 through 2019

	Demand Response Nominated MW	Required Reserve Margin	Demand Response Percent of Required Reserve Margin	Actual Reserve Margin	Demand Response Percent of Actual Reserve Margin
01-Jun-17	9,154.7	23,305.2	39.3%	33,828.1	27.1%
01-Jun-18	8,998.1	22,487.7	40.0%	31,987.5	28.1%
01-Jun-19	9,547.1	22,297.5	42.8%	39,401.6	24.2%

PJM will dispatch demand resources by zone or subzone for limited, extended summer and annual demand resources, or within a PAI area for Capacity Performance resources. When PJM dispatches all demand resources in multiple connecting zones, PJM further degrades the nodal design of electricity markets. PJM allows compliance to be measured across zones within a compliance aggregation area (CAA) or Emergency Action Area (EAA).[65] [66] A CAA, or EAA, is an electrically connected area that has the same capacity market price. This changes the way CSPs dispatch resources when multiple electrically contiguous areas with the same RPM clearing prices are dispatched. The compliance rules determine how CSPs are paid and thus create incentives that CSPs will incorporate in their decisions about how to respond to PJM dispatch. The multiple zone approach is even less locational than the zonal and subzonal approaches and creates larger mismatches between the locational need for the resources and the actual response. If multiple zones within a CAA are called by PJM, a CSP will dispatch the least cost resources across the zones to cover the CSP's obligation. This can result in more MW dispatched in one zone that are locationally distant from the relief needed and no MW dispatched in another zone, yet the CSP could be considered 100 percent compliant and pay no penalties. More locational deployment of load management resources would improve efficiency. With full implementation of capacity performance, demand response will be dispatched by registrations within an area for which an Emergency Action is declared by PJM. PJM does not have the nodal location of each registration, meaning PJM will need to guess as to the useful demand response registration by registered location. The MMU recommends that demand resources be required to provide their nodal location. Nodal dispatch of demand resources would be consistent with the nodal dispatch of generation.

65 CAA is "a geographic area of Zones or sub-Zones that are electrically contiguous and experience for the relevant Delivery Year, based on Resource Clear Prices of, for Delivery Years through May 31, 2018, Annual Resources and for the 2018/2019 Delivery Year and subsequent Delivery Years, Capacity Performance Resources, the same locational price separation in the Base Residual Auction, the same locational price separation in the First Incremental Auction, the same locational price separation in the Second Incremental Auction, or the same locational price separation in the Third Incremental Auction." OATT § 1.

66 PJM. "Manual 18: Capacity Market," § 8.7.2, Rev. 41 (Jan. 1, 2019).

Definition of Compliance

Currently, the calculation methods of event and test compliance do not provide reliable results. PJM's interpretation of load management event rules allows over compliance to be reported when there is no actual over compliance. Settlement locations with a negative load reduction value (load increase) are not netted by PJM within registrations or within demand response portfolios. A resource that has load above their baseline during a demand response event has a negative performance value. PJM limits compliance shortfall values to zero MW. This is not explicitly stated in the Tariff or supporting Manuals and the compliance formulas for FSL and GLD customers do allow negative values.[67]

Limiting compliance to only positive values incorrectly calculates compliance. For example, if a registration had two locations, one with a 50 MWh load increase when called, and another with a 75 MWh load reduction when called, PJM calculates compliance for that registration as a 75 MWh load reduction for that event hour. Negative settlement MWh are not netted across hours or across registrations for compliance purposes. A location with a load increase is set to a zero MW reduction. For example, in a two hour event, if a registration showed a 15 MWh load increase in hour one, but a 30 MWh reduction in hour two, the registration would have a calculated 0 MWh reduction in hour one and a 30 MWh reduction in hour two. This has compliance calculated at an average hourly 15 MWh load reduction for that two hour event, compared to a 7.5 MWh observed reduction. Reported compliance is greater than observed compliance, as locations with load increases, i.e. negative reductions, are treated as zero for compliance purposes.

Changing a demand resource compliance calculation from a negative value to 0 MW inaccurately values event performance and capacity performance.

67 OA Schedule 1 § 8.9.

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Inflated compliance numbers for an event overstates the true value and capacity of demand resources. A demand response capacity resource that performs negatively is also displacing another capacity resource that could supply capacity during a delivery year. By setting the negative compliance value to 0 MW, PJM is inaccurately calculating the value of demand resources.

Load increases are not netted against load decreases for dispatched demand resources across hours or across registrations within hours for compliance purposes, but are treated as zero. This skews the compliance results towards higher compliance since poorly performing demand resources are not used in the compliance calculation. When load is above the peak load contribution during a demand response event, the load reduction is negative; it is a load increase rather than a decrease. PJM ignores such negative reduction values and instead replaces the negative values with a zero MW reduction value. The PJM Tariff and PJM Manuals do not limit the compliance calculation value to a zero MW reduction value.[68] The compliance values PJM reports for demand response events are different than the actual compliance values accounting for both increases and decreases in load from demand resources that are called on and paid under the program.

The MMU recommends that compliance rules be revised to include submittal of all necessary hourly load data, and that negative values be included when calculating event compliance across hours and registrations.

Demand resources that are also registered as economic resources have a calculated CBL for the emergency event days. Demand resources that are not registered as Economic Resources use the three day CBL type with the symmetrical additive adjustment for measuring energy reductions without the requirements of a Relative Root Mean Squared Error (RRMSE) Test required for all economic resources.[69] The CBL must use the RRMSE test to verify that it is a good approximation for real time load usage. The MMU recommends the RRMSE test be required for all demand resources with a CBL.

68 OA Schedule 1 § 8.9.
69 157 FERC ¶ 61,067 (2016).

The CBL for a customer is an estimate of what load would have been if the customer had not responded to LMP and reduced load. The difference between the CBL and real time load is the energy reduction. When load responds to LMP by using a behind the meter generator, the energy reduction should be capped at the generation output. Any additional energy reduction is a result of inaccuracy in the CBL estimate rather than an actual reduction. The MMU recommends that demand reductions based entirely on behind the meter generation be capped at the lower of economic maximum or actual generation output.

An extreme example makes clear the fundamental problems with the use of measurement and verification methods to define the level of power that would have been used but for the DR actions, and the payments to DR customers that result from these methods. The current rules for measurement and verification for demand resources make a bankrupt company, a customer that no longer exists due to closing of a facility or a permanently shut down company, or a company with a permanent reduction in peak load due to a partial closing of a facility, an acceptable demand response customer under some interpretations of the tariff, although it is the view of the MMU that such customers should not be permitted to be included as registered demand resources. Companies that remain in business, but with a substantially reduced load, can maintain their pre-bankruptcy FSL (firm service level to which the customer agrees to reduce in an event) commitment, which can be greater than or equal to the post-bankruptcy peak load. The customer agrees to reduce to a level which is greater than or equal to its new peak load after bankruptcy. When demand response events occur the customer would receive credit for 100 percent reduction, even though the customer took no action and could take no action to reduce load. This problem exists regardless of whether the customer is still paying for capacity. To qualify and participate as a demand resource, the customer must have the ability to reduce load. “A participant that has the ability to reduce a measurable and verifiable portion of its load, as metered on an EDC account basis.”[70] Such a customer no longer has the ability to reduce load in response to price or a PJM demand response event. CSPs in PJM have and continue to register bankrupt customers as DR customers.

70 OA Schedule 1 § 8.2.

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PJM finds acceptable the practice of CSPs maintaining the registration of customers with a bankruptcy related reduction in demand that are unable, as a result, to respond to emergency events. Three proposals that included language to remove bankrupt customers from a CSP's portfolio failed at the June 7, 2017, Market Implementation Committee.[71] The registered customers that are bankrupt and the amount of registered MW cannot be released for reasons of confidentiality.

The metering requirement for demand resources is outdated, and has not kept up with the changes to PJM's market design. PJM moved to five minute settlements, but the metering requirement for demand resources remained at an hourly interval meter. It is impossible to measure energy usage on a five-minute basis using an hourly interval meter. PJM will estimate real time usage by prorating the hourly interval meter and assume if load is less than the CBL, that the reduction occurred during the required dispatch window. The meter reading is not telemetered to PJM in real time. The resource is allowed up to 60 days to report the data to PJM. The MMU recommends that PJM adopt the ISO-NE five-minute metering requirements in order to ensure that dispatchers have the necessary information for reliability and that market payments to demand resources be calculated based on interval meter data at the site of the demand reductions so that they can accurately measure compliance.[72]

When demand resources are not dispatched during a mandatory response window, each CSP must test their portfolio to the levels of capacity commitment.[73] A CSP picks the testing day, for one hour, on any non-holiday weekday during the applicable mandatory window. A CSP is able to retest if a resource fails to provide the required reduction by less than 25 percent. The ability of CSPs to pick the test time does not simulate emergency conditions. As a result, test compliance is not an accurate representation of the capability of the resource to respond to an actual PJM dispatch of the resource. Given that demand resources are now an annual product, multiple tests are required to ensure reduction capability year round. The MMU recommends that load management testing be initiated by PJM with limited warning to CSPs in order to more accurately represent the conditions of an emergency event.

Table 6-27 shows the test penalties by delivery year by product type for the 2015/2016 Delivery Year through the 2018/2019 Delivery Year. The shortfall MW are calculated for each CSP by zone. The weighted rate per MW is the average penalty rate paid per MW. The total penalty column is the sum of the daily test penalties by delivery year and type. The testing window for the limited product is open through September. The testing window for the extended summer, annual and Capacity Performance product is open through the end of the delivery year.

71 There was one proposal from PJM, one proposal from a market participant and one proposal from the MMU. See *Approved Minutes from the Market Implementation Committee*, <http://www.pjm.com/-/media/committees-groups/committees/mic/20170607/20170607-minutes.ashx>.

72 See ISO-NE Tariff, Section III, Market Rule 1, Appendix E1 and Appendix E2, "Demand Response," <http://www.iso-ne.com/regulatory/tariff/sect_3/mr1_append-e.pdf>. (Accessed October 17, 2017) ISO-NE requires that DR have an interval meter with five-minute data reported to the ISO and each behind the meter generator is required to have a separate interval meter. After June 1, 2017, demand response resources in ISO-NE must also be registered at a single node.

73 The mandatory response time for Limited DR is June through September between 12:00PM to 8:00PM EPT, for Extended Summer is June through October and the following May between 10:00AM to 10:00PM EPT, for Annual DR is June through October and the following May between 10:00AM to 10:00PM and is November through April between 6:00AM to 9:00PM EPT, for Base Capacity DR is June through September between 10:00AM to 10:00PM EPT, Capacity Performance DR is June through October and the following May between 10:00AM to 10:00PM EPT and November through April between 6:00AM through 9:00PM EPT. *See* PJM. "Manual 18: Capacity Market," Rev. 41 (Jan. 1, 2019).

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Table 6-27 Test penalties by delivery year by product type: 2015/2016 through 2018/2019

	2015/2016			2016/2017			2017/2018			2018/2019		
Product Type	Shortfall MW	Weighted Rate per MW	Total Penalty	Shortfall MW	Weighted Rate per MW	Total Penalty	Shortfall MW	Weighted Rate per MW	Total Penalty	Shortfall MW	Weighted Rate per MW	Total Penalty
Limited	96.4	$165.35	$5,836,255	48.9	$166.41	$2,967,158	13.9	$124.08	$631,665	0.0	$179.80	$2,100
Extended Summer	1.9	$163.70	$113,835	7.3	$138.14	$370,290	10.5	$142.86	$547,928			
Annual	3.7	$184.67	$250,621	4.8	$137.45	$241,406	16.3	$144.00	$855,940			
Base DR and EE										16.3	$186.80	$1,110,134
Capacity Performance				2.1	$160.80	$124,310	0.6	$181.80	$40,146			
Total	102.0	$166.02	$6,200,711	63.1	$160.72	$3,703,163	41.3	$137.54	$2,075,678	16.3	$186.79	$1,112,234

Emergency Energy Payments

Emergency and pre-emergency demand response dispatched during a load management event by PJM are eligible to receive emergency energy payments if registered under the full program option. The full program option includes an energy payment for load reductions during a pre-emergency or emergency event for demand response events and capacity payments.[74] There were 98.2 percent of nominated MW for the 2017/2018 Delivery Year and 98.8 percent of nominated MW for the 2018/2019 Delivery Year registered under the full program option. There were 1.8 percent of nominated MW for the 2017/2018 Delivery Year and 1.2 percent of nominated MW for the 2018/2019 Delivery Year registered as capacity only option. Demand resources clear the capacity market like all other capacity resources and the dispatch of demand resources should not trigger a scarcity event. The strike price is set by the CSP before the delivery year starts and cannot be changed during the delivery year. The demand resource energy payments are equal to the higher of hourly zonal LMP or a strike price energy offer made by the participant, including a dollar per MWh minimum dispatch price and an associated shutdown cost. Demand resources should not be permitted to offer above $1,000 per MWh without cost justification or to include a shortage penalty in the offer. FERC has stated clearly that demand resources in the capacity market must verify costs above $1,000 per MWh, unless they are capacity only. "We clarify, however, that reforms adopted in this Final Rule, which provide that resources are eligible to submit cost-based incremental energy offers in excess of $1,000/MWh and require that those offers be verified, do not apply to capacity-only demand response resources that do not submit incremental energy offers in energy markets."[75] PJM interprets the scarcity pricing rules to allow a maximum DR energy price of $1,849 per MWh for the 2017/2018 Delivery Year and the 2018/2019 Delivery Year.[76] [77] Demand resources registered with the full option should be required to verify energy offers in excess of $1,000 per MWh. PJM does not require such verification.[78] The MMU recommends that the maximum offer for demand resources be the same as the maximum offer for generation resources.

Shutdown costs for demand response resources are not adequately defined in Manual 15. PJM's Cost Development Subcommittee (CDS) approved changes to Manual 15 to eliminate shutdown costs for demand response resources participating in the Synchronized Reserve Market, but not demand resources or economic resources.[79]

Table 6-28 shows the distribution of registrations and associated MW in the emergency full option across ranges of minimum dispatch prices for the 2018/2019 Delivery Year. The majority of participants, 76.8 percent of locations and 53.9 percent of nominated MW, have a minimum dispatch price

74 *Id.*

75 161 FERC ¶ 61,153 (2017).

76 139 FERC ¶ 61,057 (2012).

77 FERC accepted proposed changes to have the maximum strike price for 30 minute demand response to be $1,000/MWh + 1*Shortage penalty - $1.00, for 60 minute demand response to be $1,000/MWh + (Shortage Penalty/2) and for 120 minute demand response to be $1,100/MWh from ER14-822-000.

78 OATT. Attachment K Appendix Section 1.10.1A Day-ahead Energy Market Scheduling (d) (x).

79 "PJM Manual 15: Cost Development Guidelines," § 8.1, Rev. 30 (Dec. 4, 2018).

between $1,550 and $1,849 per MWh, which is the maximum price allowed for the 2018/2019 Delivery Year, 2.3 percent of locations and 4.0 percent of nominated MW have a dispatch price between $0 and $1,000 per MWh, and 97.7 percent of locations and 96.0 percent of nominated MW have a dispatch price above $1,000 per MWh. The shutdown cost of resources with $1,000 to $1,275 per MWh strike prices had the highest average at $173.97 per location and $130.17 per nominated MW.

Table 6-28 Distribution of registrations and associated MW in the full option across ranges of minimum dispatch: 2018/2019 Delivery Year

Ranges of Strike Prices ($/MWh)	Locations	Percent of Total	Nominated MW (ICAP)	Percent of Total	Shutdown Cost per Location	Shutdown Cost Per Nominated MW (ICAP)
$0-$1,000	338	2.3%	350.6	4.0%	$69.18	$55.03
$1,000-$1,275	2,666	18.4%	3,355.9	37.9%	$173.97	$130.17
$1,275-$1,550	361	2.5%	380.6	4.3%	$51.11	$48.48
$1,550-$1,849	11,159	76.8%	4,775.2	53.9%	$51.43	$120.18
Total	14,524	100.0%	8,862.3	100.0%	$74.33	$121.81

Table 6-29 shows the distribution of registrations and associated MW in the emergency full option across ranges of minimum dispatch prices for the 2019/2020 Delivery Year. The majority of participants, 75.3 percent of locations and 56.7 percent of nominated MW, have a minimum dispatch price between $1,550 and $1,849 per MWh, which is the maximum price allowed for the 2019/2020 Delivery Year, 3.6 percent of locations and 3.6 percent of nominated MW have a dispatch price between $0 and $1,000 per MWh, and 96.4 percent of locations and 96.4 percent of nominated MW have a dispatch price above $1,000 per MWh. The shutdown cost of resources with $1,000 to $1,275 per MWh strike prices had the highest average at $181.51 per location and $141.57 per nominated MW.

Table 6-29 Distribution of registrations and associated MW in the full option across ranges of minimum dispatch: 2019/2020 Delivery Year

Ranges of Strike Prices ($/MWh)	Locations	Percent of Total	Nominated MW (ICAP)	Percent of Total	Shutdown Cost per Location	Shutdown Cost Per Nominated MW (ICAP)
$0-$1,000	530	3.6%	339.5	3.6%	$46.98	$86.48
$1,000-$1,275	2,761	18.8%	3,397.5	35.9%	$181.51	$141.57
$1,275-$1,550	350	2.4%	364.9	3.9%	$57.49	$55.14
$1,550-$1,849	11,073	75.3%	5,370.6	56.7%	$49.77	$102.62
Total	14,714	100.0%	9,472.5	100.0%	$74.57	$115.84

Distributed Energy Resources

Distributed Energy Resources (DER) are not well defined, but generally include small scale generation directly connected to the grid, generation connected to distribution level facilities and behind the meter generation.[80] For example, Table 6-24 shows the fuel mix of behind the meter generation participating as emergency demand response in the 2018/2019 Delivery Year. Clear rules for defining DERs and for defining the ways in which DERs will interact with the wholesale power markets do not yet exist, although the development of those rules is under active discussion.[81] [82] DERs should be treated like other resources. Creating preferential treatment for DERs could create an incentive to move resources behind the meter in a manner inconsistent with efficiency and competitive

80 Some energy storage facilities may be DERs. The February 15, 2018, FERC Order No. 841 requires that energy storage resources have access to capacity, energy and ancillary service markets. 162 FERC ¶ 61,127, at P 1 (2018).
81 In PJM, the Distributed Energy Resources Subcommittee (DERSC) is currently discussing these issues. *Distributed Energy Resources Subcommittee*, PJM, <http://www.pjm.com/committees-and-groups/subcommittees/ders.aspx>.
82 See "Notice of Technical Conference," Docket No. RM18-9-000 and AD18-10-000 (February 15, 2018); "Technical Conference Distributed Energy Resources," Docket No. RM18-9-000 and AD18-10-000 (April 10, 2018).

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markets. FERC directed that DER aggregation be as geographically broad as technically feasible.[83]

The current demand response rules appropriately restrict demand response from injecting power into the grid and receiving demand response revenue. At the January 30, 2019, Demand Response Subcommittee meeting, PJM without a stakeholder process or FERC approval, decided to allow some economic DR payments when DR injects power into the grid. PJM's test compares the total benefits of running the generator which includes generation payments and assumed retail rate savings against the total cost of the generator. If the total cost of the generator is greater than the benefits, then the resource would receive economic DR payments while injecting. The use of a retail rate in calculating wholesale power market benefits raises significant issues analogous to net metering that require discussion and tariff changes. PJM should not include retail rate benefits in the definition of demand response without approval of FERC.

Aggregation to a single node is technically feasible. Allowing DER aggregation across nodes is not necessary and is not consistent with the nodal market design. Getting the rules correct at the beginning of DER development is essential to the active and effective participation of DER in the wholesale power markets in a manner that enhances rather than undercuts the efficiency and competitiveness of the power markets.

83 162 FERC ¶ 32,718 at P 139 (2016).

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TAB K

This is Exhibit **"K"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

Consumer Savings, Price, and Emissions Impacts of Increasing Demand Response in the Midcontinent Electricity Market

Steve Dahlke[a,b] and Matt Prorok[a]

ABSTRACT

This paper estimates consumer savings, CO_2 emissions reductions, and price effects from increasing demand response (DR) dispatch in the Midcontinent Independent System Operator (MISO) electricity market. To quantify market effects, we develop a dynamic supply and demand model to explore a range of DR deployment scenarios. The study is motivated by the existence of regulatory and market rule barriers to market-based deployment of DR resources in the MISO region. We show annual consumer savings from increased market-based DR can vary from $1.3 million to $17.6 million under typical peak operating conditions, depending on the amount of DR resources available for market dispatch and the frequency of deployment. Consumer savings and other market effects increase exponentially during atypical periods with tight supply and high prices. Additionally, we find that DR deployment often reduces CO_2 emissions, but the magnitude of emissions reductions varies depending on the emissions content of marginal generation at the time and location of deployment. The results of this study suggest regulators and other stakeholders should focus policy efforts to reducing regulatory barriers to DR deployment in wholesale markets, particularly in locations that experience high price spikes, to improve market efficiency and achieve cost savings for consumers.

Keywords: Demand response, Electricity markets, Demand side management, Load management, Midcontinent ISO

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1. INTRODUCTION

A significant challenge associated with the development of wholesale electricity markets is the lack of demand-side participation. In most electricity markets, consumers face static prices that often do not change over the course of days, weeks, and months, while the costs to supply electricity change significantly across these time scales. The result is a mismatch between real-time market conditions and retail prices that causes over-consumption during high-price periods and under-consumption during low-price periods (Schweppe, Caramanis, Tabors, and Bohn, 1988; Faruqui and George, 2002). This inefficiency increases spot price volatility, makes it more difficult for operators to manage physical constraints, and increases vulnerability to the exercise of market power (Bushnell, Hobbs and Wolak, 2009). In the MISO region there is a significant potential for electricity demand response that is largely unmet (Faruqui, Hajos, Hledik, and Newell, 2009). Barriers in the region include state regulatory hesitancy and wholesale market rules designed for large centralized

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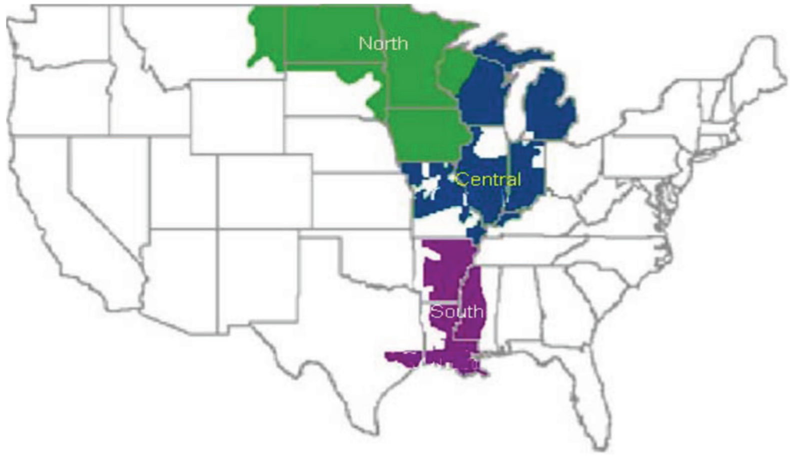
Figure 1: MISO market and subregions.



power generation (Cappers, MacDonald, Goldman, and Ma, 2013). These regulatory barriers keep economic demand response resources out of the wholesale energy market, creating an inefficiency that leads to artificially high prices.

This paper quantifies wholesale consumer savings and other impacts of increasing economic demand response (DR) dispatch in the MISO energy market using a bottom-up[1] hourly supply and demand model for the Midcontinent Independent System Operator wholesale electricity market (also referred to as Midcontinent ISO, or MISO; in the remainder of the paper we will use the acronym MISO). The MISO market spans 15 U.S. states and facilitates trade across 65,000 miles of electric transmission and between 200 gigawatts of electricity generation. We model DR dispatch across three different MISO subregions, North, Central, and South, defined in Figure 1 (MISO, 2014).

We use historic data to simulate market effects from dispatching a range of existing DR resources that are currently out of the market. All datasets and code for this analysis, as well as online appendices, are publicly available on the Open Science Framework repository at https://osf.io/6r5cw/. Our study is not the first to show energy market benefits from increased DR (e.g. see Faruqui, Hledik, Newell, and Pfeifenberger, 2007; Walawalkar, Blumsack, Apt, and Fernands, 2007; Braithwait and Eakin, 2002; Aalami, Moghaddam, and Yousefi, 2009). However, as discussed in Cappers et al. (2013), DR in the MISO market is shaped by a unique set of state-jurisdictional regulatory and market rule challenges that do not exist in other competitive wholesale markets, warranting a region-specific study. We make several contributions to the literature. First, we estimate market effects from increased DR dispatch for the MISO market, the largest power system in the United States by geographic scope and one of the largest electricity markets in the world. Second, we fill a gap in the energy literature characterized by a lack of studies on incentive-based DR. Third, we apply microeconomic theory to model the costs and benefits of dispatching incentive-based DR in a wholesale electricity market using a net-benefits criteria, described in section 2.2. Finally, we combine DR data from the U.S. Energy Information Administration (EIA) with ISO market data in

1. "Bottom-up" means we rely on historic generator-level and DR program data to build supply curves, and historic demand data to construct demand curves. Conversely, a "top-down" modeling approach may involve constructing a model using market-wide summary statistics and representative technical and cost assumptions. See Rivers and Jaccard (2005) for further discussion of differences between top-down and bottom-up modeling approaches in the context of energy modeling.

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a dynamic supply and demand simulation model. Other novel characteristics of this study include estimating wholesale DR market offers from EIA data, calculating the sensitivity of results to a range of DR energy shifting assumptions, and producing estimates of carbon emissions impacts for various DR deployment scenarios.

The rest of this paper is organized as follows. In section 2 we define and classify DR for the purposes of our analysis, and motivate our research design and modeling strategy. In section 3 we describe the methodology and data used for the analysis. In section 4 we present our results, and in section 5 we conclude with a summary of results and subsequent policy recommendations. Our modeling shows how increasing cost-effective DR dispatch can generate consumer savings net of system costs by lowering prices under typical peak operating conditions. We also show how the market impacts of DR increase exponentially when deployed during critical peak operating conditions.

2. MOTIVATION

2.1 Background

Demand response in electricity markets encompasses a range of market participant activities, programs, and technologies. DR can be classified into two broad categories, according to definitions adopted by the U.S. Department of Energy, the Federal Energy Regulatory Commission (FERC), and numerous academic articles (U.S. DOE, 2006; U.S. FERC, 2009; Albadi and El-Saadany, 2008). The first category of DR is defined as "changes in electricity usage by end-use customers from their normal consumption patterns in response to changes in price." These types of demand response resources are referred to as price-based programs, and encompass electricity price structures designed to change over time including time-of-use (TOU), critical-peak-pricing (CPP), and real-time-pricing (RTP) programs. The second category is defined as "incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is in jeopardy." These resources are referred to as incentive-based programs and include direct load control (DLC) and interruptible/curtailable (I/C) load programs.

The MISO region of the United States historically has had a higher proportion of DR relative to total load compared to other regions in the United States for several important reasons. First, some states in the region require utilities to invest a percentage or two of revenue from retail sales in DR programs. Second, utilities in the region have historically had favorable resource adequacy rules that allow load management to be counted towards meeting reserve requirements, generating savings or revenues from the DR even if it is never deployed. Third, the customer base in this region has a significant fraction of industrial load that is amenable to interruption (Cappers, Goldman, and Kathan, 2009). EIA reports that utilities in MISO have 4.4 GW of DR (U.S. Energy Information Administration, 2016), while MISO reports they have 5.7 GW of DR resources available (MISO Planning Resource Auction, 2016). This discrepancy is largely due to the fact that EIA's DR survey form covers electric retail utilities, and not large end-use customers that register their DR program directly with MISO.

Despite a large portion of DR in the MISO region, the resources are deployed at a much lower frequency than the rest of the country. For example, in 2015 only 22% of the available DR resources in the MISO market were deployed, compared to 42% in the rest of the country (U.S. EIA, 2016). In California, a particularly active market for DR, 64% of available resources were deployed. During the few occasions when DR resources in the MISO are deployed, they are often done so by individual utilities outside of the MISO market, and show up to the market operator as unexpected

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load reductions. However, the large majority of DR is available for direct deployment by MISO up to at least 5 times per summer through a product category called a "Load Modifying Resource" (LMR). LMRs do not directly participate in the energy market and are only called on during grid emergencies. However, many LMR resources are "economic" during peak periods in that they have a lower marginal cost of dispatch than the generators in the energy market that get dispatched ahead of them. MISO has an energy DR program available but participation is negligible due to market rule and regulatory barriers.

MISO has historically underutilized the DR assets available to it. Since the launch of MISO's energy markets in 2005, MISO has only deployed its registered DR under the LMR asset classification twice at the time of writing. On April 4th, 2017 during a maximum generation event triggered by unseasonably high temperatures, MISO called on just over 700 MWs of LMRs in the southern portion of its footprint (MISO LMR Performance, 2017). The only other deployment in MISO's history we have record of was in 2006 (Potomac Economics, 2017).

Various market and state regulatory barriers prevent better DR participation in the MISO market. MISO's rules for economic Demand Response Resources require a minimum size threshold of at least 1 megawatt (MW) to participate in the market[2] (MISO Tariff, 2017; MISO BPM, 2016). Additionally, MISO's rules make it difficult to aggregate small DR resources to meet the minimum size threshold.[3] This prevents many demand response resources from entering the market. Other markets that have more active DR participation, including PJM and ISO New England, have corresponding minimum size thresholds of 0.1 MW and do allow aggregation of resources across pricing nodes. The second reason for low DR participation in MISO is state regulatory resistance to giving up control of regulated DR assets in the competitive market. As a result, regulators often will not let utilities enter their DR assets into the wholesale markets, and most states in the MISO region have banned commercial activity by third party DR aggregators (Cappers et al. 2013). More information on regulatory and technical reasons why demand-side management programs have underdelivered in wholesale electricity markets around the world are provided by Wirl (2000) and Rivers and Jaccard (2011).

2.2 Modeling DR in wholesale markets

In this section we develop a general microeconomic model that is applied to understand the effects of deploying incentive-based DR in a wholesale electricity market under a net-benefits criterion. First, it is important to clarify that consumers in the wholesale market are often electric utilities or third-party intermediaries purchasing energy on behalf of their customers. In some cases, large users of electricity will bypass the utility and purchase energy directly from the wholesale market. All these entities can provide demand response in the wholesale market.[4] A utility demand response program in the wholesale market is typically an aggregation of the utility's customers who are able to provide reliable energy reductions when it is cost-effective to do so. The details of the financial arrangements between utilities and their retail customers, including incentives offered to DR consumers for participation, as well as what happens with the wholesale revenue earned by the

2. In order for any resource to set prices in the market it must be both eligible to provide specific market services and be included in MISO's Network Model. Demand Response Resources (DRR) – Type II must be at least 1 MW to be included in the Network Model. DRR-Type I do not have this same requirement, but are only modelled as load in the Network Model and thus are not able to set market clearing prices. Instead they may only participate as a price taker.

3. For DR providing energy and reserve services, MISO prevents aggregation across local balancing authority areas, and for DR providing regulation service, MISO presents aggregation across economic pricing nodes.

4. A utility may also contract with another entity to aggregate customers and offer DR into the market on their behalf.

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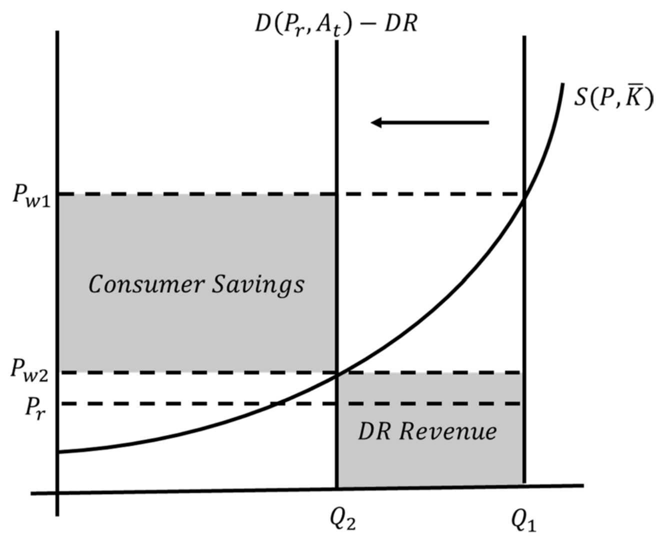
utility, are not included in our model. These retail arrangements can vary by utility and customer, they occur downstream of the wholesale model, and are out of scope for this study. In the model we assume a competitive wholesale market so that DR resources offer into the market at the marginal cost of energy reduction. This includes the cost to the consumer of not using the electricity, plus marginal costs associated with administering the energy reduction. In reality, market participants may violate this assumption by acting non-competitively or may be constrained from acting competitively by regulations.

Aggregate wholesale electricity demand is inelastic to the wholesale price and a function of an exogenous fixed retail price P_r and a demand shifting parameter A_t, represented by $D(P_r, A_t)$. A_t varies exogenously through time due to external factors such as weather and changing consumer preferences. We assume generators are competitive and offer into the market until price falls below their marginal cost of production. $S_t(P, \bar{K})$ provides the aggregate market supply at price P with total supply capacity $\bar{K}$. The quantity cleared in the market is equal to the amount demanded at the fixed retail price P_r, so that $Q = D(P_r, A_t)$. If generators are stacked by their marginal cost so that the lowest-cost generator is deployed first, the wholesale market clearing price is determined by the marginal cost of the last generator required to meet market demand Q, so that $Q = S(P_w, \bar{K})$. In the short term, Q is inefficiently high when $P_w > P_r$, and inefficiently low when $P_w < P_r$, generating deadweight loss (DWL).

Incentive-based DR programs involve payments to customers in exchange for energy reductions. Current federal regulations in the United States require DR in wholesale markets to be compensated the same as electric generators providing a similar energy service (U.S. Federal Energy Regulatory Commission, 2011). An incentive-based DR deployment in the market can be modeled by a leftward shift in the market demand curve to $D(P_r, A_t) - DR$ as shown in Figure 2. Now the market clearing quantity is $Q_2 = Q_1 - DR$, and the new wholesale price P_{w2} is equal to the marginal cost of the last generator needed to supply Q_2. The price reduction generates consumer savings equal to $Q_2 \times (P_{w1} - P_{w2})$. Since regulations require that DR providers be compensated at the wholesale price, there are still Q_1 resources receiving payment P_{w2},[5] but only Q_2 electricity consumers

Figure 2: Incentive-based DR deployment modeled as a shift in demand.



5. This consists of $Q_1 - Q_2$ DR resources and Q_2 generation resources receiving P_{w2}.

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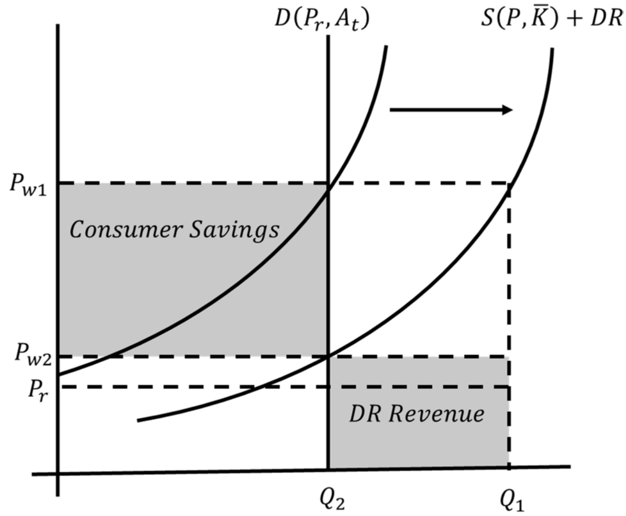
Figure 3: Incentive-based DR deployment modeled as a shift in supply.



purchasing at P_{w2}. This creates a market revenue shortfall equal to $P_{w2} \times (Q_1 - Q_2)$, the revenue owed to DR providers (labeled "DR Revenue" in Figure 2).

The fact that consumer savings from DR deployment are offset by the revenue owed to DR providers is known as the billing effect. The revenue shortfall is typically socialized as a charge applied proportionately to the remaining wholesale consumers. If DR revenue exceeds consumer savings, costs will outweigh the benefits of DR deployment. FERC regulations require that consumer savings be greater than revenue to DR consumers, so that non-DR consumers still experience a net-benefit from DR deployment. The situation in which consumer savings equals DR revenue is known as the net-benefits threshold, below which DR cannot be deployed (FERC, 2011). Any demand reduction that occurs when the market equilibrium is at an inelastic portion of the supply curve will yield more consumer savings then revenue owed to DR owners and pass the net benefits test. Our analysis is designed to ensure that all DR deployments that occur in the simulations satisfy the net benefits test.

Because incentive DR programs are compensated at the wholesale price like a generator, market operators treat DR like generators in that they are dispatched as part of the supply stack. In this case, DR dispatch can be equivalently modeled as a rightward shift in supply, shown in Figure 3. In this model, DR resources prior to being dispatched are equivalent to negative supply, so the original supply curve is left of the market supply curve presented in Figure 2. Q_1 is the quantity that would clear if DR was not included as a supply resource and instead added back to the demand curve. Q_2 is the market clearing quantity with DR included. Since in this case DR is scheduled as supply, $D(P_r, A_t)$ does not include the demand reserved as DR capacity. As in the previous case, consumer savings are equivalent to $Q_2 \times (P_{w1} - P_{w2})$, and the revenue owed to DR providers is equal to $P_{w2} \times (Q_1 - Q_2)$.

2.3 Why model incentive-based DR?

Most incentive-based DR programs in the U.S. were developed starting in the 1980's due to a significant increase in air-conditioning load, which increased the need for peaking capacity relative to non-peak. Many regulated utilities invested in incentive-based DR as a lower-cost alterna-

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tive to peaking generators (Lovins, 1985). At the time, metering technology required to implement price-based DR was not available. After significant incentive-based DR investments in the 1980's and 1990's, the FERC assumed jurisdiction via a congressional mandate and began working to remove barriers to DR participation in wholesale markets (Wellinghoff and Morenoff, 2007). Now, advanced metering technology to enable price-based DR is available. However the prevalence of price responsive demand remains small primarily due to an unwillingness by state regulators to expose retail customers to uncertain prices (Bushnell et al., 2009).

Economists disagree on the effectiveness of compensating incentive-based DR at the wholesale price as current regulations require. Some claim that wholesale payments for energy reductions inflate price signals because customers are 'double-compensated' for their reduction, as DR participants benefit both from the savings from not purchasing electricity and the wholesale market payment (Hogan, 2010). Others worry that incentive-based DR will crowd out true price response (Bushnell et al., 2009). Additionally, they point out incentive-based DR consumers may game the market and inflate pre-reduction consumption baselines if proper rules are not implemented (Chao and Depillis, 2013; Chen and Kleit, 2016). Some do note that concerns about improper baselines can be mitigated by properly structured market rules, as outlined by Chao and Depillis (2013).

Proponents of incentive-based DR in wholesale markets point out it is a second-best solution that, in the absence of price-responsive demand, moves market prices closer to the efficient level. Additionally, implementing a price-based DR program includes upfront costs that in many cases exceed the benefits to the customer (Leautier, 2014). In a market with static retail rates, failing to deploy DR resources when the market clearing price exceeds the marginal cost of demand reduction results in a market inefficiency (Kahn, 2010). This is the case in the MISO market, leading to inefficiently high prices and extra costs for consumers. Moreover, there is a gap in the literature with respect to studies on incentive-based DR. A recent literature review analyzed 117 studies on DR modeling, and concluded:

> there is a clear lack of models addressing incentive-based DR programs. This is somewhat astonishing given the fact that, in the U.S., DLC and I/C programs are applied more frequently than TOU or RTP programs. The majority of studies focus on price-based programs (Boßmann and Eser, 2016).

Furthermore, there is currently a large fleet of underutilized incentive-based DR assets in the MISO region that are not comprehensively integrated into the wholesale energy market, described previously in section 2.1. Despite concerns from some economists with respect to incentive-based DR, we analyze effects of increasing participation of incentive-based DR in the MISO market because, 1) there is a much bigger penetration of incentive-based DR currently in existence relative to price-based DR, 2) these resources are underutilized and not comprehensively integrated into wholesale markets, especially in MISO, and 3) there is a lack of studies in the literature focused on incentive-based DR.

3. METHODOLOGY

3.1 Overview

The purpose of our modeling exercise is to estimate consumer savings, emissions impacts, and price effects from increasing DR dispatch in the MISO energy market. We do this for a range of scenarios that explore differences in DR dispatch amounts, frequencies, energy shifting effects, and energy offer prices. Our modeling approach consists of a dynamic supply and demand model that varies hourly, where the market clearing prices and quantities are determined by the intersection

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of the two curves. This is similar to the model applied in Buzoianu, Brockwell, and Seppi (2005), except in our case supply curves are constructed bottom-up from historical generator-level offers data obtained from MISO. Demand curves in the model are based off hourly historic MISO demand data and are assumed to be inelastic. We assume inelastic demand because the large majority of electricity customers in the MISO region face retail rates that are fixed in the short-term and do not adjust when wholesale prices change. We use 2015 market and DR data because it is the most recent year in which demand response data is available from the EIA at the time of writing. Additionally, real-time instead of day-ahead MISO market data are used since the real-time market is used as a 'true-up' to balance unexpected deviations from day-ahead predictions and scheduling. Furthermore, real-time prices more accurately reflect historic system conditions, and are the final prices used to settle transactions in the energy market. Because our bottom-up supply curves are discontinuous, we use an iterative solver-based approach to calculate the market equilibrium for each hour and market region, programmed in the R statistical computing language. We model supply and demand for every hour of 2015 for the three MISO regions defined in Figure 1: North, Central, and South. This is motivated by recent empirical work finding sub regional variation in price responsiveness within the MISO region (Eryilmaz, Smith, and Homans, 2017). Our analytical approach quantifies market clearing price and quantity effects from dispatching DR and compares them to baseline outcomes that occurred without DR.

The model scenarios dispatch DR based on resource quantities and marginal cost estimates for existing DR resources located in the MISO region that do not participate in the energy market.[6] Since most DR resources in the MISO region are registered through the market under the 'Load Modifying Resources' (LMR) category, our model dispatch constraints are based on MISO's LMR operating agreement (Potomac Economics, 2017). LMR contracts require DR resources to be available for up to 5 deployments during the summer season for a minimum of 4 hours per deployment (MISO Tariff, 2017). Because many DR programs are available for dispatch more than 5 deployments per year and not necessarily limited to summer months[7], we simulate additional scenarios that dispatch DR up to 20 times per year and outside of summer months when it is economic to do so.

Since the number of DR deployments per year is constrained, DR should be deployed on days with both high prices and energy demand in order to maximize value. To determine the highest value days in 2015, we use a similar approach to The Brattle Group (2007) and rank highest value days according to the price-load product for 4-hour dispatch blocks. Specifically, we multiply the average price and demand for each hour in 2015 and calculate 4-hour moving averages. We then select the days that have the highest price-load product average to determine the most valuable days for DR dispatch, eliminating duplicate days. Because we model scenarios that limit DR dispatch to summer months as well as scenarios that model DR dispatch year-round, we compile two lists of 20 highest-value days from 2015, one for the entire year and the other restricted to the summer months. These lists are provided in online appendix 1, publicly available at the link provided in section 1.

3.2 Costs

A key input for the supply-demand model is resource-level energy offers, measured in dollars per megawatt-hour ($/MWh). These are the supply offers from which the market operator schedules least cost dispatch. In section 2 we describe that market rule and regulatory barriers

6. Except for the few events described in section 2.1.

7. Cappers et al. (2013) notes that incentive-based DR programs have historically been designed for between 8–20 deployments per year.

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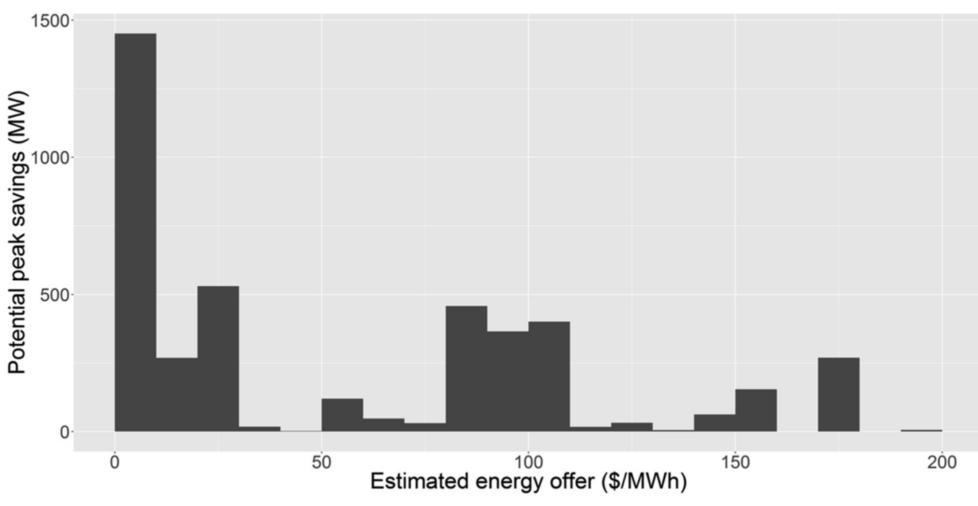
currently inhibit a competitive DR market in MISO. In contrast, our modeling effort is designed to explore the effects of a more competitive market. In a competitive market, DR is assumed to offer energy reductions at the marginal cost of deployment. In the absence of marginal cost data, DR energy offers are estimated to be a function of the cost incurred by the underlying electricity customers for service interruption, which varies by customer.[8] To estimate DR energy offers, we use utility-reported data from the EIA on DR customer incentive costs. Customer incentive costs are defined as the total financial value provided to a customer for their program participation, including direct payments, lowered tariff rates, in-kind services, or other benefits (U.S. EIA, 2014). Customers that have a high cost of electricity interruption will demand high incentive payments, and have a lower likelihood of deployment (Albadi and El-Saadany, 2008). The distribution of energy offer estimates is displayed in Figure 4. 3% of MISO DR programs had offer cost estimates above $200/MWh, which are omitted from the figure to eliminate scaling issues. A portion of these high cost DR resources were constrained to be equal to the MISO energy market price cap of $2,000/MWh. As shown in Figure 4, about one third of MISO DR resources have low energy offer estimates between $0/MWh and $10/MWh. The remaining distribution is spread about evenly between $10/MWh and $200/MWh. Further details on the DR energy offer estimation methods are provided in online appendix 2.

Our energy offer estimates are compared to historic DR offers in the PJM market, which has active energy market DR participation. In 2015, economic demand response resources in the PJM market provided over 121,000 MWhs of supply (McAnany, 2016). Demand response bids during this year range between $0/MWh and $1,850/MWh. This range aligns well with the range of our marginal cost estimates, however the PJM DR offers are higher on average (McAnany, 2016). This could be due to a number of factors, including higher costs of DR deployment in PJM compared to MISO, non-competitive bidding behavior by DR providers, or under-estimated DR program costs provided by utility survey responses to the EIA. Due to higher energy offers from DR observed in PJM, we model sensitivity scenarios in which all energy offers in MISO are increased by 100%.

Figure 4: DR resource by estimated energy offer, MISO region.



8. For example, a hospital may have a greater cost of electricity interruption than an office building.

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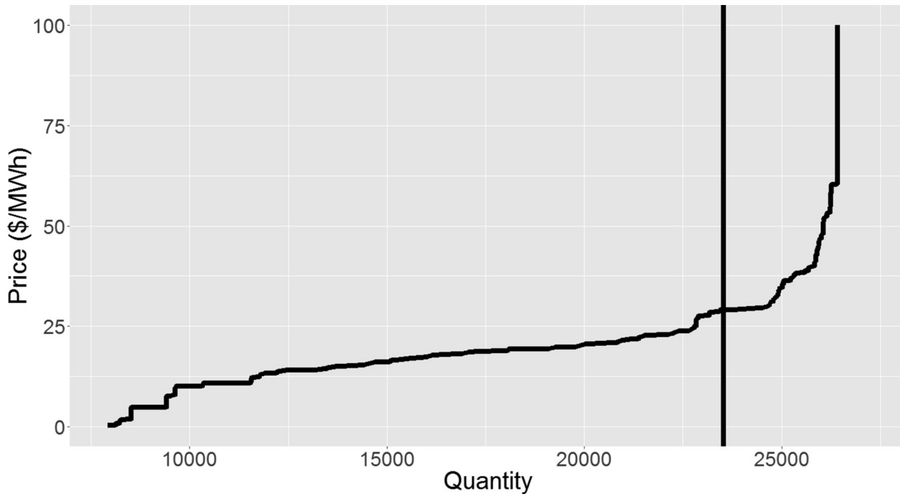
Figure 5: MISO system supply curve plus demand (vertical line) for the North region on July 12, 2015 at 4pm.



3.3 Baseline model

Hourly supply curves were constructed using historic MISO offers data. This data includes hourly price-quantity pairs for every generator offering into the MISO, anonymized to protect confidentiality. From this we construct hourly supply curves by region. We separate the model into MISO's three operations regions: North, Central and South. Inelastic demand is included based on historic load data, and the intersection of supply and demand curves determines the market clearing price and quantity prediction for each hour and region. As an example, Figure 5 plots the supply and demand curves for the North region on July 12, 2015 at 4pm.

Next, DR resources are added to the baseline model, assigning each DR resource to the corresponding region depending on that resource's reported state. The baseline supply-demand model predicts hourly prices based on historic data. The model abstracts from other real-world factors that also determine price, including transmission constraints, net imports, unforced outages, and forecast error. Sometimes these factors cause large price spikes that our model does not predict. To understand how often actual prices deviate from our model's predictions we compare the model-predicted prices to actual historic prices. Plots of the hourly distributions of actual prices by subregion for the highest-value days modeled are provided in online appendix 3.

Figure 6 shows the average predicted prices by hour versus average actual prices for the 20 highest value days in the south region during the summer of 2015. These hourly averages are smoothed[9] and weighted by daily demand. The model consistently under predicts prices during afternoon peak hours. Corresponding plots for the North and Central regions are provided in online appendix 4. Peak periods are when factors exogenous to our model including transmission constraints and forecast error are most pronounced and when we expect the model to under-predict prices. We use historical price data to adjust the baseline model to better reflect the actual price levels throughout the day. The difference between the average actual price and the average predicted price for each region are used as hourly adjustment factors to calibrate the model's predictions.

9. We apply exponential smoothing to the actual hourly price series to minimize noise across hours. Hourly smoothing doesn't materially affect modeling results since DR events are modeled in 4-hour blocks.

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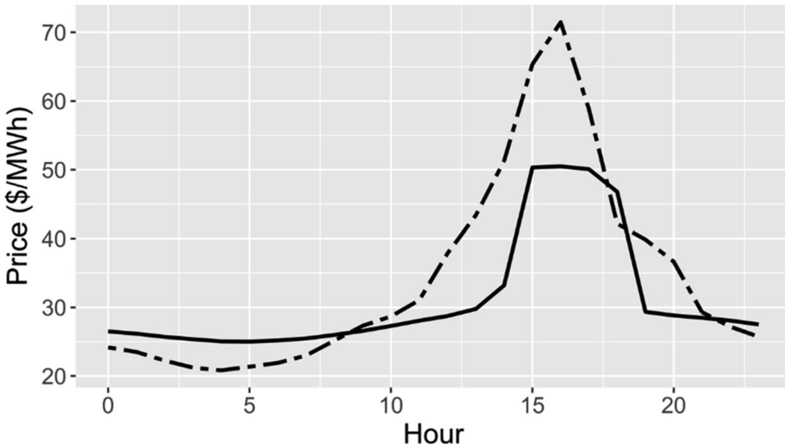
Figure 6: Average hourly prices predicted by model (solid line) versus actual prices (dashed line) during highest value summer days in 2015, south region.



This adjusts predicted prices upward during hours in which the model systematically under-predicts prices, and downward during hours that systematically over-predict prices.

Most of our modeling results, including changes in consumer savings, emissions, and prices, are calculated as differences between scenarios with and without DR in the supply curve, all else equal. Thus, the adjustments made to absolute price levels will not directly impact these results. The adjustment factors allow for predicted market clearing prices that more closely match historic prices, and simulate levels of economic DR clearing the market based on realistic price levels.

3.4 Energy shifting

Aggregate effects on demand from DR dispatch consist of both a reduction and a shift in energy use. Demand shifting involves moving electricity use to off-peak periods, but doesn't involve a net reduction in energy use over time. Smith and Brown (2015) find that on average, 16% of peak energy reduction from DR is shifted to off-peak periods. This value was derived from price-quantity elasticity estimates from a study that empirically measured the effects of a Duke Energy real-time pricing program over 8 years (Taylor, Schwarz, and Cochell, 2005). Modeling in De Jongh, Hobbs, and Bellmans (2012) assumes DR energy shifting ranges from 8% to 16%. Furthermore, FERC's Demand Response Impact and Value Estimation (DRIVE) model provides hourly impact profiles of DR programs. Examining the load shifting parameters in this model for residential programs, commercial/industrial (C/I) interruptible tariffs, and other large C/I programs, yields a weighted average energy shift value of 12.1%. In contrast, the EIA NEMS assumes DR energy shifting of 96%, although this parameter does not appear to be supported by empirical experimental evidence (Smith and Brown, 2015).

Drawing from this literature, our baseline scenario assumes 15% of DR energy reductions are shifted to off-peak hours. We also conduct sensitivity scenarios that assume 1) zero energy shifted to off-peak, and 2) 96% energy shifted to off-peak. We model DR reductions occurring during the last hour of the highest-value four-hour blocks plus the three preceding hours. The load shift is then modeled as an energy increase during the four hours following the DR reduction. In the occasional situations where DR deployment occurs during the late evening (HE 19-23), we model the rebound during the hours preceding the event, assuming customers will anticipate the DR re-

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duction instead of increasing energy use when most people are asleep. Since prices are similar on average before and after DR events, changing whether the energy shifting occurs before or after the DR event does not have a material impact on the aggregate market effects reported as results.

3.5 Carbon emissions

We estimate carbon dioxide (CO_2) emissions effects for each model scenario. For confidentiality purposes, MISO's generator offers data do not identify individual plants, so neither plant-level emissions nor fuel-type information is available. We approximate the carbon content of the marginal generation for each hour by using MISO's real-time fuel on the margin data (MISO Real-Time Fuel, 2015). The data specifies the fuel of the marginal generator by region for every hour. Specifically, we multiply the hourly change in energy from DR (in MWh) by our estimate of the hourly CO_2 emissions content of the marginal generator (in kg CO_2/MWh). We use national averages of CO_2 emissions rates per MWh by fuel type from the U.S. Department of Energy (U.S. DOE, 2016), provided in Table 1. Since the MISO fuel-type data does not break out natural gas plants by combined cycle or combustion turbine, and since data on dispatch frequency by generator type in MISO is not available, the emissions factor used for natural gas is a simple average of the combined cycle and combustion turbine emissions rates. It is possible that a reduction in DR could cause the marginal fuel type to switch, however we are unable to see when this would happen given limitations in publicly available data. Thus, our results should be treated as approximations of the CO_2 emissions effects from DR dispatch.

Table 1: U.S. average carbon dioxide emission rates by fuel type. Source: US Department of Energy.

Fuel type	Emission rate (kg CO_2/MWh)
Coal	960.6
Petroleum	743.4
Natural Gas	505.9

3.6 Scenarios

We calculate market savings, price effects, and emissions effects for several scenarios to understand how changes in several variables affect our results. The scenarios include variations on the following parameters:

a) **When to deploy DR.** As discussed in section 3.1, LMR contracts only require DR to be available during the summer months (June 01–August 31), however many DR resources in MISO can be deployed outside of the summer. We model scenarios with DR deployment occurring during the highest value hours in summer months, and another with deployment during the highest value days from the entire year.

b) **Frequency of deployment.** As discussed in section 3.1, MISO's DR contracts only require DR to be deployed up to 5 times per year, but DR programs are often designed to be deployed more than 5 times per year. In general, incentive-based DR programs are designed for 8–20 deployments per year (Cappers et al, 2013). We model scenarios where DR is deployed 5 times per year, 10 times per year, and 20 times per year. Note that deploying a DR resource more often will lower its average energy offer value necessary to recover program lifetime costs, which will lead to reduced energy offers

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in a competitive market. As a result, increasing the frequency of DR deployment will lower DR offer cost estimates described in online appendix 2. As a result, increasing the frequency of DR dispatch will lower energy offer estimates, and more DR may clear at a given price.

c) **Amount of DR resources.** The DR dataset obtained from the EIA reports 4,355 MW of DR registered in the MISO region. In contrast, MISO's resource auction results for the 2015–16 planning year indicate 5,745 MW of installed DR capacity (MISO Planning Resource Auction, 2016). We model a baseline scenario with the 4,355 MW of DR for which we have detailed cost data, and an expanded scenario with 5,745 MW of DR. When scaling up DR to match the amount reported by MISO, we assign the DR to regions based on their relative regional shares as reported in the EIA data, displayed in Table 2, and assume energy offers for the expanded DR equal to the median values from the detailed EIA cost data. More details on the data cleaning process for this EIA dataset are provided in online appendix 5.

d) **Demand shift.** As discussed in section 3.4, we vary the demand shifting assumption from 0%, 15%, and 96%.

e) **Marginal costs.** As mentioned in section 3.2, we model scenarios in which energy offer estimates are increased by 100%, due to the possibility that DR resources may offer into the market at higher prices than our estimates.

Table 2: DR resources by region. Source: US Energy Information Administration.

Region	DR (MW)	Share
Central	2074.0	0.48
North	1791.3	0.41
South	489.9	0.11
Total	4355.2	1

3.7 Scenario summary

In summary, the following list summarizes the five parameters that are varied to produce sensitivity scenarios:

- When to deploy DR
  1. Summer
  2. Year-round
- Frequency of deployment
  1. 5 deployments per year
  2. 10 deployments per year
  3. 20 deployments per year
- Amount of DR resources
  1. Base—4,355 MW
  2. Expanded—5,745 MW
- Rebound effect
  1. Low—0%
  2. Base—15%
  3. High—96%

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- Energy offers
  1. Baseline estimates
  2. Baseline estimates increased by 100%

We vary these parameters to produce 30 simulations, the results of which are discussed next.

4. RESULTS

4.1 Baseline scenario

The parameter levels for the baseline scenario are listed below:

- Summer-only deployment
- 5 deployments per year
- Base-level DR resources (4,355 MW)
- Base-level rebound effect (15%)
- Baseline energy offer estimates

The results by region are provided in Table 3. In these and subsequent results, the dollar level values are rounded to the nearest $1,000 to provide a realistic perspective on the model's precision. The results for the North and Central regions are more indicative of 'typical' peak operating conditions, while the South region results include an extreme price event. For example, the average adjusted predicted price during the peak hours in the baseline scenario for the North and Central regions was $43.57, and the maximum price observed was $62.56. The South region had similar predicted price levels except for one day where prices spiked above $100 for a few hours, at which point a small amount of DR had a large effect on prices and consumer savings. Almost 2,000 MW of DR deployment in the North and Central regions combined is predicted to produce about $1.3 million in consumer savings in the baseline scenario. Conversely, only 45 MW of DR in the south region produced $38 million in consumer savings.

The South region outlier demonstrates how a small amount of DR can generate exponentially higher consumer savings if deployed in a location where the market is clearing in a steep portion of the supply curve. While not typical, extreme price events do happen and contribute to a large share of the value case for DR in wholesale markets. For example, from 2015 through 2017, the years for which historical system price data is readily available online at the time of writing, there were 100 hours during which the average MISO system price exceeded $100/MWh. Of this 12 hours were above $200/MWh, of which 2 hours were above $300/MWh (MISO Real-Time Pricing, 2015).

In addition to consumer savings, the baseline model shows modest CO_2 emissions reductions from DR, on the order of 0.3%–0.5% of total electric sector emissions from the MISO region. Because DR must pass the net benefits test before being deployed, the revenue paid to DR providers is less than consumer savings for each region.

Table 3: Simulation results by region—baseline scenario.

Region	Annual consumer savings ($)	Annual CO_2 reduction (kg)	DR cleared—hourly average (MW)	Annual DR Revenue ($)	Price effect—hourly average ($/MWh)
North	466,000	6,754,000	789	325,000	–0.54
Central	836,000	9,696,000	1,163	511,000	–0.43
South	37,696,000	73,000	45	15,000	–32.33

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4.2 Alternative scenarios

As discussed in section 3.6, we explore how changes to the parameter values impact results. The effects of parameter changes are summarized in Table 4. The first row in Table 4 presents the results of the baseline scenario for the North and Central regions combined. Each subsequent row presents average deviations from the baseline for each scenario, totaled across the North and Central regions, holding all other model parameters constant. For example, the values in the second row indicate that increasing from 5 to 10 DR deployments per year increases annual consumer savings by $1,054,907 on average across our simulations. We omit the outlier results from the South region to better represent effects of DR during non-emergency peak operating conditions. Including the South region results would change these results by orders of magnitude.

To derive the values in Table 4, we estimate a regression model using the simulated results across all scenarios for the North and Central regions. The independent variables in the regression are indicator variables corresponding to each of the simulation parameters, corresponding to the rows in Table 4. Regression coefficients on categorical explanatory variables are interpreted as average deviations from the reference category. Thus, each coefficient represents an average change from the baseline DR scenario. Because these coefficients show average deviations in outcomes predicted by various modeled supply-demand equilibria, the underlying data generating process lacks a stochastic element and reporting standard errors is not informative. The coefficients from the regression corresponding to each parameter adjustment are added to the baseline results to produce the non-baseline values in Table 4. The output for all 30 scenarios provides the underlying data for these regressions and are provided in online appendix 6. The detailed results in the appendix show that consumer savings vary across model scenarios between $1.3 million to $17.6 million for the North and Central regions during typical peak operating conditions.[10]

As reported in Table 4, increasing the frequency of deployments per year and expanding the amount of DR resources available for deployment increases annual consumer savings, CO_2 reductions, DR cleared, and price reductions relative to the baseline scenario. This is logical, as one would expect an increase in DR deployment frequency or amount to increase the magnitude of market effects relative to the baseline scenario. Changing the demand shifting parameter to zero

Table 4: Average deviations from baseline results by scenario.

Scenario	Annual Savings ($)	Annual CO_2 reductions (kg)	DR cleared—hourly average (MW)	Annual DR revenue ($)	Price effect—hourly average ($/MWh)
Baseline	1,302,000	16,450,000	1,952	836,000	–0.49
10 deployments	+1,055,000	+10,478,000	+838	+321,000	–0.04
20 deployments	+3,319,000	+33,114,000	+321	+683,000	–0.12
Expanded amount (5,745 MW)	+996,000	+9,346,000	+562	+465,000	–0.22
Zero energy shift	+461,000	+5,548,000	0	0	–0.35
High energy shift (96%)	–2,940,000	–29,958,000	0	0	0.80
Annual deployments	+1,500,000	–3,334,000	–151	+40,000	–0.36
High energy offers	–598,000	–5,767,000	–202	–290,000	–0.14

Note: Values summarize the results of 30 simulations. Each column represents results for that variable in the north and central regions. The top row presents the baseline results, summed over the north and central regions. Each subsequent row presents the corresponding scenarios' average deviations from the baseline value.

10. These numbers exclude the simulations with 96% energy shifting as this is not an empirically realistic level.

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also increases the savings, CO_2 reductions, and the price effect relative to the baseline scenario. This is because in the baseline scenario, the 15% demand shift partially offsets the peak hour effects as consumers purchase more energy in off-peak hours. The 'annual deployments' row indicates that allowing DR to dispatch during non-summer days when more cost savings opportunities are available will increase overall consumer savings, while the negative coefficient on emissions suggests less opportunity for emissions reductions are available during non-summer months. This is because DR deployments during summer months often reduce output from less efficient peaking generators, and DR in non-summer months sometimes shifts peak energy generated from gas to off-peak energy generated from coal. Finally, increasing DR energy offer costs by 100% reduces annual consumer savings by about one-third, decreases emissions savings, lowers the amount of DR cleared, and dampens the negative price effect relative to the baseline scenario. This is to be expected, since this scenario makes DR resources more expensive for the market operator.

Excluding outliers from the South region, the results of our modeling across all our simulations show average price reductions ranging from 3% to 9%. This is consistent with past analyses of the PJM market, which showed that reducing approximately 1% of peak demand in the PJM market would result in a 5%–8% reduction in LMPs (The Brattle Group, 2007; Faruqui, Hledik, Newell, and Pfeifenberger, 2007).

The scenario with a high energy shift produced some interesting results. First, increasing the rebound effect to 96% increased overall CO_2 emissions in every region and deployment scenario, suggesting that off-peak generation in MISO has a higher average emissions content than on-peak generation. Secondly, some of our high-rebound simulations produced negative net consumer savings. In other words, deploying demand response resources that pass the net benefits test in the hour they were deployed actually increased overall costs after taking into account the off-peak increase of energy. This occurred because less supply resources are available for dispatch in non-peak hours. The large increase in energy use during off-peak hours increased prices on average by more than prices decreased during peak hours, when more supply is available to meet high levels of demand.

In all the high energy shift scenarios except for those in the South region, aggregate consumer savings from DR were less than the aggregate revenue paid to DR providers. In this situation, the DR is deployed because it passes the net benefits test during the peak hours in which the DR is dispatched, and DR providers earn revenue. However, the large increase in off-peak energy offsets consumer savings, with no corresponding decrease to DR providers' revenue. These results violate the net benefits test in principle, however they still occurred because we programmed the net benefits test in our model to be temporally myopic. By this we mean that the net benefits test did not incorporate decreased consumer welfare in future periods due to energy shifting. This myopic characteristic is also present in the ISO/RTO net benefit test methodologies in tariffs filed with FERC. FERC's final ruling in Order 745 makes no mention of incorporating effects of energy shifting in net benefits testing (U.S. FERC, 2011). Furthermore, most ISO/RTO net benefits tests in practice are characterized by econometric estimates of the monthly average price quantity pair where the supply curve becomes inelastic, with no consideration of how energy shifting from DR reduction may offset consumer savings.[11] As shown by our modeling, a demand reduction that occurs at an inelastic portion of the supply curve can fail the net benefits test if consumer savings are offset by energy shifting to other periods, without a corresponding offset to DR revenue. We identify this myopic characteristic as a policy shortcoming of the net benefits test required by FERC and operational in wholesale electricity markets across the U.S. Despite this theoretical issue identified in our

11. MISO Net Benefits Price Threshold Information, 2017; California ISO, 2018; Southwest Power Pool, 2018; PJM 2018; New York Independent System Operator, 2011.

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modeling, we note again that this issue occurred only in our simulations with a 96% energy shift. While 96% is the energy shifting value assumed in EIA's Annual Energy Outlook modeling, it does not appear to be supported by empirical experimental evidence (Smith and Brown, 2015).

4.3 Effects not quantified

In addition to what was quantified in this study there are other potential market effects which we do not attempt to quantify in our dynamic supply-demand framework. These include:

- Reduced generation reserve investment.
- Improved operational efficiency of the transmission and distribution systems.
- Integration of intermittent renewable generation.
- Reduced wholesale market price volatility.
- More competitive power markets.
- Insurance against extreme events.
- Improved system reliability.
- Delayed retirements of coal plants by increasing off-peak demand and reducing operational wear and tear induced by using them to follow shifts in load.

It is clear from the body of literature on the topic that the value from deploying DR programs extends across the range of actors and processes within the electricity system. Furthermore, the magnitude of these value streams varies greatly across individual markets and regulatory environments, emphasizing the need for targeted, market-specific analysis to understand the effects of implementing DR within a given market context.

5. CONCLUSIONS

This study quantifies consumer savings and other market effects from increasing incentive-based demand response (DR) dispatch in the Midcontinent ISO energy market. It is motivated by the fact that regulatory and market barriers in the Midcontinent region keep cost-effective DR out of the wholesale market, raising electricity prices. We develop a bottom-up, dynamic supply and demand model of the Midcontinent market that shows:

1. DR dispatch can generate consumer savings ranging from $1.3–17.6 million under typical peak operating conditions.
2. Model results for the South region demonstrate that consumer savings and other market effects can exponentially increase when a small amount of DR is deployed at locations with very high prices.
3. We estimate market effects for a range of scenarios that change DR deployment levels, frequencies, and demand-shifting effects. Emissions reductions are modest but positive for most scenarios, and average price effects range from about -$0.50 to -$1.50 per megawatt-hour across most scenarios during typical peak operations.
4. Demand response modeling can be sensitive to energy shifting assumptions. We note that the large energy shifting assumption of 96% utilized in the U.S. Energy Information Administration's National Energy Modeling Systems can produce DR deployments that violate the net benefits test once the increased post-DR consumption is accounted for. The myopic net benefits testing procedures currently used in U.S. power markets do not account for this possibility.

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Our supply-demand framework quantifies DR market effects due to supply curve shifts, and does not consider other market effects, including reduced or deferred capital investments, reduced price volatility, and improved system reliability. This study suggests that regulators, market operators, market participants, and other stakeholders should focus policy efforts to reduce regulatory and market rule barriers to DR deployment, particularly in locations that experience high price spikes. This will improve market efficiency and generate cost savings for electricity consumers net of system costs.

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TAB L

This is Exhibit **"L"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

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Fixing FERC's Order No. 745

While the Federal Energy Regulatory Commission's landmark ruling provides strong stimulus for demand response resources in wholesale electricity markets, extensive testing of the Order's net benefits test reveals several significant shortcomings. A couple of improvements can remedy these shortcomings without altering the nature of the Order.

Kai Van Horn, Isaac Castillo and George Gross

I. Introduction

The Federal Energy Regulatory Commission's Order No. 745 was promulgated on the premise that demand response resources (DRR) participation enhances the competitiveness of wholesale energy markets and that it is FERC's mandate to ''ensure the competitiveness of organized wholesale energy markets''[1] and thus ensure ''just and reasonable wholesale rates.''[2] Prior to the Order, the incentives for DRR participation in the wholesale electricity market varied from market to market and were insufficient to engender consequential DRR participation. FERC deemed the failure of independent system operators (ISOs)/regional transmission organizations (RTOs) to provide DRR incentive payments at the locational marginal price (LMP) as ''unjust and unreasonable''[3] and cited the level of the incentives DRRs received, and the lack of standardized DRR incentives, as significant barriers to DRR participation. The key objectives of FERC Order No. 745 are to remove the identified barriers to DRR participation in electricity markets and to ensure that DRRs are utilized only in instances in which they have the ''capability to

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balance supply and demand''[4] and are a ''cost-effective''[5] alternative to supply-side resources. FERC Order No. 745 is a landmark ruling that provides significant stimulus for *DRR* participation in wholesale electricity markets and has been a major catalyst for the recent growth and development of the demand response industry. The Order aims to achieve its objectives via three main thrusts. The first thrust is to establish standardized incentives, payment at the LMP, for DRRs operating in any ISO/RTO-run electricity market. This thrust addresses the Order's first objective by establishing ''greater uniformity''[6] in the incentives provided to DRRs in ISO/RTO-run markets. The second thrust is to explicitly define a cost-effectiveness criterion, the *threshold price*, to determine the instances under which such incentives are provided, and to prescribe a methodology, the net benefits test (NBT), by which ISO/RTOs calculate the threshold price. The third thrust is to establish a mechanism by which to allocate the costs to the post-curtailment loads to provide the DRR incentive payments, which we term the incentive payment allocation (IPA). In other words, the IPA sets forth an explicit means by which the proportion of the costs of providing DRR incentive payments borne by each post-curtailment load is determined. The second and third thrusts address the second objective of the Order by providing a screen to filter out those hours in which DRRs may not reduce post-curtailment buyer payments and to ensure that FERC's cost causation principle[7] is upheld in the IPA.

While the thrusts of the Order make strides toward achieving its objectives, they have significant limitations, which prevent the full realization of those objectives. The principal limitation is the failure of the NBT to account for the impacts of

While the thrusts of the Order make strides toward achieving its objectives, they have significant limitations, which prevent the full realization of those objectives.

transmission congestion. Though sufficient information, the LMPs, is currently available to integrate the impacts of transmission congestion on the cost-effectiveness of DRRs on a nodal basis into the NBT, FERC did not address or require the use of such information in the NBT methodology. A secondary limitation is the ambiguity of the IPA mechanism as stated in the Order. A lack of adequate specificity in the IPA provisions has left open the door to IPAs which are not consistent with the second objective of the Order. These limitations result in unintended economic consequences for the non-DRR buyers.

FERC NBT explicitly defines the DRR cost-effectiveness criterion, the so-called threshold price, as ''the point along the supply stack beyond which the overall benefit from the reduced LMP resulting from dispatching demand response resources exceeds the cost of dispatching and paying LMP to those resources.''[8] This threshold price is calculated on a *system-wide* basis making use of averaged historical supplier offers and historical fuel price data. If the LMP at a node exceeds the threshold price in a day-ahead or real-time market interval, all cleared DRR curtailments at the node must be provided incentive payments at the LMP. The explicit definition of a cost-effectiveness criterion benefits DRRs by providing a concrete condition under which they receive incentives at the LMP that reduces the level of uncertainty in the magnitude and frequency of their compensation. The threshold price is intended to benefit the non-DRR buyers by preventing the utilization of DRRs when they do not reduce post-curtailment buyer payments. However, the threshold price benefits to non-DRR buyers are not as certain as those for DRRs, and, while DRRs always receive incentive payments at the LMP when the threshold price is met, non-DRR buyer payments may not be reduced. When implemented, the threshold price is compared on a nodal basis to the LMPs, which explicitly account for the impacts of transmission congestion. The congestion impact information

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mismatch introduced by the direct comparison of the system-wide threshold price with the LMPs leads to cases of omission and commission in the determination of the level of DRR incentive payments that have important ramifications for the non-DRR buyer payments.

In a pre-curtailment network with transmission congestion, the LMPs differ from one node to another. As a result, cases arise in which DRR curtailments occur but do not result in a reduction in post-curtailment buyer payments i.e. cases of commission, and cases arise in which DRR curtailments do not occur that would have resulted in a reduction in post-curtailment buyer payments i.e. cases of omission. Moreover, the LMP impacts of DRRs differ on a nodal basis. In such a system, there may be a subset of nodes whose LMPs are above the threshold price and a subset of nodes whose LMPs are below the threshold price. At nodes where DRR curtailments occur, the post-curtailment LMPs are, in general, less than the pre-curtailment LMPs due to the load reductions brought about by the DRR curtailments. However, the *LMP* impacts of *DRR* curtailments at those nodes where there are no *DRR* curtailments are mixed. *The post-curtailment LMPs at nodes which have no DRR curtailments may be higher or lower than the pre-curtailment LMPs at the same nodes due to the transmission congestion impacts.* Clearly, those nodes which experience *LMP* increases as a result of *DRR* curtailments are made worse off, while those nodes which experience *LMP* reductions share in the benefits of *DRR* curtailments. The existence of cases omission and commission and cases in which loads at certain nodes are made worse off as a result of *DRR* curtailments are the unintended consequences of the failure to integrate transmission congestion impact information into *FERC NBT*. Further unintended consequences arise as a result of the Order's *IPA* definition.

The IPA definition in the Order is ambiguous and has led to IPAs which have unintended consequences in congested systems.

According to the *IPA* mechanism in the third thrust of the Order, the *IPA* must be done ''proportionally to all entities that purchase from the relevant energy market in the area(s) where the demand response resource reduces the market price for energy at the time when the demand response resource is committed or dispatched.''[9] This mechanism aims to uphold *FERC*'s cost causation principle and ensure that costs of the incentive payments to *DRR*s are distributed among the buyers in the system so that all buyers benefit from *DRR*s in the form of reduced post-curtailment payments. However, the *IPA* definition in the Order is ambiguous as to the nature of the proportionality of the payment allocation and has led to *IPA*s which have unintended consequences in congested systems. The accepted Order No. 745 compliance filings to date have included load-proportional *IPA*s (*LP-IPA*s)[10] i.e. the allocation of the costs of the *DRR* incentive payments to the non-*DRR* buyers which benefit from *DRR* curtailments is in proportion to a buyer's load's contribution to the total load of those buyers who benefit. While such an *IPA* takes two steps toward achieving the objectives of the Order, it also takes one step away as it divorces the magnitude of the benefits of *DRR* curtailments received by buyers from the proportion of the costs of the incentive payment to the *DRR* for which the buyers are responsible. In a congested system, buyers at a node *i*, at which a *DRR* curtailment occurs, may experience only a modest buyer payment reduction as a result of the curtailment. The buyer payment reductions for buyers at node *i* may be less than the portion of the costs to provide *DRR* incentive payments for which buyers at that node are responsible. The result is that, though the node *i* post-curtailment *LMP* is less than the pre-curtailment *LMP*, the buyers at node *i* may face a *post-IPA LMP* which exceeds the pre-curtailment *LMP*. *Under a load-proportional IPA there is no guarantee that the post-IPA*

LMP will be less than the pre-curtailment LMP. Clearly, buyers which face a post-*IPA LMP* which exceeds the pre-curtailment *LMP* are worse off as a result of the *DRR* curtailments. Moreover, the accepted *IPA*s have not addressed the *DRR* benefit allocation issues which arises in cases in which the total post-curtailment buyer payments decrease but the buyers at some nodes experience post-curtailment *LMP* increases while buyers at other nodes experience post-curtailment *LMP* decreases. Such cases show a limitation of the Order which is counter to *FERC*'s intent in the second objective, and that can be addressed through the design of an appropriate *IPA*.

In this work, we identify and discuss several limitations of *FERC* Order No. 745 that have unintended economic consequences and provide the results of studies which give insights into the magnitude of the economic impacts of those consequences. We then propose effective modifications to *FERC* Order No 745 that address the limitations we have identified. Our proposed modifications maintain the spirit of the Order and are both simple, requiring few changes to the procedures outlined in the Order, and effective, significantly reducing the number of hours in which *DRR* curtailments are uneconomic. We propose the application of the *NBT* on a nodal basis, a nodal *NBT*, to calculate nodal threshold prices, the calculation of which takes explicit account of the transmission congestion impacts through the use of readily available *LMP* data. The nodal *NBT* brings the explicit representation of the grid and the deliverability of the supply to meet the demand into the prescribed *NBT* process. Such a nodal criterion provides a finer screen for the evaluation of *DRR* cost-effectiveness that reduces the frequency of the occurrence of uneconomic *DRR* outcomes and the cases of omission and commission. Furthermore, we put forth a benefit-proportional *IPA* with side payments which marries the benefits realized by non-*DRR* buyers with the proportion of the costs to provide incentive payments for which they are responsible and includes the additional post-curtailment payments by those buyers made worse of as a result of *DRR* curtailments as a ''cost'' to be allocated under the *IPA*. Our approach provides what the current approaches have so far failed to provide: the explicit assurance that no loads are made worse off by *DRR* curtailments in cases in which the *DRR* curtailments reduce the total post-curtailment buyer payments. This assurance, along with the nodal *NBT*, guarantees to a greater extent that the objectives of the Order will be achieved.

Our proposed modifications maintain the spirit of the Order, and are both simple and effective.

The remainder of the article is divided into three sections. In Section II, we provide a detailed discussion of the unintended consequences that result from the limitations of *FERC* Order No. 745 and show the significant impact these consequences have on non-*DRR* buyers. In Section III, we describe our proposed modifications to the Order to address its limitations and show the non-*DRR* payment impact improvements which can be gained by applying our modifications. In Section IV, we summarize the article.

II. The Unintended Consequences of *FERC* Order No. 745

FERC Order No. 745 is one of the most important rulings regarding *DRR* participation in the wholesale electricity markets to date. The incentives mandated by the Order are already beginning to have a major impact on increasing *DRR* participation in some wholesale electricity markets.[11] This increased *DRR* participation is a testament to the effectiveness of the thrusts of the Order at achieving its first objective: to encourage *DRR* participation by removing market barriers to *DRR*s. However, we question the effectiveness of the

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thrusts at achieving the second objective, and whether the impacts of *DRR*s under the Order will be beneficial for all buyers. In this section we discuss in detail the limitations of *FERC* Order No. 745 we have identified, the unintended consequences which arise as a result of those limitations and the economic impacts of those unintended consequences on non-*DRR* buyers.

The second objective of *FERC* Order No. 745 is to ensure that *DRR*s are only used when they are a ''cost-effective'' alternative to generation i.e. the *DRR* curtailments results in reduced post-curtailment buyer payments. As we outlined in the introduction, the second thrust of the Order aims to ensure post-curtailment buyer payments do not increase through the establishment of the *NBT* and its corresponding threshold price. The *NBT* essentially provides a screen through the hours in which *DRR*s may be provided incentives at the *LMP* must pass. The goal of the use of such a screen is to prevent *DRR* curtailments in hours in which they will result in higher post-curtailment buyer payments. However, as we will show, the screen provided by *FERC NBT* is too coarse due to the system-wide nature of the data used to calculate the single system-wide threshold price and the failure to explicitly account for the impacts of transmission congestion. As a result, *FERC NBT* screen dictates that *DRR*s be provided incentive payments in many hours in which the provision of those incentives increases post-curtailment buyer payments for at least a subset of the buyers.

We illustrate several cases in which *DRR* curtailments result in increased buyer payment due to the limitations of the Order with two examples on a 7-bus system. In the first example, we consider a single 10 MW *DRR* at node 3, which represents approximately 1 percent of the total load of the system. **Figure 1** shows the pre-curtailment and post-curtailment *LMP*s at the load nodes in the 7-bus system. The system is congested, as indicated by the fact that the pre-curtailment *LMP*s differ at each node. The highest pre-curtailment *LMP* in the system is at node 3 and we assume this price exceeds the threshold price. From Figure 1, we see that the post-curtailment *LMP*s at nodes 2, 3, and 6 are decreased by the *DRR* curtailment—the intended impact. However, changes in the network congestion patterns caused by the *DRR* curtailment result in post-curtailment *LMP* spikes at nodes 5 and 7. These *LMP* spikes overwhelm the *LMP* reductions at nodes 2, 3 and 6 and the overall buyer payment impact of the *DRR* curtailment is an increase in the total post-curtailment buyer payments. This example clearly shows the importance of transmission congestion impacts on the *DRR* curtailment outcomes. The resulting buyer payment increases are an unintended consequence of the *FERC NBT* and we will show that such cases arise frequently in congested systems.

The example in Figure 1 also highlights an issue that arises in transmission-congested networks: the non-*DRR* buyer benefits of *DRR* curtailments are different at each node. When there is no transmission congestion, the benefits of *DRR* curtailments received, or losses borne, by the non-*DRR* buyers are the same on a per-MW basis for each buyer regardless of the buyer's location. However, this is not the case when transmission congestion arises. *In a transmission-constrained system, the per-MW benefits*

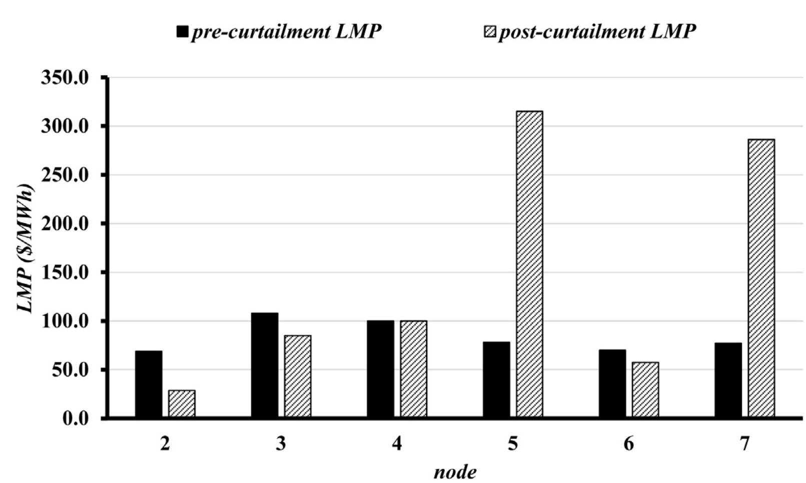

Figure 1: 7-Bus System Example 1, 10 MW DRR Curtailment at Node 3, Total Buyer Payment Increase

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(losses) received (borne) by each buyer as a result of DRR curtailments differ on a nodal basis. In the example, clearly the loads at nodes 5 and 7 have been negatively impacted by the *DRR* curtailment *despite their lack of participation as DRRs* while the loads at nodes 2, 3 and 6 benefit. Such a distribution of the *DRR* benefits and losses represents a second unintended consequence of the limitations of the Order.

A key stipulation of *FERC* Order No. 745 which plays a large role in the ultimate impact of *DRR* curtailments on the non-*DRR* buyer payments is the *IPA* stipulation. The *IPA* framework outlined in the Order requires that the costs of providing incentive payments to the *DRRs* for their curtailments be borne by the buyers who benefit from those curtailments in the form of reduced post-curtailment *LMPs*. However, how those ''costs'' are distributed to the buyers who benefit is not specified. Absent specific details from *FERC* about the proportionality of the allocation, *LP-IPAs* have emerged as the prevailing *IPA* approach. However, such *IPAs* fail to account for the impacts of transmission congestion on the distribution of the *DRR* benefits among the post-curtailment buyers. This shortcoming leads to cases under which the total post-curtailment buyer payments are reduced but, for buyers at some nodes, the post-*IPA* buyer payments increase. We illustrate such a case with a second example using the same 7-bus system as before with a different distribution of the loads to produce a different *LMP* profile. In this example, we introduce a 100 MW *DRR* curtailment at node 3, which represents approximately 10 percent of total load, and allocate the costs of the incentive payments via an *LP-IPA*. The pre- and post-curtailment *LMPs* and the post-*IPA* *LMPs* are shown in **Figure 2**.

We note that buyers at a single node, node 2, suffer a small increase in the post-curtailment *LMP* as a result of the *DRR* curtailment while buyers at the remaining nodes experience post-curtailment *LMP* decreases or no change in the post-curtailment *LMP*. The overall result of the *DRR* curtailment for the non-*DRR* buyers is a decrease in the total post-*IPA* buyer payments. We see in Figure 2 that the post-curtailment *LMP* is reduced for the loads at nodes 3-5 and node 7.[12] However, the *LMP* reductions are not uniform across the nodes and we see that, in particular, the buyers at nodes 3 and 4 experience far higher post-curtailment *LMP* reductions compared to the pre-curtailment *LMPs* than those buyers at nodes 5 and 7. This non-uniform accumulation of the *DRR* benefits on a per-MW basis, combined with the *LP-IPA*, which allocates uniformly to each buyer on a per-MW basis, results in buyers at nodes 5 and 7 paying a share of the *DRR* curtailment incentives which is higher than the benefits they receive from the curtailment. The result is the increased post-*IPA* *LMPs* compared to the pre-curtailment *LMPs* for buyers at nodes 5 and 7 shown in Figure 2. Furthermore, the *IPA* provides no compensation for the ''innocent bystander'' node 2, which has a higher post-curtailment *LMP* as a result of the *DRR* curtailment at node 3. The ultimate outcome in this example, despite the overall reduction in total post-*IPA* buyer payments, is that buyers at half of the load nodes pay higher *LMPs* than they would have without the *DRR* curtailment. The negative impact of the *IPA* in this case showcases another unintended consequence of the Order. This example also illustrates the importance of the

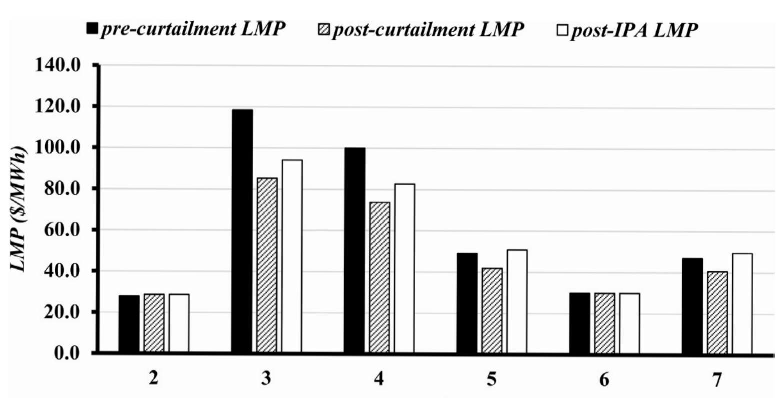

Figure 2: 7-Bus System Example 2, 100 MW *DRR* Curtailment at Node 3, Total Buyer Payment Decrease

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Table 1: Reference Cases N_0 and M_0 and *DRR* Cases N_3 and M_3 System-Wide Metrics.

Metrics	N_0 Annual Metrics	N_3 Annual Metrics	M_0 Annual Metrics	M_3 Annual Metrics
Cleared demand (h)	47,700,000	47,300,000	53,100,000	52,700,000
Buyer payments (M$)	3,320	3,240	3,090	3,060
Congestion rents (M$)	295	216	116	85.9

nature of the proportionality of the distribution of the costs to provide *DRR* incentive payments in the *IPA* and further highlights the importance of the explicit consideration of transmission congestion to ensure the thrusts of the Order meet its second objective.

The examples given above have highlight several cases in which the failure of *FERC* to account for transmission congestion considerations leads to unintended outcomes that are inconsistent with the second objective of the Order for buyers at some or all nodes in the system. We turn next to the aggregate impact of such cases over a one-year period to shed some light on the magnitude of *FERC* Order No. 745's unintended consequences.

We present a representative selection of results from our extensive simulation studies to facilitate the discussion of the aggregate impact of the unintended consequences of *FERC* Order No. 745.[13] We simulate the day-ahead markets (*DAM*s) with *DRR* penetrations in the range of [1,11]% of system peak load for the year 2010 on the IEEE 118-bus test system using data from *ISO-NE*, the cases from which we label N_c, and *MISO*, the cases from which we label M_c, where c case *DRR* capacity as a percentage of the system peak load.[14] Furthermore, we assume *DRR* curtailments occur between the hours of 1:00 p.m. and 9:00 p.m., in compliance with *FERC NBT* and that an *LP-IPA* is used. Our reference case for comparison in both the N_c and M_c cases is the study system without *DRR*s, N_0 and M_0, respectively.

Table 1 shows the metrics for the one year simulated in the reference cases and in the 3 percent *DRR* cases. We see that *DRR*s are a net benefit to the system reducing the overall buyer payments in the N_3 and M_3 cases. *DRR* curtailments result in 2.4 percent and 1.9 percent reductions in the total buyer payments from the reference case in the N_3 and M_3 cases, respectively.

Though the annual buyer payments are reduced in both of the *DRR* cases presented, there are many hours in which *DRR* curtailments do not reduce buyer payments. In **Figure 3**, we present the monthly number of hours in which *DRR* curtailments resulted in post-curtailment buyer payment increases in case N_3.

In most months, we see that the number of hours in which *DRR* curtailments result in increased buyer payments remains below 20 indicating the capability of *FERC NBT* to screen out the hours in which providing *DRR* incentive payments at the *LMP* would be detrimental to the non-*DRR* buyers. However, we see several months in which a large number of hours had curtailments which increased the total buyer payments. Surprisingly, one of these months is August when we would expect *DRR* curtailments to be the most

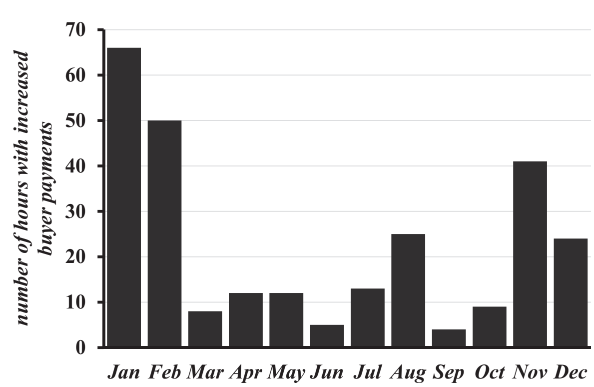

Figure 3: Post-Curtailment Buyer Payment Increases Due to *DRR* Curtailments for Case N_3

effective due to the higher loads and higher prices most systems experience during the summer. We conclude that *FERC NBT* performs poorly in August due to shifts in the congestion patterns caused by the *DRR* curtailments which increase payments for buyers at many nodes. *FERC NBT* breaks down primarily during the winter months. In January and February, the hardest-hit months, approximately 71 percent and 62 percent of the hours during which *DRR* curtailments occurred, resulted in a total buyer payment increases post-curtailment. For these two months, *FERC NBT* failed to screen out the majority of hours that in the end resulted in higher buyer payments than if the load had been served by generators.

In **Figure 4**, we show the monthly number of hours in which *DRR* curtailments resulted in post-curtailment buyer payment increases in case M_3. In this case, we see that the limitations of *FERC NBT* are even more pronounced. In nearly every month the number of hours in which *DRR* curtailments increase the post-curtailment buyer payments exceeds 20 hours.

In fact, in the months of October and November, in every hour in which there are *DRR* curtailments, those *DRR* curtailments result in increased post-curtailment buyer payments. Furthermore, only in the months of June, July, and August does the number of hours in which *DRR* curtailments result in decreased post-curtailment buyer payments

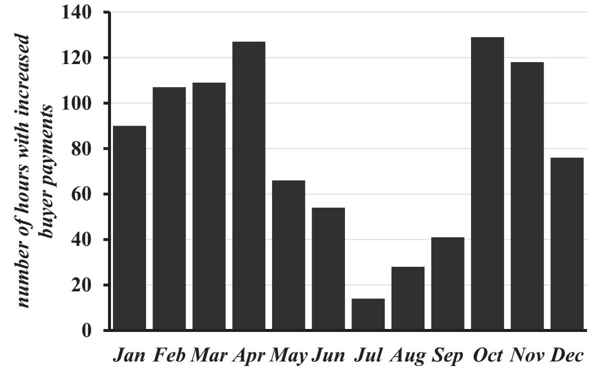

Figure 4: Post-Curtailment Buyer Payment Increases Due to DRR Curtailments for Case M_3

exceed the number of hours in which *DRR* curtailments do not. Clearly, *FERC NBT* screen is too coarse (Figures 3 and 4).

We also investigated the distribution of *DRR* benefits and losses among the buyers. Indeed, our analysis of the N_3 and M_3 case studies indicates that *there are nodes in the system that experience higher post-curtailment LMP so often that, at the end of the year, their buyer payments in the case with DRRs are higher than in the case with no DRR participation*. Out of the 99 load nodes in the N_3 test system, 19 experienced an increase in the annual buyer payments due to the *DRR* curtailments for case N_3. In **Figure 5**, we show buyer-payment related metrics for the 10 nodes that experienced the greatest percentage increase in buyer payments at the end of the year for case N_3. For contrast, we also show the nodes that experienced the highest decrease in consumer payments in this case. These nodes have greater demand response

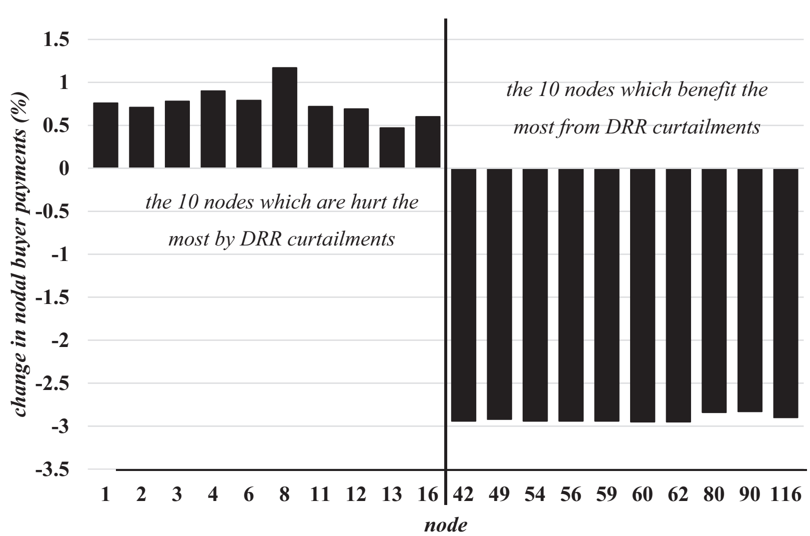

Figure 5: The Impact of DRR Curtailments on the Top 10 Nodes Which Benefit and Top 10 Which Experience Losses over the One-Year Period in Case N_3

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participation and also experience a decrease in the annual consumer payments of approximately 3 percent compared to case N_0. The node that experienced the highest percentage increase in the buyer payments with respect to case N_0, is node 8 at 1.17 percent.

The situation in our cases with the *MISO* data is no different. In those cases, there are a total of 29 nodes that experience higher annual buyer payments with *DRR* participation. The emergence in both the *ISO*-NE and *MISO* cases of a set of nodes at which buyers are made worse off by *DRR*s, while *DRR*s benefit buyers overall, highlights the differences in the distribution of the *DRR* benefits that can arise under the stipulations of *FERC* Order 745 in a congested system.

We draw three conclusions from our studies into the aggregate impacts of the unintended consequences resulting from the limitations of *FERC* Order No. 745:

- *FERC NBT* provides an insufficiently fine screen to filter out *DRR* curtailments in hours in which they cause increases in the total post-curtailment buyer payments.
- The distribution of *DRR* benefits and losses among the buyers under the Order is a serious issue and the prevailing *LP-IPA* fails to fully address it.
- The failure of the thrusts of the Order to integrate the transmission congestion impacts is a driving force behind the outcomes we observe.

The cases we have described in which *DRR*s lead to increased post-curtailment buyer payments for some or all buyers occur in a large number of *DRR* curtailment hours under the current stipulations of *FERC* Order No. 745. The number of hours in which *DRR* curtailments are uneconomic highlights the importance of the Order's failure to account for the

network effects and points to the need of a finer screen to capture hours in which *DRR* curtailments are uneconomic. The failure to account for network congestion impacts also raises issues with the *LP-IPA*, and we have shown that the result may be a tacit picking of winners and losers among the buyers through the distribution of the *DRR* benefits and losses. It is clear that the limitations of *FERC* Order No. 745 have a significant impact on the magnitude and the distribution of *DRR* benefits. These unintended consequences work against the thrusts of the Order in achieving its second objective. In the following section, we describe proposed modifications to the Order to integrate transmission congestion impacts into the *NBT* and the *IPA* and show the improvements in the market outcomes that can be achieved by doing so.

III. The Proposed Modifications to FERC Order No. 745

The thrusts of *FERC* Order No. 745 have come close to hitting their mark of achieving the Order's objectives. However, the unintended consequences limit the effectiveness of the Order at achieving the second objective. In this section we describe modifications to the Order to address the limitations. We propose two modifications which, in essence, integrate the transmission congestion impacts. The modifications preserve the spirit of 745 and make precise adjustments to the *NBT* to provide a finer screen to determine the hours in which *DRR*s are compensated at the *LMP* and to the *IPA* to address the distribution of *DRR* benefits. We first discuss the modifications to *FERC NBT* to reduce the number of hours in which *DRR* curtailments occur but result in increased total buyer payments.

Our proposed *NBT* modifications are based on the clear need to integrate congestion information into *FERC NBT* methodology. The system-wide nature of *FERC NBT* is insufficient to capture the often serious impact of transmission congestion on the market outcomes. To this end, we

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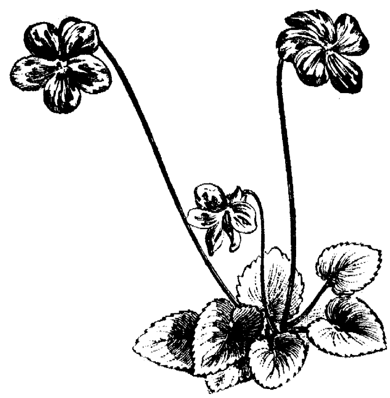
propose the use of a *nodal NBT*. The nodal *NBT* retains many of the same characteristics of the system-wide *FERC NBT* and keeps the basic format of *FERC NBT* unchanged. The key differences between the nodal *NBT* and *FERC NBT* are that the former is applied on a nodal basis and that the former makes use of available *LMP* data, instead of seller offer data, to calculated threshold prices on a nodal basis, which we term the locational threshold prices (*LTP*s). When there is transmission congestion, the markets clear on a nodal basis. Therefore, to apply *FERC NBT* on a nodal basis, we would need to reconstruct the nodal offer curves in every hour. However, it is not straightforward to reconstruct the nodal offer curves and so we use the hourly *LMP*s over a month as a proxy for the nodal seller offer curves in a congested system. For each node we take the hourly *LMP*s and cleared load in the peak hours of a month and construct an ''offer'' curve by arranging the hourly *LMP*s in increasing order and cumulatively summing the cleared load associated with each *LMP*.[15] This *LMP*-based proxy offer curve represents the purchase price at the node, which includes transmission congestion impacts, under a range of load conditions and so captures the transmission congestion impacts under each of those conditions.

This offer curve is then treated within the *NBT* framework of the Order to determine the *LTP*s at each node. The modifications to *FERC NBT* to arrive at the nodal *NBT* give rise to a finer screen by integrating a greater amount of the relevant system information into the *NBT* cost-effectiveness test. As we will show, the nodal *NBT* reduces the number of hours in which *DRR* curtailments occur but result in increased total buyer payments. The integration of congestion information into the *NBT* via the



nodal *NBT* impacts the frequency and location of *DRR* curtailments and thus impacts the distribution of the *DRR* curtailment benefits among the non-*DRR* buyers. However, the nodal *NBT* does not directly address the distribution of *DRR* benefits. To address the benefit distribution issue, we propose a more specific *IPA*.

We propose a benefit-proportional *IPA* with side payments (*BP-IPA* w/ *SP*). Under the *BP-IPA* w/ *SP*, the increased post-curtailment payments experienced by some buyers as a result of *DRR* curtailments are considered a 'cost' of the *DRR* curtailment to be allocated among the beneficiaries of the curtailment and the buyers which were made worse off by the *DRR* curtailment are made whole by a side payment. The costs of providing these side payments, combined with the costs to provide the *DRR* incentive payments are allocated to those buyers which benefit from the curtailment *in proportion to the benefits they receive*. For example, consider a congested three bus system and suppose there are three buyers, A, B and C, each with a 10 MW load at different nodes and one *DRR*. Now suppose a *DRR* curtailment occurs that reduces buyer A's payments by \$60, buyer B's payments by \$40 and increases buyer C's payments by \$20. Suppose the incentive payment to the *DRR* is \$80. The total ''cost'' to the buyers which benefit from the curtailment (buyers A and B) under the *BP-IPA* w/ *SP* is \$80 for the *DRR* incentive payment plus \$20 for the make-whole payment to buyer C, a total of \$100. The total benefit is the sum of the individual benefits of buyers A and B, or \$100. We note the curtailment does not increase total buyer payments since the total ''cost'' is equal to the total benefits. Buyer A received 60 percent of the total benefits of the curtailment and so, under the *BP-IPA* w/ *SP*, is responsible for 60 percent, or \$60, of the ''cost.'' Similarly, Buyer B received 40 percent of the benefits of the curtailment and so is allocated 40 percent or \$40, of the ''cost.'' In this example, the benefits are exactly equal to the ''costs'' for all the buyers and thus no buyer is made worse off by the curtailment. Note that under an

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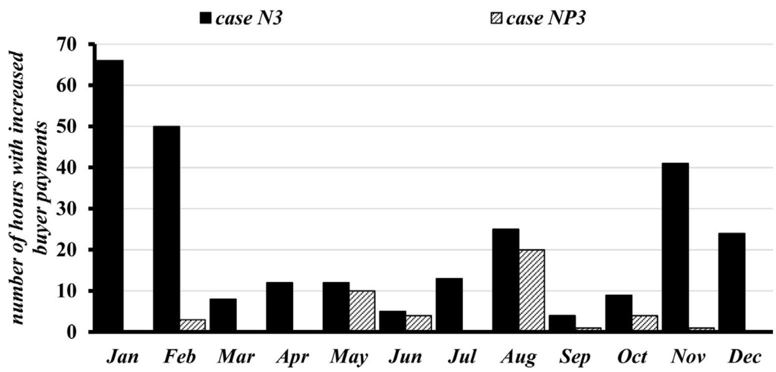

Figure 6: Number of Hours in Each Month in Which DRR Curtailments Increase Buyer Payments in Case N_3

LP-IPA buyer B would suffer an increase in the post-*IPA* buyer payments. This example illustrates an important strength of the *BP-IPA* w/ *SP*: under this *IPA*, we can guarantee that no buyers are made worse off by the *DRR* curtailment provided that the *DRR* curtailment reduces total post-curtailment buyer payments. In the case where the *DRR* curtailment does not reduce the total post-curtailment buyer payments, which are the cases which we address with the nodal *NBT*, we suggest a distribution of the losses such that the final outcome is a load-proportional sharing of the losses i.e. individual buyer's benefits and losses are taken into account and those buyers which are made worse off by the *DRR* curtailment due to congestion patterns are allocated a lesser portion of the costs and vice versa. The *BP-IPA* w/ *SP* reduces the instances where some buyers are made worse off while others benefit from *DRR*s, which arise when *DRR* curtailments occur in congested systems, by redistributing the benefits of the curtailment to compensate those buyers that are made worse off. Such an *IPA* is consistent with *FERC*'s cost-causation principle and enhances the ability of the thrusts of the Order to effectively achieve its second objective.

To show the impacts of the proposed nodal *NBT* and *BP-IPA* w/ *SP* and the reductions in the impacts of the unintended consequences which might be achieved under these proposed modifications we present a set of simulation studies. For all the simulation studies presented in this section, we use the same test system and set-up that was used for the simulation studies presented in Section II. We denote the simulation studies using the nodal *NBT* as: $\mathrm{NP_c}$ for the cases using *ISO-NE* data and $\mathrm{MP_c}$ for the cases using *MISO* data, with *c* as the demand response capacity. To start, we explore the impacts on the number of curtailment hours which result in buyer payment increases of using the nodal *NBT* in place of *FERC NBT* under which, in many curtailment hours, the payments to the *DRR*s exceed the benefits attained.

In Figure 6, we summarize the monthly number of hours in which the payments to the *DRR*s exceeded the benefits attained for case $\mathrm{NP_3}$ using the nodal *NBT* and show the same for case N_3 for comparison. In this case a total of 43 instances resulted in higher *DRR* payments than system benefits, which represents approximately 5.7 percent of the total curtailment hours. Compared to case N_3, where 17.8 percent of the curtailment hours resulted in extra payments due to the demand curtailments, the nodal *NBT* screened out more of the hours in which *DRR* curtailments resulted in increased total post-curtailment buyer payments. The percentage of hours with such unintended consequences is reduced for all cases with the nodal *NBT*, compared to *FERC NBT* cases.

We note that, even with the proposed changes to the *NBT*, there are still hours in which the societal costs exceed the benefits of *DRR* participation. This is due to the fact that, while the nodal *NBT* explicitly includes transmission congestion information, it does not account for the impacts of concurrent *DRR* curtailments at multiple nodes on the buyer payments at each node. Consequently, while considerably reduced in number, there still arise cases where the collective impact of the *DRR* curtailments results in an increase in the total buyer payments under the nodal *NBT*.

In Figure 7, we show the monthly number of hours in which the societal costs of *DRR* participation exceed the benefits in the $\mathrm{MP_3}$ and M_3 cases. For all

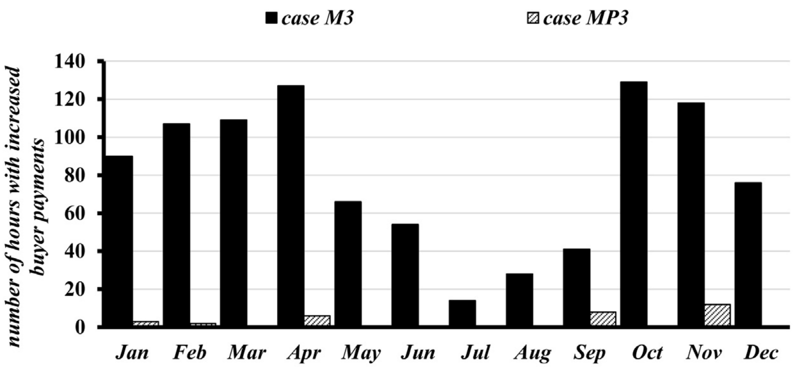

Figure 7: Number of Hours in Each Month in Which DRR Curtailments Increase Buyer Payments in Case M_3

indication that these *DRR* curtailments represented cases of omission which are corrected by the nodal *NBT*. The few hours in which the post-curtailment *LMP*s still increase are due to the impacts of concurrent *DRR* curtailments at other nodes whose impacts have not been captured by the nodal *NBT*. The application of the nodal *NBT* has reversed the fortunes of the buyers at node 8 such that they too enjoy the benefits of *DRR* curtailments rather than becoming an unintended consequence and bear the cost of *DRR* curtailments at other nodes in the system. For cases such as node 8, the *LTP* provides a more appropriate metric than the system-wide threshold price. The former is a better measure of whether *DRR* curtailments at a specific node will bring about greater benefits *to that node* than the costs to provide incentive payments which will be incurred.

We now examine the impacts of the nodal *NBT* on a node which was the beneficiary of *DRR* curtailments under *FERC NBT*. In **Figure 9**, we show the

the cases using the *MISO* data, there was a significant drop in the number of curtailment hours. Some 66 percent of the curtailment hours resulted in higher payments than benefits in case M_3. In case MP3, the 31 instances of hours with higher *DRR* payments than benefits represent 20 percent of the total curtailment hours. As in the NP_3 case, the application of *LTP*s in the MP_3 case, and the finer screen they provide, reduces considerably the number of hours in which *DRR*s increase the total post-curtailment buyer payments.

Next, we discuss the differences between the impacts of *DRR* curtailments on individual nodes under the nodal *NBT LTP*s compared to *FERC NBT* system-wide threshold. Since, under the nodal *NBT*, we use the *LTP*s, there is no longer a set of nodes whose *LMP*s are above the threshold price and a set whose *LMP*s are below, but rather hours in which a node's *LMP* is above the *LTP* and hours in which it is not. We examine the buyer payment impacts under the nodal *NBT* on a node which was previously made worse off as a result of *DRR* curtailments. In **Figure 8**, we show the pre- and post-curtailment *LMP*s at node 8 during the first week of May 2010 in case study NP_3.

Under *FERC NBT*, node 8 had no *DRR* curtailments during this week and experience post-curtailment *LMP* increases in most of the hours in which *DRR* curtailments occurred at other nodes in the system due to the network effects. However, the *LTP* is lower than the peak hour pre-curtailment *LMP*s and so, under the nodal *NBT*, *DRR* curtailments occur at node 8 and result in post-curtailment *LMP* decreases in most hours, an

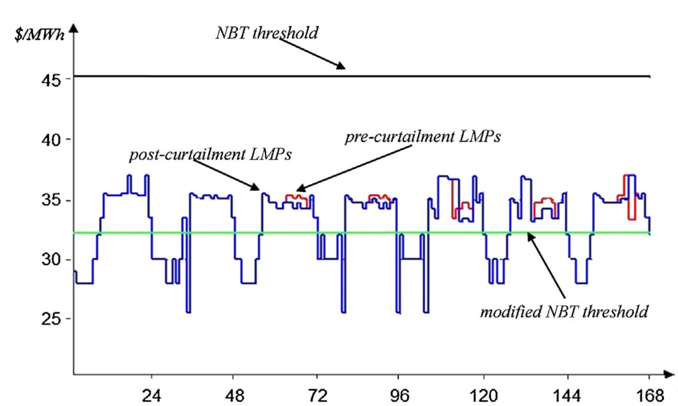

Figure 8: Pre- and Post-curtailment LMPs during the Week of May 1–7 at Node 8 in Study Case NP_3

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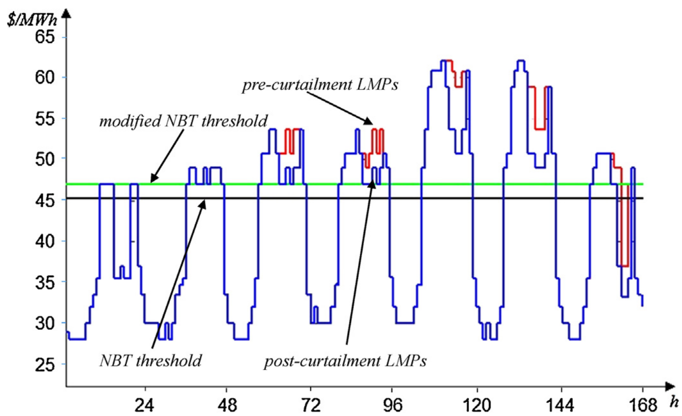

Figure 9: Pre- and Post-curtailment LMPs during the Week of May 1–7 at Node 116 in Study Case NP_3

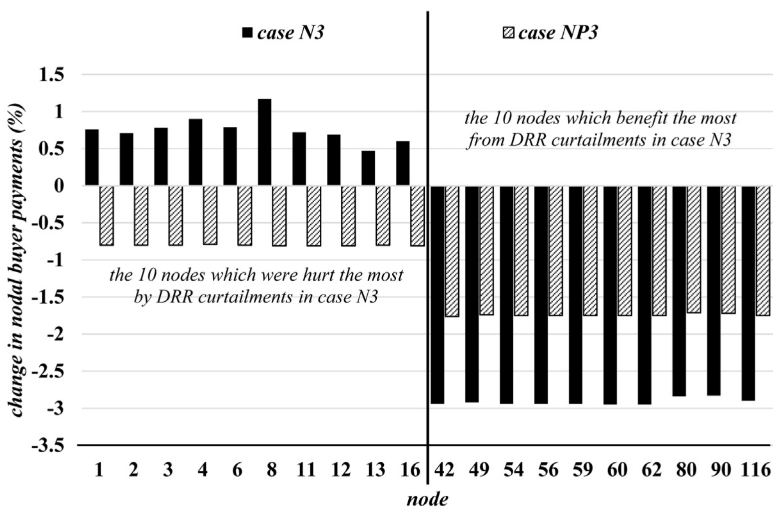

Figure 10: The Impact of DRR Curtailments Under the Nodal NBT and BP-IPA with Side Payments on the Top 10 Nodes Which Benefit and Top 10 Nodes Which Experience Losses over the One-Year Period under FERC NBT in Case N_3

pre- and post-curtailment *LMP*s during the first week of May at node 116 in study case NP_3. We note that the *LTP* is slightly higher than the system-wide threshold.

Nodes such as node 116 experienced persistently higher pre-curtailment *LMP*s, which were higher than the system-wide threshold price, than other nodes in the system and so such nodes benefited more frequently from *DRR* curtailments both due to the frequency of the curtailments at such nodes and the magnitude of the *LMP* reductions those curtailments brought about. The persistently high pre-curtailment *LMP*s explain why the *LTP* is higher than the system-wide threshold at node 116, since the *LTP* is calculated from these higher peak-hour *LMP*s. That the *LTP* is higher than the system-wide threshold price also indicates that, under *FERC NBT*, *DRR* curtailments at node 116 which occurred in cases which the *LMP*s were between system-wide threshold price and the *LTP* would not result in buyer payment reductions at node 116. Such cases would represent a cases of commission which *FERC NBT* screen would fail to filter out and that the *LTP* captures. However, the pre-curtailment *LMP*s at node 116 are above the *LTP*, and consequently well above the system-wide threshold price, and so the curtailments at node 116 are largely unaffected by the introduction of the *LTP* i.e. *FERC NBT* was an effective screen for curtailments at node 116 in the week pictured. However, our observations of node 116 are not the case for all nodes, and the nodal impacts of *DRR* curtailments may not be well represented by *FERC NBT*, as we observed in the case of node 8 and as reported in our studies presented in Section II. The nodal *NBT* provides the finer screen needed to account for the nodal differences in *DRR* value which arise due to transmission congestion and which have a profound impact on conditions under which *DRR* curtailments result in nodal benefits.

Though the nodal *NBT* addresses the cases of omission and commission which arise under *FERC NBT* and reduces the number of hours in which *DRR* curtailments result in buyer payment increases, it does not address the distribution of *DRR* benefits among the buyers in congested systems. We now turn to the impacts of our proposed *IPA* modifications to show the effectiveness of the *BP-IPA* w/ *SP* in addressing the distributional impacts of the *DRR* curtailment benefits in congested systems.

To show the reduction in the number cases in which nodes experience post-*IPA LMP* increases which can be gained by the use of the *BP-IPA* w/ *SP*, we show in **Figure 10** the percentage decrease in buyer payments in case NP_3 at the same nodes that were worse off in case N_3 using *FERC NBT*, presented in Section II. We see that, due to the side-payments, buyers at no nodes incur higher total payments due to *DRR* curtailments in case NP_3. In fact, all those nodes which were made worse off under *FERC NBT* and *IPA* now benefit from the curtailments. The *IPA* methodology we suggested addresses the distribution of *DRR* benefits such that all nodes in the case presented benefit from the *DRR* curtailments.

We also show the percentage decrease in consumer payments in case NP_3 at the same nodes that benefited the most from demand curtailments under *FERC NBT* in case N_3. All these nodes continue to benefit from demand curtailments but, as expected with *BP-IPA* w/ *SP*, these benefits are reduced due to the inclusion of the side payment to the buyers at nodes that were worse off. Such a redistribution of the *DRR* benefits ensures that *DRR* curtailments are beneficial *for all buyers* and so such curtailments are in line with the second objective of the Order.[16]

In this section we described our proposed *NBT* and *IPA* modifications and showed the improvements which can be realized by applying those modifications. The nodal *NBT* applies the same basic structure in *FERC NBT* but includes relevant system information to integrate the impacts of transmission congestion. These additional considerations reduce considerably the incidence of *DRR* curtailments when they result in total buyer payment increases under the nodal *NBT* compared to *FERC NBT* in our test cases. The *BP-IPA* w/ *SP* follows the thrust of the order to allocate the costs of *DRR* on a proportional basis to those buyers that benefit from the curtailments. Further, the explicit inclusion of side payments and the benefit-proportional allocation ensures that, in cases in which *DRR* curtailments reduce total buyer payments, no load is made worse off. Our results showed that the *BP-IPA* w/ *SP* eliminates instances in which some buyers benefit from *DRR*s while others are made worse off. The combination of the nodal *NBT* and *BP-IPA* w/ side payments provide a more effective approach to ensure that *DRR*s are use only when they are truly a ''cost-effective'' alternative to supply-side resources.

IV. Concluding Remarks

FERC Order No. 745 set out to break down the putative barriers to *DRR*s in *ISO*/*RTO*-run electricity markets to encourage greater *DRR* participation and, to this end, it is proving to be successful. However, the Order's second aim, to implement a set of mechanisms to ensure that *DRR*s are called upon to curtail their load only when they reduce buyer payments, has come up short. The failure of the Order to integrate the impacts of transmission is a significant limitation that has unintended consequences for the total benefits which *DRR*s may bring to the system and for the distribution of those benefits among the buyers in the system. We identify the sources of the unintended consequences and provide modifications to some aspects of the Order to improve the outcomes for non-*DRR* buyers. We show the specific cases that arise from these limitations and that the aggregate impact of those cases can be significant over the course of a year. Our simulation studies show that *DRR* curtailments may actually increase the overall buyer payments for a subset of buyers and that the distribution of the *DRR* benefits presents a major issue.

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These significant impacts motivate the need for our proposed modifications to the thrust of the Order.

We propose improvements that do not alter the nature of the Order and provide additional considerations to ensure *DRR* curtailments, when provided, are beneficial to non-*DRR* buyers. The modifications we introduce are:

- The nodal *NBT* and the corresponding *LTP*s which reduce the incidence of hours in which *DRR*s increase total buyer payments, and
- The *BP-IPA* w/ *SP* which ensures that, in cases in which *DRR* curtailments do not increase total buyer payments, no buyer is made worse off as a result of the *DRR* curtailments.

By using *LTP*s instead of a system-wide threshold price, we provide a more appropriate signal for the dispatch of *DRR*s. The introduction of the *BP-IPA* w/*SP* addresses the benefit distribution issues. We showed that these modifications considerably reduce the magnitude of the unintended consequences of *FERC* Order No. 745 and more effectively achieve the second objective of the Order.

Our approach provides a means by which to improve of the Order without changing its "spirit."■

Endnotes:

1. *FERC, Final Rule, Order No. 745, Demand Response Compensation in Organized Wholesale Energy Markets*, 18 CFR Part 35, issued Mar. 15, 2011, at 1.

2. *Id., FERC, Final Rule, Order No. 745*, at 1.

3. *Id., FERC, Final Rule, Order No. 745*, at 39.

4. *Id., FERC, Final Rule, Order No. 745*, at 1.

5. *FERC* defines a *DRR* to be cost-effective if "the overall benefit [for buyers] of the reduced *LMP* that results from dispatching demand response resources exceeds the cost of dispatching and paying *LMP* to those resources."

6. *FERC, Final Rule, Order No. 745*, at 15, *supra*.

7. *FERC, Order on Rehearing and Clarification, Order No. 745-A, Demand Response Compensation in Organized Wholesale Energy Markets*, 18 CFR Part 35, issued Dec. 15, 2011, at 45.

8. *FERC, Final Rule, Order No. 745*, at 62, *supra*.

9. *FERC, Final Rule, Order No. 745*, at 77, *supra*.

10. See, for example, for *MISO, FERC, Order on Compliance Filing*, Docket No. ER11-4337-000, issued Dec. 15, 2011, at 5; for *PJM, FERC, Order on Compliance Filing*, Docket No. ER11-4106-000, issued Dec. 15, 2011, at 24; and for *ISO-NE, FERC, Order on Compliance Filing*, Docket No. ER11-4337-000, issued Jan. 19, 2012, at 16.

11. Significant growth in the quantity of cleared *DRR*s and in the payments to *DRR*s has occurred in PJM's energy markets since it implemented *FERC* Order No. 745 in April 2012. The *PJM DRR* monthly activity reports are available at http://www.pjm.com/markets-and-operations/demand-response/dr-reference-materials.aspx.

12. The post curtailment *LMP* at node 6 is unaffected due to the existence of a marginal generator at this node.

13. For additional results, see I. Castillo, *Assessment of the Impacts of Demand Curtailments in the Day-Ahead Markets: Issues in and Proposed Modifications of the FERC Order No. 745*, M.S. thesis, Univ. of Illinois at Urbana Champaign, Urbana, IL, 2012, at 36–50.

14. The test system data are taken from the Univ. of Washington Dept. of Electrical Engineering Power Systems Test Case Archive at http://www.ee.washington.edu/research/pstca/. Offer and load data for the *MISO* are found at https://www.midwestiso.org/Library/MarketReports/Pages/MarketReports.aspx. Offer and load data for the *ISO-NE* are found at http://www.is-one.com/markets/hrlydata/index.html.

15. A detailed treatment of the *LTP* methodology can be found in Castillo, 2012, at 51–58, supra.

16. We observe similar improvements in the unintended consequences in case MP_3 and so we omit them for the sake of brevity.

TAB M

This is Exhibit **"M"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

Money for Nothing? Why FERC Order 745 Should have Died

Xu Chen and Andrew N. Kleit***

ABSTRACT

Customer baseline load (CBL) measurement is designed to represent participants' expected usage in a number of electricity demand response (DR) programs. Our empirical results, however, show that CBLs can be systematically higher than DR participants' estimated load, especially for those experienced in DR activities, likely due to manipulation behaviors. Thus, the integrity of CBL may degrade over time. With an inflated CBL, the impact of DR programs may therefore be highly exaggerated, and consumers can be paid money when they are not actually reducing their demand. In particular, we design a manipulation-indicating variable "seemingly unattractive free-money opportunity" (SUFO) and discover system-wide manipulative behaviors that increase with time and are widely adopted by experienced DR participants. We suggest that policy makers in FERC, RTOs, and states regulatory agencies consider the threat of manipulation when modifying DR market rules following the Supreme Court's recent upholding of FERC Order 745.

Keywords: Demand response, Customer baseline load (CBL), Market manipulation, Electricity markets, FERC Order 745

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1. INTRODUCTION

Increasing the responsiveness of consumers to price to create a more efficient and reliable system is an important issue in electricity energy supply markets. By exposing consumers to real-time prices, Demand Response (DR) can reduce peak demand and enhance system reliability. FERC Order 745 (FERC 2011b), which required RTOs to compensate DR with locational marginal prices (LMPs), was vacated by U.S. Court of Appeals for the District of Columbia (USCA Case #11-1486, 2014) on the grounds of both that FERC exceeding its jurisdiction and that the DR pricing formula was "arbitrary and capricious." The court order was widely regarded as the end of traditional DR in the wholesale market. After FERC's appeal, the Supreme Court in January 2016 overturned the lower court opinion and ruled that FERC has the authority to regulate DR. FERC, regional transmission organizations (RTOs) and state governments now have the opportunity to implement and to modify DR programs. In DR programs, demand reduction is measured by comparing a customer's actual load with an administratively determined customer baseline load (CBL). The CBL based DR system requires constant administrative interactions from FERC and RTOs. For example, a recent FERC Order directs PJM to increase the granularity of capacity DR performance monitoring (FERC 2014). Though with all the efforts from FERC and RTOs, DR participants may be able to inflate their CBLs and thus profit by creating artificial load reductions. Obtaining a

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precise CBL and eliminating CBL inflation incentives are therefore critical to effective DR implementation in the coming era.

Researchers have determined that energy DR participants have theoretical opportunities to take advantage of the system by manipulating their CBLs (Chao 2011, Chao and DePillis 2013). Any "artificial" DR reduction may jeopardize system reliability, while creating transfers to DR providers from other rate payers. Here we empirically test for the existence of CBL-inflating behaviors.

In section 2, we introduce the definition of DR in current electricity energy markets. We also discuss the contents of FERC's 2011 Order 745 and manipulation methods to which that Order is potentially vulnerable. Section 3 presents our theoretical approach and the concept of a "seemingly unattractive free-money opportunity" (SUFO). Section 4 describes our data, which comes from the pre-Order-745 era. Section 5 discusses the model specification, the econometric approach and empirical results modeling users' CBL. Section 6 shows our models and empirical results for DR reduction, which support the existence of inflated CBLs. We note that this result occurred even before FERC increased the incentives for such behavior through its enactment of Order 745. Section 7 offers conclusions.

2. BACKGROUND

FERC (2011a) defines DR as "changes in electric use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized." We focus here on DR in energy, as opposed to capacity, markets, the subject of FERC Order 745. Several recent articles discuss the peak load reduction effect of DR (for example, Faruqui and George (2005), and Faruqui, Hledik et al. (2007)) and the DR compensation method (Bushnell, Hobbs et al. 2009, Walawalkar, Fernands et al. 2010). Few papers, however, examine DR manipulation theories and CBL-inflating strategies (Chao 2011, Chao and DePillis 2013), while several documents describe DR manipulation cases (FERC 2012a, FERC 2012b). No previous research has examined whether inflated CBLs have occurred widely in RTOs.

FERC Order 745 (FERC 2011b) requires all RTOs to compensate demand response resources with locational marginal price (referred to as the "full LMP payment"), regardless of CBL measurement methods or participants' retail contracts. Over the last several years, the appropriate payment for DR resources has been a topic of much controversy (Hogan 2010, Kahn 2010, Walawalkar, Fernands et al. 2010, Chao 2011, Chao and DePillis 2013).

In PJM's energy market, DR resources and generators submit supply offers (or bids, i.e., willingness to supply a certain amount of energy with a certain level of compensation), and PJM dispatches generators and DR resources in economic order (lowest cost first) to meet system demands. Before FERC Order 745's implementation in PJM in April 2012, DR resources in PJM were compensated by locational marginal price (LMP) minus the generation (G) and transmission(T) parts of the retail tariff (referred to as LMP-G-T payment) in energy-market economic dispatches (PJM 2011). After April 2012, PJM paid LMP, i.e., an increase of generation and transmission fee from the original LMP-G-T payment, for demand response resources in energy market. Following the FERC directive, PJM calculated a firm's CBL based on its historical usage. CBL for a weekday is determined as the average of the four highest usages of the five most-recent non-event

1. A non-event day, or non-dispatch day, is a day that a DR participant does not provide DR curtailment in the market, either because it does not submit a bid in the market for that day, or because its bid is not accepted by the RTO in the merit order dispatch process.

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(or non-dispatch)[1] weekdays (in the same hour interval) in the previous 45 calendar days (PJM 2011). Other RTOs also have similar historically determined CBLs.

The historically-based CBL determination method may incentivize potential manipulation strategies, which would lead to a "free-money" problem. Chao (Chao 2011) described moral hazards (over-consumption to increase CBL), adverse selection (consumers anticipating long term declining electricity demand being more likely to enroll in DR program) and behind the meter switching (switching usage between two energy sources to generate fake reduction measured from one source) as three potential free-money problems. Chao discusses DR payments and CBL construction, while reaching the topic of eliminating CBL manipulation through proper market rules. The article does not, however, seek to provide empirical evidence for existence of manipulation and little such evidence is provided. Here we attempt to fill this gap.

In addition to the manipulation strategies discussed above, we suggest an "idiosyncratic-demand bidding strategy" may also result in free money to DR providers. In idiosyncratic-demand bidding, a DR participant's bidding behavior depends on its normal usage schedule instead of the price signal, i.e., the participant uses high consumer-specific usage days as CBL determination days and supplies DR resources on low usage days. Idiosyncratic-demand bidding is thus a CBL-inflating strategy and a market manipulation behavior, since it does not match FERC and RTOs' definition of DR: "reduction from normal usage in respond to price signals."

For example, assume a ship factory that produces steel every Monday and Tuesday, consuming 100 MWh per hour. The factory assembles a ship every Wednesday to Friday, consuming 60 MWh per hour. With idiosyncratic-demand bidding, the factory may submit bids for 40MW of DR resources at a low price every Wednesday to Friday, and leave Monday and Tuesday as CBL-determination days. The factory is thus dispatched by the RTO from Wednesday to Friday and has a CBL 40 MW higher than its expected usage. Thus, without reducing usage, the DR participant has a consumption level below the CBL and, as a result, gains DR revenue. The participant is thus paid for an artificial reduction—one that does not actually take place.

In the above idiosyncratic-demand bidding example, the factory clearly violates PJM rules and FERC Orders by claiming a regular consumption pattern as a DR activity. However, if the consumption pattern in DR days changes in a smaller scale from the regular one (for example, a several percent of usage change due to the weather,) it may be difficult to determine whether the DR participant intends to manipulate the market by idiosyncratic-demand bidding. This "free money" that is taken by DR providers who are able to inflate their CBLs is paid by Load Serving Entities and eventually by other rate payers in the RTO.

The New England ISO (ISO NE) has uncovered evidence of idiosyncratic-demand bidding (ISO-NE 2008) in response to its rules on calculating CBL. ISO NE calculated CBL as the average usage of the previous ten non-event days and did not have a limited historical window for CBL-determination days (for example, 45 calendar days as in PJM) in 2007. DR participants in ISO NE could submit bids with a low price on most days and leave several high-usage days in the summer as CBL-determination days. Participants thus created a high CBL that was the average usage of several high-usage summer days and remained almost constant across the year. Further, some DR participants, who had operated on-site generators on a regular basis before participating in DR programs, were found reducing output from their generators during CBL-determination days to achieve a high CBL. FERC has announced an investigation of the above CBL-manipulation events (see, for example, FERC (2012a) and FERC (2012b)), and issued penalties for the fraudulent, or manipulative behaviors (see for example, FERC (2013a) and FERC (2013b)).

In *EPSA v. FERC* 753 F. 3d 216, 225 (2014), the Appeals Court for the District of Columbia struck down Order 745 for two reasons. First, the appeals court concluded that FERC did not have

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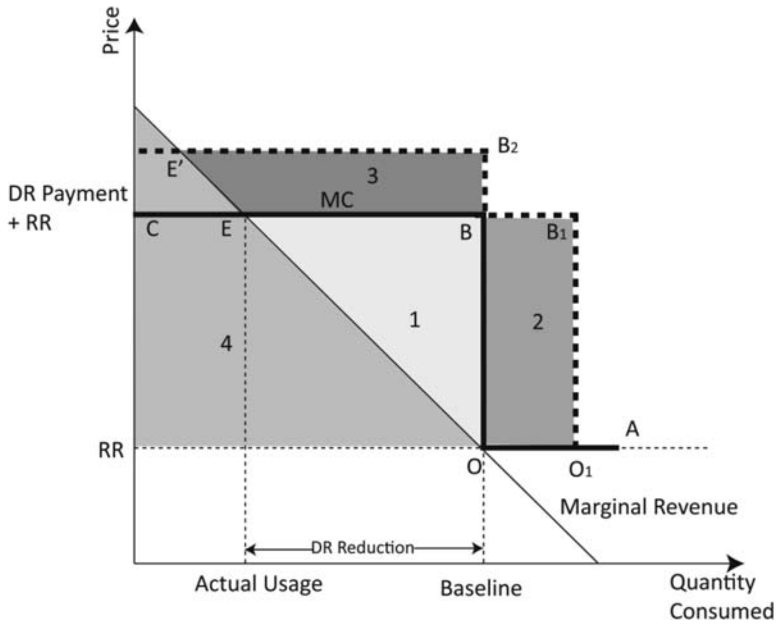
Figure 1: Marginal Cost of Consuming Electricity in DR



jurisdiction to impose the order. FERC jurisdiction is limited to wholesale markets, and the court viewed DR implement under the order as affecting retail markets. Second, the Court, following the criticism noted above, viewed the LMP payment requirement as "arbitrary and capricious". On appeal, the Supreme Court overturned the Appeals Court in a 6–2 decision (*FERC v. EPSA*, slip. op. 14-840, January 25, 2016). The Supreme Court decision leaves the door open to further rules by FERC, RTOs, and states. We seek to contribute to the debate on these new rules.

3. THEORETICAL APPROACH

We consider two manipulative or CBL-inflating strategies: over-consumption and idiosyncratic-demand bidding. Figure 1 presents the decision facing a DR participant with a fixed retail rate. The marginal revenue curve shows the revenue of consuming an additional unit of energy. The marginal cost (MC) curve shows the marginal cost of consuming energy, including the firm's retail rate and DR payment. We consider the following scenarios:

1) When there is no DR, a firm will consume energy at point O, the intersection of the firm's energy demand curve (Marginal Revenue curve) and market energy supply curve (the Retail Rate, or RR.) The firm gains profit equal to area 4.
2) If the firm is dispatched by the RTO to provide DR resources and its CBL correctly predicts future usage, it faces a marginal cost curve as the route CBOA. The marginal cost for consuming more than CBL is still RR. However, the MC for consuming below the CBL becomes the DR payment plus RR. Point E, the intersection of MC and Marginal Revenue, becomes the new equilibrium. With DR payment, the firm thus receives the additional profit represented by area 1. Note that because the firm benefits

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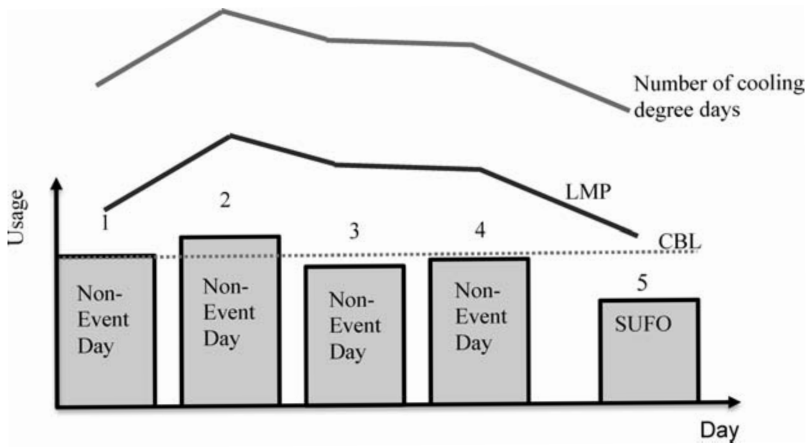
Figure 2: A Condition of SUFO Caused by Temperature Drop



from the use of electricity, the marginal revenue of consuming power is greater than zero.

3) If a dispatched firm has a CBL higher than the non-DR usage, i.e., the participant has lower demand than expected, the MC curve faced by the firm is route CB_1 O_1A. The firm remains at point E and gains more profit (area 2) than in condition 2.
4) When the wholesale market has a higher LMP, route $E'B_2OA$ represents the firm's MC, and point E' will be the new equilibrium. Electricity consumption declines and the participant gains more profit (area 3) than it would with a lower LMP.

Given this, a day with a high LMP and an inflated CBL we deem an "attractive free-money opportunity;" while a day with low LMP and an inflated CBL we call a "seemingly unattractive free-money opportunity" (SUFO). A SUFO can be created by a participant's idiosyncratic-demand bidding when the system load of the RTO drops due to, for example, a large change in temperature.

Figure 2 shows an example of a SUFO, with the participant's usage over five days (days 1–5) shown, along with system LMP and the number of cooling degree days. In Figure 2, the number of cooling degree days declines on day 5, so that both the expected usage of DR participants and system load of the RTO decrease. With a lower system load, the RTO generally will have a lower LMP. DR participants thus face a low LMP and low expected use on day 5. If a participant can generate a CBL higher than his expected load on day 5, its apparent curtailment effort on that day may be overstated, and its payments therefore inflated.

Price-responding DR providers make bidding decisions based on LMP. Compared to submitting bids on low-price day 5, participants without manipulation intent may prefer bidding on high-price days 1–4, in response to the high LMP. Days 1–4 thus become DR event days and are excluded in future CBL calculation. However, participants may utilize idiosyncratic-demand bidding to obtain a manipulation-related profit. If they do not submit bids during high LMP days 1–4, the average usage for the 4 most recent non-event days (i.e., days 1–4) become the CBL on low LMP day 5, according to PJM rules. Participants then may take advantage of a free-money opportunity to bid on day 5. Bidding on low LMP days but not high LMP days, an activity that seems economically abnormal, can thus be a manipulation scheme. Thus, without real energy curtailment, participants bidding on SUFO days will earn free money from the RTO.

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Participants' ability to inflate their CBLs may also depend on their experiences with DR programs. Taking advantage of a SUFO opportunity may require knowledge of CBL procedures and an ability to predict usage. Participants may learn manipulation-related strategies from previous DR experiences. We thus expect an increase in manipulation-related behaviors as participants become more experienced in DR activities. The integrity of a CBL-based DR policy therefore may degrade over time.

While in the above example SUFO depends on weather, a common condition shared by a group of participants, not all customers facing the same weather have the same SUFO. A participant's SUFO CBL is calculated by usages on its past non-event days, thus its SUFO is based on its non-event days choices before the SUFO day, i.e., a firm's bidding history established by the RTO's acceptance of its bids, as well as its idiosyncratic demand. Even though it is influenced by the same usage shock, a participant has different SUFO condition with another consumer who has a different bidding history. In the modeling process, SUFO thus can be delineated from aggregate shocks (such as changes in weather) for all participants.

4. MODEL SPECIFICATIONS, DATA SUMMARY AND HYPOTHESES

4.1 Data Sources and Description

In this section we summarize our data and provide specifications for our statistical model. Our data includes:

1) Hourly locational marginal prices (LMPs) for the PECO zone in the Philadelphia region in PJM, obtained from PJM historical market records, http://www.pjm.com/markets-and-operations/energy/real-time/lmp.aspx.
2) Hourly observations of electricity use, CBL, reduction and transmission fees paid during event hours in the economic DR program for each DR participant in PECO territory, obtained from the PECO Energy Company. While market settlement data is available, other data is not. For example, we know when a participant successfully bid in the market, and that the bidding price is lower than the market clearing price (since the participant is dispatched), but we do not observe its bidding price. Participants in the observation were either charged a fixed rate, or had peak-time pricing contracts. We observe participants' behavior between January 2010 and August 2011 during event hours (hours in which participants' bids are accepted by the RTO in the merit order dispatch process). We do not have data on participants' usage during non-event hours. The observation period is before FERC Order 745, and participants were paid LMP-G-T. Thus, incentives for manipulation were less in the period studied than under FERC Order 745. Our DR data suffers from two types of censoring. First, some DR participants survived in the market in the observation period. Others, however, exited the market during the observation period, so no further observations were available for them. Second, we observe each participant's behaviors on its event hours, but do not have information about its behaviors on non-event hours.
3) Hourly data on temperature and cloudy sky conditions for Philadelphia International Airport, obtained from the National Oceanic and Atmospheric Administration (NOAA). Most DR participants in the PECO zone are located within 20 miles of the airport.

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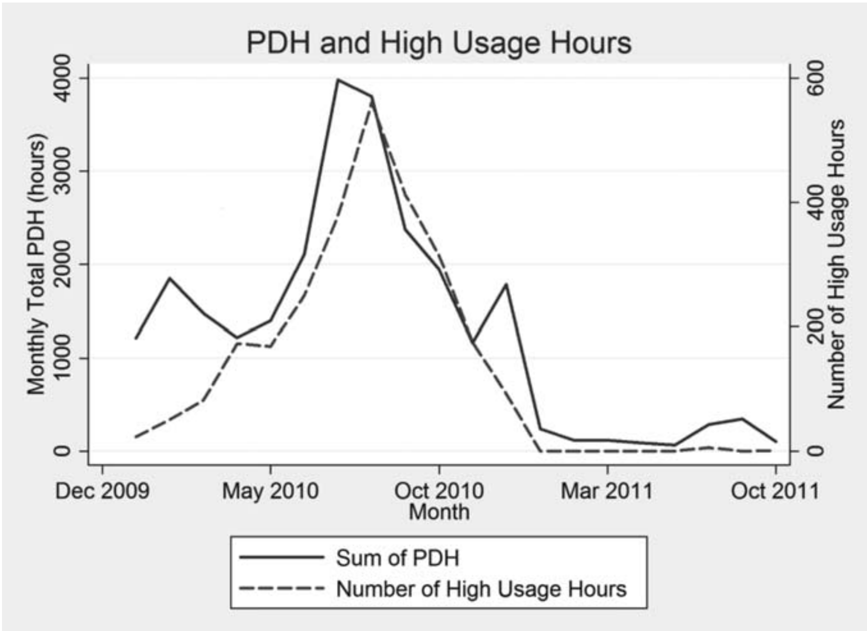
Figure 3: The Relationship between Peak Usage Hours and DR Dispatch in PECO Territory



4.2 Data Summary

One "participant-dispatch-hour" (PDH) is defined here as a particular participant being dispatched for one hour. Dispatches lasting M hours with N participants dispatched at the same time are considered as M × N PDHs. About 73 percent of PDHs occur between 9:00 and 20:00. Seventy one participants in the PECO area were dispatched in the observation period, for a total of 25,679 PDHs in the 593 days.

Figure 3 shows the relationship between peak usage and dispatch activities. The solid line shows the total of participant-dispatched-hours (PDH) in the given month. The dashed line shows the number of peak usage hours in PECO territory. The monthly total PDHs has a strong correlation (0.645) with the monthly number of peak-usage hours.[2] LMP and PECO loads have a correlation of 0.972.

We use three dependent variables in our regressions. In our first set of regressions, we model CBL (in KWh). We also model Bid Willingness (the possibility that a participant submits a DR bid in the market) and Reduction Ratio (DR percentage reduction once dispatched) as dependent variables. Reduction Ratio is the amount of reduction from the CBL divided by the CBL. Reduction Ratio is available for individual participants only during dispatched hours.

The independent variables we use are as follows:

2. We define a "peak-usage hour" as an hour in which the PECO system usage is higher than the system usage in 90% of all hours. The "number of peak hours" is the total number of such peak-usage hours in a month.

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1) Learning, which indicates the number of hours that a participant has been dispatched before the current hour.
2) LMP and transmission fees. These determine the DR payments. Hourly LMP has the same value across participants for each hour. Transmission prices vary across participants.
3) An indicator variable "Weekday," which shows whether a dispatch hour is on a weekday.
4) HUI and CUI are the heating and cooling usage indices, respectively in a particular hour. HUI is defined as max [55.5-temperature (in degrees Fahrenheit), 0] [3] and CUI is defined as max [temperature-55.5, 0].
5) A participant's Past HUI (CUI) is the average of the highest four HUI (CUI) in the particular hour in its most recent 5 comparable non-event days[4] in the last 45 calendar days. This variable varies across participants.
6) HUI (CUI) Seemingly Unattractive Free-Money Opportunity (SUFO) is the difference between past HUI (CUI) and current HUI (CUI), i.e., past HUI (CUI) minus current HUI (CUI). As shown in Figure 2, a decline in HUI (CUI) from past HUI (CUI) may create an opportunity for a SUFO.[5]
7) The Variable HUI (CUI) SUFO $\times$ Learning Experience is the product of the above HUI (CUI) SUFO variables and the ln(Learning Hours).[6]
8) Work-Hour Indicator, which is an indicator variable with value 1 for weekday hours between 8:00 to 18:00, 0 elsewise.
9) Daytime Sky Clear in Heating (Cooling) is a variable with a value of 0 when the temperature is higher (lower) than 55.5°F, or when hours are outside work hours (8:00 to 18:00). For other hours, values are: 0 if more than 7/8 of the sky is covered; 1 if 1/2 to 7/8 covered; 2 if 1/8 to 1/2 covered; and 3 if less than 1/8 covered. Three significant effects may accompany a clear sky condition: a: participants may turn off some of their lights when the sky is clear; b: sunshine may heat the buildings so that there is less need for heat in the winter and more need for air conditioning in the summer; and c: a solar onsite generator to handle demand responses can operate more effectively during the daytime if the sky is clear. Since the sunlight-heating effect reduces usage in winter and increases usage in summer, separate variables are created for heating and cooling conditions.
10) We include a list of variables indicating the participants' business or industry. There are four categories: College, Commercial, Hospital, and Other. The category "Other" acts as the null, and an indicator variable is constructed for each of the other categories.

3. We have fitted PECO load-temperature pairs into a cubic curve; the results imply that the lowest PECO usage occurs at a temperature of 55.5 °F.

4. HUI (CUI) in the past for Saturday (Sunday) is calculated as the average of 2 weekend usages in the most recent 3 non-dispatch Saturdays (Sundays), following PJM's CBL-calculation method.

5. SUFO, i.e., the situation that everyone in the RTO has a lower load, may occur due to drop of HUI (CUI) or weekends and holidays. In PJM, the CBL for weekends and holidays are calculated by the average of past weekends and holidays, which theoretically corrects the potential SUFO problems generated by holidays. However, there was no mechanism to correct the HUI (CUI) SUFO in the observation period. DR participants could require the RTO to conduct a temperature adjustment of CBL, however, they seldom made such a request.

6. The logarithmic form of the Learning Variable is used here to account for a declining marginal value of learning through market participation.

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Table 1: Descriptive Statistics (25,545 Observations)

Variable	Mean	Std. Dev.	Min.	Max.
Learning Hours	898.5	922	0	4,028
LMP ($/MWh)	62.65	46.72	−27.17	471.4
Transmission Rate (cent/KWh)	2.52	0.477	0.08	10.4
Work-Hour Indicator	0.611	0.488	0	1
Past HUI	6.65	10.96	0	40
HUI SUFO*Learning Experience	2.654	32.93	−283.2	211.5
Past CUI	17.5	14.2	0	48
CUI SUFO*Learning Experience	27.25	51.03	−197.2	277.6
Heating Usage Index (HUI)	6.041	9.857	0	43.5
Cooling Usage Index (CUI)	13.23	12.76	0	48.5
Daytime Sky Clear in HUI Condition	0.0904	0.287	0	1
Daytime Sky Clear in CUI Condition	0.199	0.399	0	1
College Winter Holiday Indicator	0.0393	0.194	0	1
Average CBL (MW)	11.79	18.46	0.34	53.86
Percentage SD of CBL	18.9	8.62	0.209	79
Total Dispatched Hours	1794	1321	1	4028

Table 2: Number of Participants by Contract and Participant Type

	Number of Participants		
Type	Flat Fixed Rate	Peak Time Pricing	Total
College	13	9	22
Commercial	8	10	18
Hospital	4	10	14
Others	13	4	17
Total	38	33	71

11) College Winter Holiday is a binary variable with a value of 1 between December 15th and January 15th for college DR providers, 0 otherwise.
12) Peak Time Pricing is an indicator variable with value 1 for participants engaged in a peak-time-pricing rate structure, and value 0 for those in flat-fixed retail rate plan.
13) Average CBL represents the average of an individual participant's CBL on dispatch hours in the 20-month observation period. Unlike the time-varying hourly CBL, a participant's Average CBL is a constant across time.
14) Percentage SD of CBL represents the percentage standard deviation of CBL for a participant in the 20 months of observations.
15) The variable "Total Dispatched Hours" represents the total number of hours that a participant was dispatched by PJM to provide DR resources across the observation period. A participant's Total Dispatched Hours is a constant across time.

Table 1 shows the descriptive statistics for variables. Table 2 presents the distribution of participants in various categories and rate structures. PECO load does not have a strong correlation with HUI (-0.064), perhaps because natural gas and other non-electric heating sources are widely used in winter in PECO.[7] However, PECO load is highly correlated with CUI (0.55).

7. According to Energy Information Administration, 51.0% of home heating in Pennsylvania were provided by natural gas, 20.7% by electricity, and 19.7% by fuel oil. See http://www.eia.gov/state/data.cfm?sid = PA#Consumption.

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4.3 Hypotheses

We model the impact of variables on three aspects: a participant's CBL, i.e., whether a factor increase or decrease CBL; DR participation, i.e., whether a factor results in more or less bids that are accepted by PJM; and reduction in DR event hours. For example, the following hypothesis regarding LMP involves the variable LMP's impact on CBL, bid, and reduction. The three aspects of the impact will be tested in three different set of models. The major hypotheses that reveal market manipulations are:

1) H1: Learning experience increases manipulations. With more learning hours, participants may gain a greater understanding of CBL inflation methods and potential free-money opportunities. DR experience may therefore increase manipulative behaviors. Participants may also be more experienced in usage reduction. We expect experience to increase CBL, bidding frequency, and observed reductions.
2) H2: A participant's CBL is impacted by the weather conditions on its previous non-event days. It is clear in theory that CBLs are determined by historically energy use, rather than expected energy use, thus are subjected to manipulations. The paper will test empirically that a high HUI (CUI) in the past may imply a larger CBL.
3) H3: A SUFO decreases bidding willingness for participants without manipulation experience, while increases the observed reduction via an inflated CBL. A high SUFO by definition implies a current HUI (CUI) lower than that in past non-event days HUI (CUI), and further may imply current system usage and LMP lower than those in past non-event CBL-determination days. Since a high SUFO is "seemingly unattractive" due to low system LMP, we expect for SUFOs to decrease participation willingness in modelling of bidding behaviors. In modelling of observed usage reduction, we expect SUFO to have a positive impact, due to CBL inflation.
4) H4: Experienced participants bid on SUFO days to exercise manipulative strategies. As indicated in section 3, the existence of a SUFO and the bidding behaviors that take advantage of the inflated CBL on a SUFO day (low LMP day) may imply idiosyncratic-demand bidding. Participants need experience to exercise SUFO biddings since a SUFO is "seemingly unattractive." The learning variable may indicate participants' experience in understanding the market. In modeling participation willingness and bidding behaviors, if we obtain a negative coefficient for SUFO in testing the third hypothesis, and a positive coefficient for SUFO * Learning in the fourth hypothesis, the coefficients may imply that participants accumulate an understanding of idiosyncratic-demand bidding from their experiences.

There are other hypotheses of interest that may enhance market understanding for demand response behaviors, but are not directly related with market manipulation. They are:

1) Since PJM compensated LMP minus generation and transmission price for DR reduction in the observation period, we expect a greater willingness for participating in DR at higher LMP hours. The electricity grid may have higher load during high LMP hours, and participants are also expected to have loads higher than normal. Since a CBL is likely to under-represents normal usage in high LMP peak hours, the impact on observed reduction level is ambiguous.

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2) Since a college may have lower usage during winter holidays, CBL may thus over-represent normal usage during this period. Colleges thus may have more bidding behaviors in the market to take advantage of the CBL, which shows as positive coefficients in modeling bidding willingness.
3) A participant with a larger demand for electricity may use more electricity and thus may gain some advantage in DR bidding, if economies of scale apply. These economies of scale may appear in both the bidding process and the DR reduction implementation.
4) Participants may have higher CBL and greater reduction ability on weekdays and during work hours, compared with weekends and off-work hours.
5) Compared with those in flat-fixed rate, peak-time-pricing participants may pay more attention to price changes and may have a stronger ability to adjust their consumptions. They may thus provide more DR resources than those who have a flat-fixed rate.

5. ECONOMETRIC APPROACH AND RESULT FOR CBL

5.1 Modeling Consumer Baseline

Modelling CBL tests a part of the first hypothesis (impacts of learning experiences on CBLs) and the second hypothesis. To model CBLs, we will run an OLS regression, a fixed effect OLS regression, and a Heckman model with various explanatory variables. The fixed-effect OLS regression allows each participant to have an unobserved quality (fixed-effect term) that impacts the outcome. A fixed-effect model thus may produce more robust estimators. However, this model cannot provide estimators for variables that a participant has constant values for, such as a firm's business sector. The tests of several hypotheses thus rely only on the OLS model. The OLS and fixed-effect OLS regression models are:

$$CBL = \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times X_t + \beta_3 \times X_i + \varepsilon_{i,t}, \varepsilon \sim N(0,\sigma) \quad (1)$$

$$CBL = \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times X_t + \beta_i + \varepsilon_{i,t}, \varepsilon \sim N(0,\sigma) \quad (2)$$

In equations (1) and (2), $X_{i,t}$ includes vectors for individual participant time-varying variables (Learning Hours, Past HUI, Past CUI, and College Winter Holiday Indicator); X_i contains vectors for individual constant variables (Percentage SD, Peak Time Pricing, and participant type); X_t is the group of vectors for time-varying variables (Work-Hour Indicator, and weekend Indicators); and $\varepsilon_{i,t}$ is the normal distributed error term. The fixed-effect model in equation (2) does not include X_i, whose variables have the same value across time, and includes a constant fixed-effect vector β_i for each participant.

In the observation period, many DR participants exited the market during the first winter.[8] Further, our 20 months observation period covers two summers and only one whole winter. A selection problem may therefore exist because many of our observations come from participants who survive in the market. To account for this possibility we employ a Heckman model.

8. In contrast to early exit, no significant amount of late entry is observed in the dataset. The amount of Demand Response Resources in PJM was therefore declining in the observation period.

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In the Heckman two-step model, the first step consists of a Probit regression for the selection function as shown in equation (3) below; the second step is an OLS regression, as shown in equation (4).

$$Quit = \alpha_0 + \alpha_1 \times Z_{i,t} + \alpha_2 \times Z_i + \alpha_3 \times Transmission\ \ Fee + \alpha_4 \times \text{Total Dispatched Hours} + \varepsilon_{i,t}, \varepsilon \sim N(0,\sigma) \quad (3)$$

$$CBL = \beta_0 + \beta_1 \times Z_{i,t} + \beta_2 \times Z_i + \beta_3 \times Z_t + \beta_4 \times IMR + \varepsilon_{i,t}, \varepsilon \sim N(0,\sigma) \quad (4)$$

In the selection equation, the dependent variable Quit is an indicator with value 1 for a participant after it exited the market and 0 otherwise. Exit behavior serves as the dependent variable in the selection function. $Z_{i,t}$ represents variables "Learning Experience", "HUI (CUI) in the Past" and indicator "College Winter Holiday"; Z_i consists of variables "Percentage SD of CBL" and other fixed characters for DR participants; Z_t represents variables "Work-Hour Indicator" and "Weekday Indicator." The Inverse Mill's Ratio is calculated from the results of the first step and acts as an independent variable in the second step. The variable Transmission Fee is included in the first step but not the second. The variable Transmission Fee can be expected to impact the exit decision, since PJM paid DR resources LMP-G-T and the transmission fee thus impacted a participant's profit. However, there is no apparent reason why the transmission fee would impact the CBL, the dependent variable in the second step. Transmission fee thus can be the instrument variable in the Heckman model. Similarly, the variable "Total Dispatched Hours" is used in the first step but not the second, and the Z_t variables are used in the second step but not the first.

Since the data includes repeat observations for participants, the error terms may be correlated for observations of the same participant. Thus, clustered errors are used in all regressions.

5.2 Results for Factors that Influence the Consumer Baselines

Table 3 shows the OLS, fixed-effect OLS regression and Heckman model results with CBL as the dependent variable.

Three positive and statistically significant coefficients are obtained for the variable Learning Hours. The result supports our hypothesis that with increased experience, participants learn about CBL manipulative and inflating methods. We note that this increase in CBL occurred despite the expectation laid out by Chao (2011) that adverse selection of DR participants would results in declining electricity consumption for the participants in the DR program. The load data shows that the zonal peak load for the PECO territory in PJM increased 1%–2% in the observation period;[9] however, the average CBL increase reached 15%. The abnormal increase in CBL over time is consistent with manipulative and inflation behaviors and is not thus consistent with the minor change in load patterns.

As expected, DR participants have higher CBLs during weekday work hours. Commercial participants have higher CBLs, compared with the default category. Peak time pricing does not show significant impact on CBL. Past CUI obtains a significant positive coefficient in the fixed effects equation. This is consistent with our hypothesis that a high previous high temperature (rep-

9. PECO's highest load in 2011 was 1.33% higher than the 2010 highest load. The average of the 2 percentile peak load (top 175 hours) in 2011 increased 1.56% from 2010. The average of the 5 percentile peak load, 10 percentile peak load and average load slightly decreased from 2010.

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Table 3: OLS, Fixed-Effect OLS and Heckman Regression Results (dependent variable: CBL in KWh)

	OLS:	Fixed-Effect OLS:	Heckman Model
Learning Hours	9.287***	0.893**	9.272***
	(2.254)	(0.384)	(2.252)
Work-Hour Indicator	830.4	1,119**	825.4
	(1,295)	(530.0)	(1,295)
Past HUI	2.015	−39.47*	2.092
	(81.70)	(23.69)	(81.60)
Past CUI	71.04	83.47*	72.38
	(61.42)	(46.81)	(61.75)
College Winter Holiday	−8,095	−3,713	−7,893
Indicator	(6,297)	(3,276)	(6,241)
Saturday	−4,448**	−1,187	−4,481**
	(2,146)	(777.8)	(2,154)
Sunday	−4,107**	−1,245	−4,093**
	(1,999)	(817.0)	(2,001)
College	18,093		18,063
	(10,929)		(10,920)
Commercial	7,424*		7,442*
	(3,831)		(3,848)
Hospital	−525.3		−520.3
	(3,068)		(3,082)
Peak Time Pricing	7,054		7,021
	(7,983)		(7,976)
Percentage SD of CBL	−12.31		−13.58
	(224.2)		(224.6)
IMR			−618.8
			(504.0)
Constant	−11,912	5,309***	−11,824
	(10,675)	(162.4)	(10,662)
Observations	25,059	25,545[a]	25,059
R-squared	0.461	0.976	0.461

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
[a] The observation numbers differ across regressions because the fixed-effect model omits several variables that contain missing values.

resented by variable past CUI) may increase the use of energy in cooling in previous non-event days and thus inflate the CBL.

Contrary to expectations, the past HUI variable yields a negative coefficient in the fixed-effect OLS regression. PECO is a summer peaking area and thus we would expect that HUI does not impact the system as much as CUI; sample selection bias also may occur due to the fact that many small participants exited the market during the first winter of our observation period[10]: both may contribute to the unexpected coefficient. In the Heckman model, with the Inverse Mill's Ratio, the regression finds a non-significant positive coefficient for past HUI. These coefficients imply that heating demand may not be an important factor for DR in PECO.

10. Small participants (with low CBLs) remained in the observations in the first winter (HUI period) but not the following summer (CUI period), thus creating a positive correlation between "low CBL" and HUI, i.e., negative correlation between CBL and HUI.

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6. ECONOMETRIC APPROACH AND EMPIRICAL RESULTS FOR DR REDUCTION

In this section, we present our econometric methods and the results for modelling participation willingness and real-time reduction. Section 6.1 shows the construction of a Tobit regression model, to analyze variables' impacts, the combination of impacts on participation (i.e., bidding choice) and reduction, on the performance of DR. In section 6.2, we further break DR performance into two parts, participation and reduction, and analyze each part separately. Analysis of bidding participation tests the bidding parts of Hypotheses 1, 3, and 4, while analysis of reduction tests the reduction parts of Hypotheses 1 and 3. The section shows the constructions of a Heckman model, a survival model, and a two-part model. Section 6.3 shows the econometric results for all regressions.

6.1 Tobit Regression Model

Due to the nature of the censored data, the reduction amount is observable only when a participant is dispatched. We therefore run a Tobit model to account for this censoring. To run a Tobit model we construct a variable "Reduction Index" with the variable "Reduction Ratio" and use it as the dependent variable in the Tobit regression. Reduction Ratio, the percentage of curtailment over CBL, i.e., (CBL - real time usage)/CBL, varies between 0 and 1. Reduction Index is defined following equation (5), which is a method to create a variable ranging $[0, \infty)$ from a variable ranging $[0, 1]$.

$$Reduction\ Index = \frac{Reduction\ Ratio}{1 - Reduction\ Ratio} \tag{5}$$

We then create a latent variable, Reduction $Index_{i,t}*$, which varies between negative and positive infinity, and assume that can be observed as the variable Reduction $Index_{i,t}$ only when it has a value larger than 0. The Tobit model is as follows:

$$Reduction\ Index^*_{i,t} = \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times X_t + \beta_3 \times X_i + \varepsilon_{i,t}, \tag{6}$$

$$Reduction\ Index_{i,t} = \begin{cases} 0, & Reduction\ Index^*_{i,t} < 0 \\ Reduction\ Index^*_{i,t}, & Reduction\ Index^*_{i,t} \geq 0 \end{cases}$$

6.2 Heckman Model and a Two-part Model

To model DR bidding choices and reduction amounts we again utilize a Heckman model and a two-part model (for more information about the two-part model, see, for example, Duan, Manning et al. (1984)). In these models the first step or part analyzes the choice of whether participants provide DR in the market, and the second step or part analyzes the amount of DR resources provided. The fixed cost associated with bidding (for example, labor cost for submitting bids, communication cost between PJM and DR customers, etc.) may be a significant consideration for DR customers. To distinguish between bidding and reduction is thus important for modelling DR. We use the two models for two reasons: both models capture the two-step DR process, separately analyzing bidding choices and reduction; and both models are capable of processing the special-structured data we have. The data observes a participant's bidding choices on all hours, but observes

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a participant's reduction only when its bidding choice is a "Yes." Under the assumption that a participant constantly adjusts its consumption pattern in accordance to market condition no matter whether it submits a bid, the data would be censored, and Heckman model corrects the censoring bias. Under the assumption that a participant reduces its consumption only when it submits a bid and gets dispatched by the RTO, there is no censoring, and the two-step model is appropriate. Either of the above assumptions may be valid, and we present regression results from both models.

In the Heckman model, the first step Probit regression may capture DR providers' choices and the results can be used to obtain an Inverse Mill's Ratio (IMR). The second step then analyzes the demand reduction once participants decide to provide DR, with IMR as an explanatory variable to adjust for censoring. In the two-part model, the two parts are separated. We employ either Logit regression or survival analysis in the first part, and either OLS or fixed-effect OLS in the second part. No IMR is used in the second part. The two-part model does not adjust for censoring.

The first step of the Heckman model is a Probit regression, as shown in equation (7).

$$Participant\ Choice_{i,t} = \begin{cases} 1, & if\ \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times X_t + \beta_3 \times X_i + \varepsilon_{i,t} > 0, \varepsilon \sim N(0,\sigma) \\ 0, & otherwise \end{cases} \tag{7}$$

In Probit model equation (7), all variables X_i, X_t, and $X_{i,t}$ are included. An Inverse Mill's Ratio (IMR) is generated in the first step via the Probit regression. The IMR is then used as an explanatory variable in the second step.

In the second step of Heckman model, we attempt to determine reduction ability after a DR participation decision is made. Since many explanatory variables range between negative and positive infinity, we seek to have a dependent variable that matches the distribution of independent variables, so that the model may produce more accurate results. We use ln(Reduction Index) as our measure of DR reduction ability (or reduction willingness). The two concepts, reduction ability and reduction willingness, both contribute to energy curtailment behavior, and our data does not enable us to distinguish between the two. The variable "Reduction Ability" here and in the following sections models both factors.

The dependent variable "reduction ability," defined as ln(Reduction Index) and shown in equation (8), ranges between negative and positive infinity. The variable "reduction ability" turns out to be $sigmoid^{-1}$ (Reduction Ratio), where $sigmoid^{-1}$ is the inversed function of sigmoid function as shown in equation (8), and Reduction Ratio is the amount of DR reduction over CBL (See, for example, Barro (1977) for similar construction of a dependent variable.)

$$Reduction\ Ability = = ln\frac{Reduction\ Ratio}{1 - Reduction\ Ratio} = sigmoid^{-1}(Reduction\ Ratio) \tag{8}$$

We then estimate

$$sigmoid^{-1}(Reduction\ Ratio_{i,t}) = \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times X_t + \beta_3 \times X_i + \beta_4 \times IMR + \varepsilon_{i,t}, \varepsilon \sim N(0,\sigma) \tag{9}$$

$$sigmoid^{-1}(Reduction\ Ratio_{i,t}) = \beta_0 + \beta_1 \times X_{i,t} + \beta_2 \times X_t + \beta_3 \times IMR + \beta_i + \varepsilon_{i,t}, \varepsilon \sim N(0,\sigma) \tag{10}$$

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Equation (9) shows the OLS regression equation, and equation (10) shows the fixed-effect form with a fixed-effect indicator β_i and without characteristic variable X_i. Impacts from X_i variables that do not vary with time (average CBL, participants' type, etc.) are included in term β_i in the fixed effect model. Compared with the first-step Probit regression shown in equation (7), the two regressions in the second step do not contain the two variable HUI (CUI) SUFO $\times$ Learning Experience. These two variables impact the Bid Willingness in the first step but not reduction in the second step, according to the theory presented in Section 3. They thus become the instrumental variables for the Heckman model.

In the two-part model, two regressions can be used in the first part—a multiple failure survival analysis by Cox model or a Logit regression. Both regressions may capture participants' choices about whether to offer into the DR market. We employ the Cox hazard function model, as shown in equation (11). The Cox survival analysis model has fewer underlying assumptions and produces more accurate results. However, the model does not provide coefficients for X_t variables. We use the same set of explanation variables in the Logit, Probit, and hazard model equations.

$$\lambda_{i,t}(X_{i,t}) = \lambda_t \times \exp(\beta_1 \times X_{i,t} + \beta_2 \times X_t) \tag{11}$$

In equation (11), λ is the hazard rate; and only individual varying variables X_i and $X_{i,t}$ are covered in the proportional hazards Cox model. The time-varying variables in X_t have the same value across all individuals (such as weather and temperature), and the impacts of X_t variables contribute into the baseline hazard term λ_t as a combined effect. The model does not generate coefficients for those X_t variables.

6.3 Empirical Results Modeling Demand Response Reduction

The second column in Table 4 shows the results for the Tobit regression on DR reduction as measured by Reduction Index defined in equation (5). Columns three to five show the regression results for the first-stage models (i.e., first step of the Heckman regression and the first part of the two-part model). Table 5 shows the result of the second-stage models (i.e., second step of Heckman model and the second part of the two-part model). Both second-stage models contain either OLS or fixed-effect OLS regression.

In the regression results, the first stage analyzes DR participants' choices whether to bid in the market, and the second stage analyzes the reduction ability or reduction willingness given participants submit bids in the market and are dispatched. The Tobit regression reflects the combination of bidding choice and reduction in consumption.

The learning variable obtains significant positive coefficients in both groups of regressions, consistent with Hypothesis 1. Thus, both willingness to bid in the market and observed usage-reduction ability increase with experience. This implies that learning experience may improve participants' skill in utilizing CBL manipulation strategies. Experience may also enhance participants' ability to reduce energy usage, as indicated by the positive coefficients in the second step.

The effect of locational marginal price is complex. Results shown from the first-stage regressions indicate that high LMP increases willingness to bid in the DR market, consistent with our hypothesis. The negative coefficients in the second-stage regressions indicate that participants have lower reduction ratios during high LMP hours. When a high LMP occurs, the system may have a peak load, and simultaneously participants are likely to have high loads, reducing their ability to decrease their consumption below their CBLs. The positive coefficient from the Tobit regression shows that higher LMPs increases DR performance.

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Table 4: Results for Tobit regression, the First Step of Heckman Model and the First Part of Two-part Model

	Tobit	Heckman Step 1: Probit	Two-part Model Part 1: Survival Analysis	Two-Part Model Part 1: Logit
Dependent Variable	Reduction Index	Bidding Choice	Bidding Choice	Bidding Choice
Learning Hours	0.00202	0.000237**	0.00107***	0.000451*
	(0.00123)	(0.000113)	(0.000255)	(0.000237)
LMP	0.0202*	0.00177***		0.00294***
	(0.0108)	(0.000441)		(0.000867)
Transmission Fee	−3.051	−0.291	−0.481	−0.494
	(1.953)	(0.227)	(0.444)	(0.488)
Work-Hour Indicator	8.581***	1.023***		1.999***
	(3.187)	(0.0754)		(0.141)
HUI SUFO	−0.188*	−0.0188*	−0.238***	−0.0418*
	(0.110)	(0.0111)	(0.0384)	(0.0235)
HUI SUFO *ln(Learning)	0.0142	0.00101	0.0251***	0.00246
	(0.0177)	(0.00197)	(0.00502)	(0.00406)
CUI SUFO	−0.173**	−0.0205***	−0.126***	−0.0376***
	(0.0811)	(0.00681)	(0.0240)	(0.0132)
CUI SUFO *ln(Learning)	0.0642**	0.00775***	0.0201***	0.0150***
	(0.0250)	(0.00104)	(0.00304)	(0.00195)
Heating Usage Index (HUI)	0.0616	0.00706		0.0151*
	(0.0451)	(0.00437)		(0.00902)
Cooling Usage Index (CUI)	0.150**	0.0177***		0.0383***
	(0.0725)	(0.00389)		(0.00832)
Daytime Sky Clear in HUI Condition	−5.061***	−0.584***		−1.103***
	(1.866)	(0.0279)		(0.0492)
Daytime Sky Clear in CUI Condition	−5.712***	−0.664***		−1.258***
	(2.148)	(0.0208)		(0.0355)
College Winter Holiday Indicator	3.127*	0.403***	0.293	0.839***
	(1.613)	(0.141)	(0.554)	(0.277)
Saturday	−2.995**	−0.329***		−0.648***
	(1.422)	(0.101)		(0.236)
Sunday	−2.844**	−0.321***		−0.647***
	(1.337)	(0.0896)		(0.201)
College	−1.131	−0.163	−0.497	−0.325
	(2.571)	(0.289)	(0.358)	(0.586)
Commercial	1.199	0.0768	−0.259	0.134
	(2.080)	(0.234)	(0.326)	(0.468)
Hospital	−3.230	−0.412	−1.178**	−0.809
	(2.835)	(0.290)	(0.473)	(0.616)
Peak Time Pricing	1.591	0.194	0.0755	0.379
	(1.830)	(0.200)	(0.316)	(0.400)
Average CBL	0.120	0.0188**	0.000581	0.0340**
	(0.0835)	(0.00776)	(0.0120)	(0.0164)
Percentage SD of CBL	−0.0544	−0.00328	−0.0124	−0.00629
	(0.0753)	(0.00695)	(0.00994)	(0.0144)
Constant	−15.11*	−1.542**		−2.992*
	(9.158)	(0.721)		(1.537)
Observations	347,255	345,607	347,407	347,408
R-squared	0.0905	0.2072		0.2044

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

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Table 5: Regression Results for the Second Step of Heckman Model and the Second Part for Two-part Models

	Heckman Step 2: OLS	Heckman Step 2: Fixed-Effect OLS	Two-Part Model Part 2: OLS	Two-Part Model Part 2: Fixed-Effect OLS
LHS Variables	Reduction Ability	Reduction Ability	Reduction Ability	Reduction Ability
Learning Hours	3.99e-05	8.96e-05	0.000202***	0.000229***
	(8.60e-05)	(6.36e-05)	(6.63e-05)	(6.31e-05)
LMP	−0.00177*	−0.00317***	−0.000556	−0.00198***
	(0.000960)	(0.000660)	(0.000853)	(0.000680)
Transmission Fee	0.179		−0.0116	
	(0.229)		(0.186)	
Work-Hour Indicator	−0.708**	−0.583***	−0.0594	−0.00606
	(0.287)	(0.163)	(0.0985)	(0.0606)
HUI SUFO	0.00108	0.00241	−0.00701	−0.00578
	(0.00942)	(0.00972)	(0.00977)	(0.0106)
CUI SUFO	0.00140	0.00895	0.0190**	0.0269***
	(0.0104)	(0.00587)	(0.00732)	(0.00520)
Heating Usage Index (HUI)	−0.0280***	−0.0258***	−0.0238***	−0.0211***
	(0.00472)	(0.00361)	(0.00396)	(0.00332)
Cooling Usage Index (CUI)	−0.0258***	−0.0219***	−0.0145***	−0.0106**
	(0.00597)	(0.00535)	(0.00499)	(0.00503)
Daytime Sky Clear in HUI Condition	0.541***	0.531***	0.185***	0.175***
	(0.145)	(0.115)	(0.0490)	(0.0480)
Daytime Sky Clear in CUI Condition	0.498***	0.510***	0.0880*	0.107**
	(0.148)	(0.105)	(0.0508)	(0.0455)
College Winter Holiday Indicator	0.108	0.0776	0.344	0.321
	(0.316)	(0.350)	(0.334)	(0.347)
Saturday	0.318*	0.167*	0.117	0.0492
	(0.189)	(0.0843)	(0.151)	(0.0873)
Sunday	0.494**	0.331***	0.287*	0.208*
	(0.201)	(0.104)	(0.167)	(0.108)
College	−0.135		−0.239	
	(0.314)		(0.324)	
Commercial	−0.396		−0.355	
	(0.384)		(0.373)	
Hospital	−0.621**		−0.879***	
	(0.302)		(0.307)	
Peak Time Pricing	0.00959		0.140	
	(0.254)		(0.237)	
Average CBL	−0.0291***		−0.0178***	
	(0.00583)		(0.00314)	
Percentage SD of CBL	−0.00607		−0.00740	
	(0.0123)		(0.0124)	
IMR (Dispatch)	−0.821**	−0.819***		
	(0.334)	(0.224)		
Constant	0.106	−0.279	−1.528***	−2.227***
	(0.900)	(0.496)	(0.498)	(0.100)
Observations	23,440	23,440	23,484	23,933
R-squared	0.169	0.126	0.166	0.119

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The positive coefficients in the first stage for "Work-Hour Indicator" show that participants are more likely to bid in the market during work hours. However, negative coefficients in the second stage imply that participants have lower reduction ability during work hours. The positive coefficient from the Tobit regression implies that the overall reduction ratio is higher during work hours.

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The variables "CUI SUFO" and the interaction term with ln(Learning) are the key explanatory variables with respect to manipulation. A high SUFO implies a day with inflated CBL and lower LMP than past non-dispatch days, and is created by a participant's previous bidding pattern. In the absence of CBL experience, participants may not have sufficient incentive to bid during relatively low LMP hours, even though SUFO may be created accidently. However, experienced DR participants may understand the calculation of CBL and potential idiosyncratic-demand bidding. They may utilize bidding strategies to create SUFO and then take advantage of the current high CBL and bid in the market.

The variable "CUI SUFO" obtains negative coefficients in the first stage and positive coefficients in the second stage, consistent with Hypothesis 3. The interaction term achieves positive coefficients for the first step, consistent with Hypothesis 4. These results imply that inexperienced participants are less willing to bid in the market when SUFO is high. The positive coefficients in the second stage, indicating high observed reduction, support our expectation that inflated CBLs may exist on SUFO days.

In the first-stage models, the positive coefficients for the interaction terms indicate that participants are more likely to utilize idiosyncratic-demand bidding as they become experienced. A higher CUI SUFO initially has a negative effect on DR bidding, but this becomes a positive factor after around 500 learning hours,[11] implying that participants come to know how a past high temperature may inflate their CBL. The number of learning hours varies between 0 and 4,000 in the one and a half years observation period. Our data indicates that an event day on average has 12 DR hours, thus the 500 hours experience may be accumulated in 40 event days, perhaps during a three-month period.

The variables HUI SUFO and the cross-term with ln(Learning) achieve similar results in the Tobit and the first-stage regressions. The coefficients imply the same bidding pattern as with CUI SUFO on these variables. However, the regressions in the second part of the two-part model provide insignificant coefficients. Since PECO is a summer peaking area, HUI SUFO in winter may not represent an important manipulation opportunity

The HUI and CUI coefficients show the same pattern as the coefficients for LMP. The positive coefficients in the first-stage models imply more willingness to bid on high HUI and CUI hours. The negative coefficients from the second-stage models imply a lower observed reduction. High HUI and CUI increase expected usage, and thus CBL may underrepresent the expected load during high HUI and CUI hours.

The first-stage coefficients for Sky Clear Conditions in Heating or Cooling Period are negative, implying that participants are less likely to reduce usage on a clear day. When sunshine is expected, DR suppliers may believe that the heating, ventilation and air conditioning (HVAC) systems will be in more demand than on a cloudy day. The positive coefficients on the sunshine variable in the second stage indicate greater energy reduction ability on sunny days. However, the negative coefficient in the Tobit regression shows an overall lower level of DR on sunny days, representing a combination of low Bid Willingness and high reduction ability.

The negative coefficients for weekend variables in the first-stage regressions imply a lack of willingness of firms to engage in DR on those days. Results in the second-stage regressions indicate high reduction ability on weekends, as expected. The overall reduction for DR on the weekends is lower than on weekdays, as shown by the negative Tobit regression coefficient. Re-

11. The number of hours for HUI SUFO to become a positive factor is: e ^ (- coefficient (SUFO) / coefficient (SUFO*ln(learning))) which equals 528 hours.

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gression results for the variable "College Winter Holiday" indicate a higher bidding willingness in the first stage regressions, as expected. Results show that participants with peak time pricing contracts do not significantly differ with other participants in their Bid Willingness and reduction ability.

The explanatory variable "Average CBL" obtains positive coefficients in the first-stage regressions, and negative coefficients in the second stage regressions. According to the first-step regressions, firms using larger amounts of electricity have a greater probability of bidding in the market. This advantage may stem from economies of scale. The negative coefficients in the second stage indicate that firms using more electricity have lower relative reduction ability once dispatched.

7. CONCLUSION

Demand response (DR) may potentially play an important role in the electricity systems by reducing peak load and preventing social welfare loss. However, the historical-based customer baseline load (CBL) determination method can induce manipulation strategies, reduce social welfare, increase the burden of rate payers, and at the same time jeopardize system reliability. Vulnerable CBLs that can be manipulated may lead to DR programs that are far from effective.

Regressions based on the PECO data further suggest that participants are utilizing manipulation strategies. The existence of manipulated CBLs is indicated as CBLs dramatically increase with learning experience. In addition, there is substantial evidence that firms engage in DR during Seemingly Unattractive Free-money Opportunities (SUFO) when their CBLs potentially over-represent expected usages. In particular, participants create and use more SUFO days to earn extra profit as their experiences accumulate.

FERC Order 745 envisions that DR participants will provide energy during peak hours, generating a large amount of social welfare and deferring costly infrastructure constructions. However, the incentives for manipulation shown here may well have been undermining DR programs. Indeed, because our data comes from the pre-Order 745 era, the adverse effects of CBL-based DR associated with Order 745's DR payment may be greater than those shown here. (See Lu and Li (2013) for a statistical method to test it.)

In paying for perceived demand reductions, rather than allowing consumers simply to consume until their marginal benefit equals the price of electricity, FERC has created a system ripe for manipulation. Keeping the system in place required a regime of constant FERC vigilance – as was shown in the cases of several manipulation investigations (see, for example, FERC (2013c) and a recent FERC Order directing PJM to increase the granularity of capacity DR performance monitoring (FERC 2014)), or else the system would devolve into a large "free-money" machine with increasing burdens on customers unable to participate in such programs.

With the Supreme Court's upholding of FERC Order 745, the future of DR payment levels, as well as the measurement of DR, can be further studied. To achieve a more robust CBL may require the DR customers to submit to RTOs more detailed, or even real-time, meter reading data on both event days and non-event days. With all the costs in obtaining detailed data, RTOs in the CBL verification process may face important weaknesses in their market monitoring stemming from the information disadvantages with respect to DR participants regarding participants' operations. Perhaps regulatory agencies concerned with promoting demand management should shift their attention toward marginal cost pricing, as well as demand response in the ancillary and reserve market, which has recently shown itself to be successful. (See PJM (2014).)

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TAB N

This is Exhibit **"N"** referred to in the Revised Affidavit of Brian Rivard sworn before me this 21st day of November, 2019

A Commissioner for Taking Affidavits

Lauren Theresa Daniel, a Commissioner, etc.,
Province of Ontario, while a Student-at-Law.
Expires April 8, 2022.

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ORIGINAL ARTICLE

On the optimal design of demand response policies

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Abstract We characterize the optimal regulatory policy to promote efficient demand response (DR) in the electricity sector. DR arises when consumers reduce their purchases of electricity below historic levels at times when the utility's marginal cost of supplying electricity is relatively high. The US Federal Energy Regulatory Commission (FERC) advocates compensation for DR that reflects the utility's marginal cost. We show that the optimal policy often provides less generous compensation, and demonstrate that implementation of the FERC's policy can reduce welfare well below the level secured by the optimal DR policy.

Keywords Electricity pricing · Demand response · Regulation

JEL Classification L51 · L94

1 Introduction

The cost of supplying electricity can vary substantially from day to day and even from hour to hour. This is the case because generating units with relatively high operating costs often must be called upon to produce electricity during times of peak demand. In contrast to the ever-changing cost of supplying electricity, the retail price of electricity typically varies little, if at all, for long periods of time. Such time-invariant

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pricing reflects historic difficulty in measuring the precise time at which electricity is consumed and ongoing consumer resistance to time-sensitive pricing now that smart meters render such pricing feasible.

To help overcome the inefficiencies that arise when the retail price of electricity diverges substantially from the marginal cost of supplying electricity (Borenstein and Holland 2005; Joskow and Tirole 2007), US regulators have, at the urging of Congress, implemented demand response (DR) policies.[1,2] In essence, DR policies compensate electricity customers for reducing their purchases of electricity below historic norms during periods of peak electricity demand. Of central concern in the design of DR policies is the compensation that is provided to consumers who reduce their electricity consumption.

The Federal Energy Regulatory Commission (FERC)'s Order 745 concludes that compensation for reduced electricity consumption should reflect the utility's marginal cost of supplying electricity.[3] Although such marginal-cost compensation may seem natural, it has garnered intense criticism.[4] Specifically, critics of Order 745 argue that marginal-cost compensation will induce excessive DR. Hogan (2009, 2010) and Chao (2011), for instance, suggest that the unit compensation for DR should be reduced below the utility's marginal cost of supplying electricity (c) by the prevailing unit retail price of electricity (r).[5] Under this compensation policy, a consumer is effectively first required to purchase electricity from the utility at price r before being permitted to re-sell the electricity to the utility at price c (Borlick et al. 2012).

Although these arguments seem compelling, they typically have not been accompanied by fully-specified formal analyses. We provide such an analysis and employ it to characterize the optimal regulatory policy in several relevant settings. Our formal analysis accounts for the realistic possibility that some consumers who provide DR may offset some or all of their reduced purchase of electricity from the utility with electricity they produce on-site. For example, some industrial customers may produce electricity with combined heat and power (CHP) units powered by natural gas and some residential consumers may produce electricity using rooftop solar panels.

[1] §1252(f) of the Energy Policy Act of 2005 (Pub. L. No. 109-58, 119 STAT. 966 (2005)) states that "It is the policy of the United States that time-based pricing and other forms of demand response, whereby electricity customers are provided with electricity price signals and the ability to benefit by responding to them, shall be encouraged."

[2] The U.S. Department of Energy (2006) defines DR to encompass "Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized."

[3] Order 745 states that a "demand response resource must be compensated for the service it provides to the energy market at the market price for energy, referred to as the locational marginal price (LMP)" (Federal Energy Regulatory Commission 2011, ¶2).

[4] The FERC's authority to implement this compensation policy also has been challenged. The US Court of Appeals for the District of Columbia (2014) vacated FERC Order 745 in May 2014. However, in January 2016, the Supreme Court overturned the decision of the Appeals Court, thereby reinstating Order 745 (US Supreme Court 2016).

[5] Bushnell et al. (2009), Borlick (2010), and Borlick et al. (2012), among others, offer corresponding conclusions.

Our analysis provides substantial support for the critics of the FERC's policy. Indeed, the optimal compensation for DR in the streamlined basic model that we analyze is precisely the compensation that the critics recommend. More generally, though, the optimal compensation can differ from both the level specified in FERC Order 745 and from the level that critics have advocated.

Chao (2011) suggests that a DR policy will play no useful role when retail prices can adjust rapidly to reflect the prevailing marginal cost of supplying electricity.[6] Our formal analysis of this issue again provides considerable support for this conclusion, but identifies conditions under which an optimally-designed DR policy can enhance welfare even when smart meters and real-time pricing allow retail prices to reflect prevailing marginal costs. The incremental value of a DR policy in this setting arises because the prevailing retail price affects consumption by all consumers whereas the prevailing compensation for DR only affects the actions of consumers who provide DR. The ability to differentially affect the behavior of a subset of consumers can be valuable when consumers employ different technologies for on-site electricity production and such production entails social losses from environmental externalities.

In addition to characterizing the optimal DR policy, we investigate the welfare gains that an optimally designed policy can secure. We also examine the welfare losses that can arise when the FERC's marginal-cost compensation policy is implemented in place of the optimal policy. We find that the welfare gains from an optimal policy can be substantial under arguably plausible conditions, as can the losses from the FERC's policy.

We develop and explain these findings as follows. Section 2 reviews the key elements of our model. Section 3 characterizes the optimal regulatory policy in the streamlined basic setting where: (1) the retail price of electricity does not vary with the realized state of demand for electricity, (2) consumers cannot influence the baseline level of electricity consumption that determines whether they are providing DR, (3) society values symmetrically the welfare of all consumers, including those who can readily replace DR with on-site generation of electricity and those who lack this capability, and (4) electricity production entails no social losses from externalities. Section 4 identifies the changes to the optimal policy that arise when each of these restrictions is relaxed. Section 5 illustrates the welfare gains that an optimally designed DR policy can secure and the welfare losses that arise when the FERC's marginal-cost compensation policy is implemented in place of the optimal policy. Section 6 concludes and discusses directions for further research. The Appendix outlines the proofs of all formal conclusions. An online Technical Appendix (Brown and Sappington 2016) provides additional details.

2 Model elements

A regulated utility produces and delivers electricity to consumers. The utility's cost of producing and delivering X units of electricity is $C(X)$, which is an increasing,

[6] Chen et al. (2010) and Li et al. (2011) document the optimality of setting the price of electricity equal to its instantaneous marginal cost of production and propose an iterative algorithm to achieve the optimal outcome in the presence of limited information.

convex function.[7] This cost structure reflects the utility's need to employ progressively less efficient generating units as the demand for electricity increases above the utility's baseload capacity.[8]

Consumer $i \in \{1, \ldots, N\}$ derives value $V_i(x_i, \theta)$ from consuming x_i units of electricity in state θ. $V_i(\cdot)$ is a strictly increasing, strictly concave function of x_i in each state. Furthermore, each consumer's total and marginal valuation of electricity increases with the state (so $\frac{\partial V_i(\cdot)}{\partial \theta} > 0$ and $\frac{\partial^2 V_i(\cdot)}{\partial \theta \partial x_i} > 0$ for all $x_i > 0$). The state might reflect the extent of temperature and sunshine extremes, for example. Particularly high (low) temperatures and associated intense (limited) sunshine typically increase the marginal value of electricity that is employed to power air conditioning (heating) units. The state θ is the realization of a random variable that has strictly positive support on the interval $[\underline{\theta}, \overline{\theta}]$, with density function $g(\theta)$ and distribution function $G(\theta)$.

Every consumer can purchase electricity from the regulated supplier. Some consumers also can produce their own electricity using either a dispatchable on-site generation technology (e.g., CHP units powered by natural gas) or a non-dispatchable technology (e.g., solar panels).[9] We take as given each consumer's investment in one of these technologies and analyze the consumer's on-site production (and consumption) of electricity.[10] Consumer i's cost of producing x_i^o units of electricity in state θ is $C_i(x_i^o, \theta)$. This function is strictly increasing and strictly convex in x_i^o in each state under the dispatchable technology. In contrast, $C_i(x_i^o, \theta) = 0$ for all $x_i^o \leq \overline{x}_i(\theta)$ and $C_i(x_i^o, \theta) = \infty$ for all $x_i^o > \overline{x}_i(\theta)$ under the non-dispatchable technology. Thus, $\overline{x}_i(\theta)$ is the maximum amount of electricity that consumer i can produce at no additional cost (beyond the cost of his initial capacity investment) in state θ. This maximum output might represent the amount of electricity produced by the consumer's solar panels, for example, which varies with the intensity of the prevailing sunshine.[11]

7 Formally, $C'(X) > 0$ and $C''(X) \geq 0$ for all $X > 0$.

8 In practice, a utility's production costs may increase discontinuously at output levels where less efficient auxiliary generating units are brought on line. We assume $C(\cdot)$ is continuously differentiable for analytic tractability. This assumption does not alter our primary qualitative conclusions. Our model also can be viewed as one in which the utility is a distribution company that purchases electricity from competitive suppliers at increasing marginal cost.

9 A consumer's choice of on-site production technology might be affected by such factors as his status as a commercial or residential customer, his projected consumption of electricity, the characteristics of his commercial/residential property (including the available space or the rooftop slope and exposure to the sun), and local zoning ordinances, for example. These considerations and others may lead some consumers to refrain from any investment in on-site production capabilities. For expositional ease, we abstract from the possibility that a consumer might invest in multiple distinct production technologies.

10 Each consumer is assumed to consume all of the electricity he generates on-site, thereby abstracting from the possibility that a consumer might supply electricity to other consumers or sell electricity to the regulated utility.

11 DNV GL (2014) reports that solar capacity represents the major component of distributed generation (DG) capacity in eight of the ten US states with the most DG capacity. CHP units powered by natural gas account for the majority of DG capacity in Connecticut and New York.

Each consumer pays a fixed charge (R) for the right to purchase electricity from the utility. x_i^u is the amount of electricity that consumer i purchases from the utility. The amounts of electricity a consumer purchases and produces are assumed to be unaffected by R. In contrast, consumer i's choices of x_i^u and x_i^o are affected by the unit price (r) of electricity purchased from the utility and by the prevailing compensation for DR. Consequently, the regulator can set R to ensure the utility's financial solvency while setting r to determine the amount of electricity that consumers purchase from the utility.[12]

Consumer i's DR, x_i^d, is the extent to which the consumer reduces the amount of electricity he purchases from the utility below a baseline level, $\underline{x}_i$. Formally, $x_i^d \equiv \max\{0, \underline{x}_i - x_i^u\}$.[13] In practice, $\underline{x}_i$ often reflects the average amount of electricity consumer i has purchased from the utility historically (KEMA 2011). To focus on the pricing issues of central interest, we assume initially that consumer i perceives $\underline{x}_i$ to be an exogenous parameter, e.g., a baseline level established by the regulator over which the consumer has no control.[14]

$m(\theta)$ denotes the payment a consumer receives from the utility for each unit of DR he provides in state θ. Because this compensation for DR can vary with the state, it can be set at a relatively high level when θ is high, for example, to encourage consumers to reduce the amount of electricity they purchase from the utility when the utility's marginal cost of producing electricity is relatively high. Thus, $m(\cdot)$ can assume a role that peak load retail prices might play if they were feasible.[15]

The regulator chooses her policy instruments $\{r, R, m(\theta)\}$ to maximize expected social welfare while ensuring non-negative expected profit for the utility. Social welfare in our basic model is simply aggregate consumer welfare,[16] which is the difference between: (i) the sum of the value that all consumers derive from their electricity consumption and the compensation they receive for the DR they provide, and (ii) the sum of consumers' payments to the utility and the costs consumers incur in producing electricity themselves. Formally, when consumer i produces $x_i^o(\cdot, \theta)$ units of elec-

[12] Section 4.1 considers the setting where the regulator is not permitted to set a fixed charge (R), perhaps because of concerns about the financial burden that a substantial fixed charge can impose on individuals with limited wealth who consume little electricity. Section 4.5 considers the setting where the unit retail price of electricity (r) can vary with the realized state.

[13] In principle, a consumer might be penalized for purchasing more than the established baseline level of electricity, in which case x_i^d might be negative. We follow industry practice in abstracting from this possibility.

[14] We thereby abstract initially from the possibility that, as in Chao (2009, 2011) and Chao and DePillis (2012), a consumer's choice of x_i^u in one period might affect the value of $\underline{x}_i$ that is established in future periods. Section 4.3 considers the possibility that consumers might be able to influence their baseline consumption levels.

[15] The analysis in Sect. 4.5 admits state-specific retail prices, $r(\theta)$, that can function like peak load prices. In practice, peak load prices often are designed to generate sufficient revenue to cover the utility's capacity costs (e.g., Crew et al. 1995). The fixed retail charge (R) can play this role in our model. Section 4.1 considers the optimal design of r and $m(\theta)$ when fixed retail charges are not feasible.

[16] The utility's profit is zero under the optimal regulatory policy in all of the settings we analyze. Section 4.4 considers a setting where social welfare includes the losses from environmental externalities associated with electricity production.

tricity and purchases $x_i^u(\cdot,\ \theta)$ units of electricity from the utility in state θ, aggregate expected consumer welfare is[17]:

$$E\{U(\cdot)\} = \sum_{i=1}^{N} \int_{\underline{\theta}}^{\overline{\theta}} \Big[V_i \left(x_i^u(\cdot,\ \theta) + x_i^o(\cdot,\ \theta),\ \theta \right) - r x_i^u(\cdot,\ \theta) + m(\theta) x_i^d(\cdot,\ \theta) - C_i \left(x_i^o(\cdot,\ \theta),\ \theta \right) \Big] dG(\theta) - NR. \quad (1)$$

The utility's expected profit is the difference between its expected revenues and its expected costs (which include payments to consumers for the DR they provide). Formally:

$$E\{\pi\} = NR + \sum_{i=1}^{N} \int_{\underline{\theta}}^{\overline{\theta}} \left[r x_i^u(\cdot) - m(\theta) x_i^d(\cdot) \right] dG(\theta) - \int_{\underline{\theta}}^{\overline{\theta}} C\left(X^u(\cdot,\ \theta) \right) dG(\theta), \quad (2)$$

where $X^u(\cdot,\ \theta) \equiv \sum_{i=1}^{N} x_i^u(\cdot,\ \theta)$. The regulator's formal problem, denoted [RP], is to choose $r,\ R$, and $m(\theta)$ to:

$$\text{Maximize } E\{U(\cdot)\} \text{ subject to } E\{\pi\} \geq 0, \quad (3)$$

where given $r,\ R$, and $m(\theta)$, consumer i chooses $x_i^u(\cdot,\ \theta)$ and $x_i^o(\cdot,\ \theta)$ to:

$$\text{Maximize } \; V_i \left(x_i^u(\cdot,\ \theta) + x_i^o(\cdot,\ \theta),\ \theta \right) - R - r x_i^u(\cdot,\ \theta) + m(\theta) x_i^d(\cdot,\ \theta) - C_i \left(x_i^o(\cdot,\ \theta),\ \theta \right). \quad (4)$$

Ω_i^D (Ω_i^{-D}) denotes the set of $\theta \in [\underline{\theta},\ \overline{\theta}]$ realizations for which consumer i provides (does not provide) DR at the solution to [RP].[18] To focus on the settings of primary interest, much of the ensuing analysis considers settings where the optimal regulatory policy induces some DR.[19]

The timing in the model is the following. First, the baseline level of electricity consumption ($\underline{x}_i$) for each consumer is specified exogenously. Second, the regulator sets $r,\ R$, and $m(\theta)$. Third, the state (θ) is realized. Fourth, each consumer determines how much electricity to produce on-site and how much to purchase from the utility. Fifth, the utility supplies all of the electricity that consumers demand, receives the associated revenue, and delivers the required payments to consumers for the DR they provide.

[17] The "·" here denotes factors other than θ that affect consumers' electricity production and consumption. These factors can include r and $m(\theta)$.

[18] Formally, Ω_i^D (Ω_i^{-D}) is the set of $\theta \in [\underline{\theta},\ \overline{\theta}]$ for which $\frac{\partial V_i(x_i^u + x_i^o,\, \theta)}{\partial x_i^u}|_{x_i^u = \underline{x}_i} < (\geq)\, r + m(\theta)$ at the solution to [RP].

[19] Formally, unless otherwise noted, we assume $\Omega_i^D \neq \{\varnothing\}$ for some $i \in \{1, \ldots, N\}$. For expositional simplicity, we also assume that $x_i^u(\cdot,\ \theta) > 0$ for all $\theta \in [\underline{\theta},\ \overline{\theta}]$, for $i = 1, \ldots, N$.

3 The optimal demand response policy in the basic setting

Before characterizing the optimal regulatory policy in the basic setting described in Sect. 2, we examine how the unit compensation for DR, $m(\theta)$, affects a consumer's actions. Lemma 1 reports that when a consumer is initially purchasing some electricity from the utility, producing some electricity himself using a dispatchable technology, and providing some DR, the consumer will reduce his purchase from the utility and increase his own production of electricity as $m(\theta)$ increases. Furthermore, due to the increasing marginal cost of on-site generation, the consumer will increase his production of electricity by less than he curtails his purchases from the utility. Consequently, an increase in $m(\theta)$ induces a reduction in the sum of the consumer's purchase and production of electricity. In contrast, the consumer will always produce the maximum amount of electricity that his on-site non-dispatchable technology permits, so his electricity production and consumption in each state are not affected by the prevailing compensation for DR.

Lemma 1 *Suppose* $x_i^u(\cdot, \theta) > 0$, $x_i^o(\cdot, \theta) > 0$, *and* $x_i^d(\cdot, \theta) > 0$. *Then* $\frac{dx_i^u(\cdot,\theta)}{dm(\theta)} \leq 0$, $\frac{dx_i^o(\cdot,\theta)}{dm(\theta)} \geq 0$, *and* $\frac{d(x_i^u(\cdot,\theta)+x_i^o(\cdot,\theta))}{dm(\theta)} \leq 0$. *These weak inequalities hold as strict inequalities* (*equalities*) *when consumer i employs the dispatchable* (*non-dispatchable*) *on-site production technology.*

Proposition 1 now characterizes the optimal regulatory policy in the basic setting.

Proposition 1 *At the solution to* [*RP*]:

$$m(\theta) = C'\left(X^u(\cdot, \theta)\right) - r; \tag{5}$$

$$\sum_{i=1}^{N} \int_{\Omega_i^{-D}} \left[r - C'\left(X^u(\cdot, \theta)\right)\right] \frac{\partial x_i^u(\cdot, \theta)}{\partial r} dG(\theta) = 0; \text{ and} \tag{6}$$

$$R = \frac{1}{N}\left[\int_{\underline{\theta}}^{\overline{\theta}} C\left(X^u(\cdot, \theta)\right) dG(\theta) + \sum_{i=1}^{N} \int_{\underline{\theta}}^{\overline{\theta}} \left\{m(\theta) x_i^d(\cdot, \theta) - r x_i^u(\cdot, \theta)\right\} dG(\theta)\right]. \tag{7}$$

Equation (7) states that, due to the regulator's concern with maximizing consumer welfare, the utility is afforded only the minimum expected profit required to ensure the utility's operation (i.e., $E\{\pi(\theta)\} = 0$). Equation (6) indicates that the optimal unit retail price of electricity (r) equates to zero a weighted average of deviations between r and the utility's marginal cost of production. In standard Ramsey fashion, the weights reflect the sensitivity of consumer demand to variations in r.[20]

Equation (5) states that the optimal unit compensation for DR in state θ is the difference between the utility's marginal cost of production in this state and the retail

20 Ramsey (1927) and Baumol and Bradford (1970) characterize Ramsey prices. Joskow and Tirole (2007) identify conditions under which optimal retail prices for electricity reflect Ramsey principles.

price of electricity. This conclusion reflects the fact that in order to induce the welfare-maximizing level of DR from each consumer in every state, the effective unit price that each consumer faces for purchasing electricity from the utility should reflect the utility's marginal cost of supplying electricity in each state. The effective price a consumer faces is the sum of the nominal retail price of electricity (r) and the unit compensation for DR (m) the consumer foregoes when he decides to purchase the marginal unit of electricity from the utility rather than increase his DR. Therefore, the optimal policy equates $r + m(\theta)$ and $C'(\cdot)$ by setting $m(\theta) = C'(X^u(\cdot, \theta)) - r$.[21]

Proposition 1 supports the critics of the FERC's marginal-cost compensation policy. As the critics note, the FERC's policy effectively awards to consumers the full social value of a commodity (i.e., reduced electricity consumption) without first requiring them to pay anything for the commodity (since they are not required to purchase electricity at the prevailing retail price before effectively selling it to the utility). Therefore, the FERC's policy induces more than the welfare-maximizing level of DR, ceteris paribus.

Before proceeding to consider alternative settings, we note that even the optimal regulatory policy does not ensure efficient (i.e., welfare-maximizing) consumption and DR by all consumers in every state. Such (conditional) efficacy (given the induced purchases of electricity from the utility by other consumers) requires $\frac{\partial V_i(x_i^u + x_i^o, \theta)}{\partial x_i^u} = C'(X^u(\cdot, \theta))$ for all $\theta \in [\underline{\theta}, \overline{\theta}]$, for $i = 1, \ldots, N$. Corollary 1 reports that efficiency is not ensured even in the simple setting where the utility is the sole producer of electricity.

Corollary 1 *The consumption and DR actions of each consumer who provides DR are efficient at the solution to* [*RP*]. *The corresponding actions of consumers who do not provide DR generally are not efficient.*

Corollary 1 reflects the fact that the regulator chooses $m(\theta)$ to ensure that each consumer who provides DR delivers the efficient level of DR in each state. However, because the unit retail price does not vary with the state, the regulator typically cannot induce consumers who do not provide DR to purchase the efficient level of electricity from the utility in each state.

4 Extensions

We now examine how the optimal regulatory policy changes when fixed retail charges for electricity are not feasible, when distributional concerns arise, when consumers can influence their baseline consumption levels, when electricity production generates social losses from environmental externalities, and when retail prices can vary with the realized state.

[21] The deviation of $m(\theta)$ from marginal cost here does not reflect the deviation of price from marginal cost that commonly arises under peak load pricing to ensure revenue that matches operating costs (e.g., Crew et al. 1995). The regulator can choose the fixed charge (R) to ensure the utility's financial solvency in the basic setting analyzed here.

4.1 Fixed retail charges are not feasible

We begin by characterizing the optimal compensation for DR when fixed retail charges are not feasible (so R is constrained to be 0 in [RP]). In practice, fixed retail charges for electricity are quite small in many jurisdictions,[22] perhaps because fixed charges might disproportionately burden consumers with limited wealth. Let [RP-NR] denote the regulator's problem in this setting and let λ_r denote the Lagrange multiplier associated with the utility's profitability constraint ($E\{\pi\} \geq 0$) in this problem.

Proposition 2 *At the solution to* [*RP-NR*], *given the optimal unit retail price* r:

$$m(\theta) = C'\left(X^u\right) - r - \left[\frac{\lambda_r - 1}{\lambda_r}\right] \frac{\sum_{i=1}^{N} x_i^d(\cdot)}{\left|\sum_{i=1}^{N} \frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|}. \tag{8}$$

It is readily shown that $\lambda_r > 1$ when the utility's average cost (including payments for DR) exceeds its marginal cost at the solution to [RP-NR]. Propositions 1 and 2 imply that in this case, an inability to impose fixed retail charges reduces the optimal compensation for DR, ceteris paribus. The reduced compensation reduces the amount by which r must be increased above marginal cost to ensure the utility's financial solvency.

4.2 Distributional concerns

Now return to the setting where the regulator can set r, R, and $m(\theta)$, and consider the possibility that the regulator might value differently the welfare of consumers who can provide DR and those who cannot. For example, implementation costs may limit participation in a DR program to large commercial and industrial consumers, and the regulator may be particularly concerned with the welfare of small residential consumers.[23] Let $\widetilde{\alpha}$ denote the weight the regulator assigns to the welfare of the $\widetilde{N}$ consumers who can provide DR, and let $\widetilde{x}^d(\cdot)$ and $\widetilde{x}^o(\cdot)$, respectively, denote DR and electricity production by these consumers. In addition, let $\widehat{\alpha}$ denote the weight the regulator assigns to the welfare of the $\widehat{N}$ consumers who cannot provide DR (where $\widetilde{N} + \widehat{N} = N$). [RP-d] will denote the regulator's problem in this setting with distributional concerns.[24] Proposition 3 characterizes the optimal unit compensation for DR in this setting.

[22] To illustrate, two of the three major electric utilities in California (Pacific Electric and Gas and San Diego Gas and Electric) impose no fixed retail charge. The third utility (Southern California Edison) imposes a monthly fixed charge of only \$0.99 (Borenstein 2014).

[23] Borlick (2011) notes that the marginal-cost compensation for DR advised by the FERC requires consumers who do not provide DR to subsidize those who do.

[24] The regulator seeks to maximize the relevant weighted average of the expected welfare of the two types of consumers while ensuring non-negative profit for the regulated utility. The proof of Proposition 3 includes a formal statement of [RP-d].

Proposition 3 *At the solution to* [*RP-d*], *given the optimal unit retail price* r:

$$m(\theta) = C'\left(X^u(\cdot,\,\theta)\right) - r - \frac{\widehat{N}[\widehat{\alpha} - \widetilde{\alpha}]\sum_{i=1}^{N} x_i^d(\cdot,\,\theta)}{[\widetilde{\alpha}\widetilde{N} + \widehat{\alpha}\widehat{N}]\sum_{i=1}^{N}\left|\frac{\partial x_i^u(\cdot,\theta)}{\partial m(\theta)}\right|}. \tag{9}$$

Proposition 3 provides the intuitive conclusion that, ceteris paribus, the regulator will reduce the compensation for DR when she values relatively highly the welfare of consumers who cannot provide DR (i.e., when $\widehat{\alpha} > \widetilde{\alpha}$). Although the reduced compensation induces less than the (unweighted) surplus-maximizing level of DR, it permits reductions in the charges (r and R) imposed on consumers who do not provide DR. Equation (9) indicates that, ceteris paribus, the reduction in $m(\theta)$ tends to be more pronounced as: (i) $\widehat{\alpha}$ increases, so the regulator values more highly the welfare of consumers who cannot provide DR, (ii) $\widehat{N}$ increases, so there are more consumers who cannot provide DR, (iii) $\sum_{i=1}^{N} x_i^d(\cdot)$ increases, so the magnitude of the equilibrium DR increases, and (iv) $\sum_{i=1}^{N}\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|$ declines, so a reduction in $m(\theta)$ causes a smaller increase in the demand for electricity from the utility (and an associated smaller increase in the utility's marginal cost of production).

4.3 Endogenous baseline consumption levels

Now consider the possibility that consumer i might undertake action a_i at personal cost $D_i(a_i)$ to increase his baseline consumption level, $\underline{x}_i$. For example, as Chao (2011) and Chao and DePillis (2012) posit, a consumer might purchase more than the level of electricity that maximizes his contemporary welfare in early periods, recognizing that doing so will increase his baseline consumption level in later periods. We assume $\underline{x}_i$ is an increasing, concave function of a_i and $D_i(\cdot)$ is a strictly increasing, strictly convex function for all $i = 1, \ldots, N$.[25]

The regulator first specifies $\{R,\ r,\ m(\theta)\}$ and the rule that will be employed to establish baseline consumption levels. Consumers then choose their actions to influence their baseline consumption levels. Finally, consumers determine how much electricity they will purchase from the utility and how much electricity they will produce themselves. The regulator seeks to maximize aggregate expected consumer welfare while ensuring non-negative expected profit for the utility.[26]

Let [RP-a] denote the regulator's formal problem in this setting.[27] Also let $\delta_{i\theta} = 1$ if $\theta \in \Omega_i^{Da}$ and $\delta_{i\theta} = 0$ otherwise, where Ω_i^{Da} is the set of $\theta \in [\underline{\theta},\,\overline{\theta}]$ for which consumer i provides DR at the solution to [RP-a]. For expositional ease, Proposition 4 characterizes the optimal compensation for DR in this setting for the case where $\Omega_i^{Da} \neq \{\varnothing\}$ for each $i = 1, \ldots, N$.

[25] We further assume that, for all $i = 1, \ldots, N$, consumer i's expected welfare is a strictly concave function of a_i and consumer i chooses $a_i > 0$.

[26] Consumer i's welfare now includes both the personal cost of action a_i and the impact of this action on $\underline{x}_i$.

[27] The proof of Proposition 4 includes a formal statement of [RP-a].

Proposition 4 *At the solution to* [*RP-a*], *given the optimal unit retail price* r:

$$m(\theta) = \frac{C'(X^u) - r}{\left[\sum_{i=1}^{N}\left\{\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right| + \delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}\right\}\right] / \sum_{i=1}^{N}\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|}. \tag{10}$$

It is readily shown that an increase in $m(\theta)$ induces consumers who provide DR to devote more effort to increasing their baseline consumption levels (so $\frac{\partial a_i}{\partial m(\theta)} > 0$ for all $i = 1, \ldots, N$) at the solution to [RP-a].[28] Therefore, the denominator of the fraction in Eq. (10) exceeds 1. Consequently, Propositions 1 and 4 indicate that, ceteris paribus, the optimal compensation for DR is scaled down systematically when consumers can influence their baseline consumption levels. The reduction in $m(\theta)$ limits incentives to artificially inflate baseline consumption, but leads to distortions where they otherwise would not arise, as Corollary 2 reports.

Corollary 2 *Even the consumption and DR actions of consumers who provide DR generally are not efficient at the solution to* [*RP-a*].

4.4 Externalities

We now allow for the possibility that electricity production can entail social losses from environmental externalities and the regulator might seek to limit these losses through her policy instruments $\{r(\theta), R, m(\theta)\}$. Let e_i denote the social loss associated with each unit of electricity that consumer i produces on-site.[29] The unit loss can vary across consumers because different consumers may employ different technologies to generate electricity. For instance, e_i may be zero when consumer i is a residential customer who employs rooftop solar panels to generate electricity. In contrast, e_i may be strictly positive when consumer i is a commercial enterprise that employs a CHP unit powered by natural gas to generate electricity. $e(X)$ will denote the total social loss from externalities that arises when the utility produces X units of electricity.[30]

The regulator seeks to maximize expected social welfare, which is the difference between expected aggregate consumer welfare and the expected social loss from externalities. This expected loss is:

$$E\{L(\cdot)\} = \int_{\underline{\theta}}^{\overline{\theta}} \left[\sum_{i=1}^{N} e_i x_i^o(\cdot,\, \theta) + e\left(X^u(\cdot,\, \theta)\right)\right] dG(\theta). \tag{11}$$

[28] See the proof of Proposition 4.

[29] This linear structure for the losses from externalities due to electricity production by consumers is adopted for analytic and expositional simplicity. The key qualitative conclusions drawn below persist under nonlinear structures.

[30] $e(X)$ is an increasing function. For simplicity, we abstract from the possibility that the social loss from externalities due to production by the utility might vary with the amount of electricity that consumers produce.

Proposition 5 *Equation* (7) *holds at the solution to* [*RP-e*]. *In addition*:

$$m(\theta) = C'\left(X^u\right) - r + e'\left(X^u\right) - \frac{\sum_{i=1}^{N} e_i \frac{\partial x_i^o(\cdot)}{\partial m(\theta)}}{\sum_{i=1}^{N} \left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|}; \text{ and} \quad (12)$$

$$\sum_{i=1}^{N} \int_{\Omega_i^{-D}} \left\{ \left[r - \left(C'\left(X^u\right) + e'\left(X^u\right)\right)\right] \frac{\partial x_i^u(\cdot)}{\partial r} - e_i \frac{\partial x_i^o(\cdot)}{\partial r} \right\} dG(\theta) = 0. \quad (13)$$

Equation (13) indicates that the retail price of electricity is optimally set to ensure that an expected weighted average of deviations of price from the utility's marginal cost of production (including relevant externality costs) is zero, after adjusting for losses from externalities associated with on-site production of electricity by consumers. The weights on the deviations again are the relevant price-sensitivities of consumer demand for electricity.

Equation (12) reports that when externalities are present, the optimal unit compensation for DR is increased above $C'(X^u) - r$ by the extent to which reduced production by the utility reduces social losses from externalities. In the case where consumers do not produce electricity on-site or where such production does not generate externalities, $m(\theta)$ is optimally increased by $e'(X^u)$, the rate at which social losses from externalities decline as the utility's production of electricity declines.[31] More generally, this increase in $m(\theta)$ is reduced by the extent to which reduced production by the utility increases social losses from externalities due to increased electricity production by consumers on-site. This adjustment becomes more pronounced as e_i increases and as consumers become more likely to replace the electricity they do not purchase from the utility with electricity they produce themselves (i.e., as $\frac{\partial x_i^o(\cdot)}{\partial m(\theta)}$ increases relative to $\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|$).[32]

Self-interested consumers do not consider the social losses from on-site production when deciding how much electricity to produce. Consequently, because the regulator is not endowed with the ability to levy consumer-specific taxes on electricity (and externality) production, the regulator cannot induce consumers to undertake efficient

31 As noted above, the utility can be viewed as a distribution company that purchases electricity from competitive suppliers. If government policies (e.g., emissions taxes) compel electricity suppliers to internalize the social losses from environmental externalities, then the utility's marginal cost of procuring electricity will reflect both the physical marginal cost of generating electricity and the associated marginal social losses from externalities. (Fabra and Reguant 2014 find that a large fraction of emissions costs are passed on to consumers in the form of higher retail prices for electricity.) The optimal unit compensation for DR in this setting would reflect the difference between the utility's marginal cost of procuring electricity and the prevailing unit retail price of electricity.

32 Recall from Lemma 1 that $\frac{\partial x_i^o(\cdot)}{\partial m(\theta)} < \left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|$ for all $i = 1, \ldots, N$. Therefore, $e'(X^u) - \frac{\sum_{i=1}^{N} e_i \frac{\partial x_i^o(\cdot)}{\partial m(\theta)}}{\left|\sum_{i=1}^{N} \frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|} > 0$ when $e'(X^u) = e_i = \underline{e}$, a constant, for all $i = 1, \ldots, N$. Consequently, Eq. (5) implies that $m(\cdot)$ is optimally increased above $C'(\cdot) - r$ when the marginal social loss from externalities is constant and identical for all sources of electricity production. The increase in $m(\theta)$ serves to reduce social losses from externalities because the increase in the amount of electricity consumers produce on-site as their DR increases is less than the amount of their DR.

on-site production of electricity. The efficient level of on-site production by consumer i in state θ (given his induced purchase of electricity from the utility) is given by $\frac{\partial V_i(x_i^u + x_i^o, \theta)}{\partial x_i^o} = C_i'(x_i^o) + e_i$.[33]

Corollary 3 *Suppose $x_i^o > 0$ for some consumer $i \in \{1, \ldots, N\}$ at the solution to [RP-e] identified in Proposition 5. Then the level of on-site production by consumer i at the identified solution is efficient if and only if $e_i = 0$.*

4.5 State-specific pricing

In settings where smart meters are deployed ubiquitously, a regulator may be able to set a state-specific unit retail price, $r(\theta)$, in addition to R and $m(\theta)$. Let [RP-s] denote the regulator's formal problem in such a setting where she seeks to maximize aggregate expected welfare (which accounts for losses from externalities) while ensuring non-negative expected profit for the utility.[34] Proposition 6 identifies conditions under which a DR policy admits no strict welfare gains in this setting.

Proposition 6 *At the solution to [RP-s], $r(\theta) = C'(X^u(\cdot, \theta)) + e'(X^u(\cdot, \theta))$ and $m(\theta) = 0$ for all $\theta \in [\underline{\theta}, \overline{\theta}]$ if: (i) no consumer produces electricity (so $x_i^o = 0$ for all $i = 1, \ldots, N$); (ii) consumer production of electricity entails no externalities (so $e_i = 0$ for $i = 1, \ldots, N$); or (iii) all consumers provide DR in all states (so $x_i^d(\cdot) > 0$ for all $i = 1, \ldots, N$ and for all $\theta \in [\underline{\theta}, \overline{\theta}]$).*

Proposition 6 indicates that when the regulator sets the optimal state-specific retail prices for electricity, a DR policy will not enhance welfare if consumers do not produce electricity on-site or if such production entails no externalities. Under these conditions, the regulator can maximize surplus by setting the retail price of electricity equal to its social marginal cost of production in each state.[35] Consequently, non-zero compensation for DR would only reduce expected welfare by causing the effective price a consumer pays for electricity purchased from the utility to diverge from the utility's social marginal cost of production.[36]

The same is true when all consumers provide DR in every state. In this case, an increase in $r(\theta)$ has the same impact as an increase in $m(\theta)$ on each consumer's electricity purchase and production decisions. Consequently, a DR policy offers no strict welfare gains when the regulator sets the optimal state-specific retail prices for electricity.

In contrast, identical changes in $r(\theta)$ and $m(\theta)$ do not affect symmetrically the actions of all consumers who produce electricity on-site when only some of them

[33] For simplicity, we assume here that $\frac{\partial V_i(x_i^u, \theta)}{\partial x_i^o} > C_i'(0) + e_i$ for all $x_i^u \geq 0$, for $i = 1, \ldots, N$.

[34] The proof of Proposition 6 provides a formal statement of [RP-s].

[35] This conclusion reflects the maintained assumption that the regulator can set a fixed charge (R) that does not affect electricity consumption.

[36] Chao (2011, p. 79) observes that "In the special case where the [retail price of electricity] equals the wholesale price, the optimal demand response payment would be zero. Therefore, for consumers on dynamic retail pricing, there is no longer any reason to pay then for demand reduction."

provide DR. Therefore, as Corollary 4 indicates, the regulator optimally increases $m(\theta)$ above 0 in states where, relative to corresponding effects on the demand for electricity from the utility, an increase in $r(\theta)$ increases losses from externalities due to increased electricity production by consumers more rapidly than does an increase in $m(\theta)$. The increase in $m(\theta)$ permits a less pronounced increase in electricity (and externality) production by consumers than would an increase in $r(\theta)$.

Corollary 4 *Suppose $x_i^o(\cdot) > 0$ for some consumers and $x_i^d(\cdot) > 0$ for some, but not all, consumers at the solution to* [*RP*]. *Then*:

$$m(\theta) \gtreqless 0 \text{ as } \frac{\sum_{i=1}^{N} e_i \frac{\partial x_i^o(\cdot)}{\partial r(\theta)}}{\sum_{i=1}^{N} \left| \frac{\partial x_i^u(\cdot)}{\partial r(\theta)} \right|} \gtreqless \frac{\sum_{i=1}^{N} e_i \frac{\partial x_i^o(\cdot)}{\partial m(\theta)}}{\sum_{i=1}^{N} \left| \frac{\partial x_i^u(\cdot)}{\partial m(\theta)} \right|} \text{ at the solution to [RP].} \tag{14}$$

As is the case in other settings, the regulator's inability to impose consumer-specific taxes on on-site electricity (and externality) production in the present setting often precludes her from inducing efficient on-site electricity production, as Corollary 5 reports.

Corollary 5 *Suppose $x_i^o > 0$ for some consumer $i \in \{1, \ldots, N\}$ at the solution to* [*RP-s*] *identified in Proposition* 6. *Then the level of on-site production by consumer i at the identified solution is efficient if and only if $e_i = 0$.*

Corollary 5 implies that when consumers produce electricity and generate social losses from externalities in doing so, the optimal regulatory policy generally does not induce efficient levels of on-site production even when the regulator can set state-specific retail prices.[37]

5 Welfare gains and losses

We now illustrate the welfare gains that can arise when an optimally designed DR policy is implemented. We also illustrate the welfare losses that can arise when compensation for DR is instead set equal to the utility's marginal cost of producing electricity. To do so, we consider the following *benchmark setting* in which the utility is the only producer of electricity and production entails no losses from externalities. The utility's cost of producing X units of electricity is $C(X) = F + aX + bX^2$, where a, b, and F are nonnegative constants.

There are N_H identical "H consumers" and N_L identical "L consumers." The former (e.g., commercial and industrial consumers) value electricity more highly than do the latter (e.g., residential consumers). Each i ($\in \{L, H\}$) consumer derives value $V_i(x_i, \theta) = v_i \left[\frac{\theta (x_i)^{1+\alpha_i} - \overline{V}_i}{1+\alpha_i} \right]$ from x_i units of electricity in state θ, where $\overline{V}_i \geq 0$ is a constant. v_L is normalized to 1 and v_H is set equal to 1.88, reflecting the estimated relative values of lost load for residential and non-residential electricity consumers

[37] As is evident from the proof of Proposition 6, the optimal policy also typically does not induce efficient levels of consumption and DR in the presence of nontrivial externalities from on-site production.

(London Economics Internatiional LLC 2013). We set $\frac{1}{\alpha_L} = -0.15$ and $\frac{1}{\alpha_H} = -0.20$, reflecting common estimates of the short-run price elasticity demand for electricity for residential and non-residential customers, respectively.[38]

The demand parameter θ reflects the extent to which the daily high temperature ($\overline{T}$) exceeds an upper threshold (78°F) and the daily low temperature ($\underline{T}$) falls below a lower threshold (65°F) in our sample. Thus, higher values of θ typically will be associated with increased demand for electricity for cooling and heating.[39] Formally, $\theta = 1 + \max\{0, \overline{T} - 78\} + \max\{0, 65 - \underline{T}\}$. Our sample consists of the daily temperature realizations in 2013 in all states in the PJM Interconnection region (NOAA 2014).[40] (Brown and Sappington 2016 present the results of corresponding analyses that reflect conditions in the California and ISO New England regions.)[41] $\theta \in [0, 70]$ in this sample, and maximum likelihood estimation reveals that the distribution of θ is well-approximated by a gamma distribution with scale parameter 3.064 and shape parameter 8.021.[42]

$\underline{x}_i$ is the amount of electricity an $i \in \{L, H\}$ consumer would purchase in this benchmark setting under the optimal regulatory policy in the absence of any DR program.[43] $N_L + N_H$ is set to ensure that expected demand is equal to the average hourly load in the PJM Interconnection region in 2013.[44] $\frac{N_L}{N_L+N_H}$ is set equal to 0.879, the fraction of US electricity customers classified as residential customers in the PJM Interconnection region in 2012 (Energy Information Administration 2014a).

The utility's fixed cost of production (F) is taken to be \$39, 252, 470. This number reflects the 46 % of revenue collected annually from ratepayers in the PJM Interconnection region that is estimated to be employed to cover the fixed costs of installing generation capacity and maintaining and upgrading the region's transmis-

[38] See, for example, King and Chatterjee (2003), Espey and Espey (2004), Narayan and Smyth (2005), Taylor et al. (2005), Wade (2005), Bernstein and James Griffin (2006), and Paul et al. (2009). It is readily verified that consumer i's price elasticity of demand for electricity in this setting is $\frac{1}{\alpha_i}$.

[39] This formulation reflects a common approach to capturing changes in building energy use due to ambient temperature variation (e.g., Eto 1988).

[40] PJM Interconnection is the "regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia" (www.pjm.com/about-pjm/who-we-are.aspx).

[41] ISO New England is "the independent, not-for-profit corporation responsible for keeping electricity flowing across the six New England states and ensuring that the region has reliable, competitively priced wholesale electricity" (www.iso-ne.com/about). We investigate potential outcomes in the California, ISO New England, and PJM Interconnection regions because Bushnell (2007) provides estimates of the cost parameters a and b in these three regions. We focus on outcomes in the PJM Interconnection region here for brevity and because this region is the largest and the most populous of the three regions.

[42] The data reveal that the distribution of θ is also approximated reasonably well by a generalized extreme value (GEV) distribution with parameters $(\mu, \sigma, \xi) = (18.460, 10.928, -0.029)$. The key qualitative conclusions reported below are unchanged when this GEV distribution is employed instead of the identified gamma distribution.

[43] The optimal regulatory policy in the absence of a DR policy is characterized in Brown and Sappington (2016).

[44] This average hourly load, 90,314 MW, is total annual consumption (791,152,262 MWh) in the PJM Interconnection region in 2013 divided by 8760, the number of hours in a year (Pennsylvania New Jersey Maryland 2014).

Table 1 Outcomes in the benchmark setting

	No DR policy	Optimal DR policy	FERC DR policy
r	83.19	75.20	78.10
R	299.96	323.36	307.57
$E\{m(\theta)\}$	0	21.29	86.28
$E\{C^P(\cdot)\}$	8.49	6.99	5.13
$E\{W\}$	29.16	34.23	30.27

sion and distribution network.[45] The remaining cost parameters are set at $a = 0.0$ and $b = 0.00045$, the parameter values that Bushnell (2007) estimates for this region.

Table 1 reports outcomes in this benchmark setting: (i) in the absence of any DR policy (so $m(\theta) = 0$ for all θ), (ii) under the optimal marginal-cost compensation ("FERC") policy (where $m(\theta) = C'(\cdot)$ for all θ), and (iii) under the optimal DR policy (i.e., at the solution to [RP]). The first row of data in Table 1 reports the unit price of electricity (r) in dollars per MWh.[46] The second row reports the fixed charge (R) in dollars per year.[47] The third row presents the expected DR compensation payment ($E\{m(\theta)\}$) in dollars per MWh.[48] The fourth row reports expected peak-load production costs ($E\{C^P(\cdot)\}$), which are the utility's expected costs (in millions of dollars) in states in which strictly positive DR arises.[49] The last row presents the level of aggregate expected consumer welfare ($E\{W\}$) in millions of dollars.[50]

Table 1 reports that the optimal DR policy in the benchmark setting increases welfare by 17.4 % above the corresponding level achieved in the absence of any DR policy.[51] The welfare gain reflects in part the 17.6 % reduction in expected peak-load production costs the optimal DR policy secures.[52] The cost reductions, in turn, permit a lower unit price for electricity. Consumers also benefit from the compensation they receive for their DR, which nearly offsets the increase in the fixed charge.

The optimal DR policy increases expected welfare by 13.1 % above the level secured under the optimal FERC policy. This welfare increase arises even though the optimal

45 ISO-NE (2006) and Thomas et al. (2014) estimate that variable energy production costs constitute between 48 and 60 % (an average of 54 %) of ratepayer revenue. Revenue is calculated as the product of the average retail rate for electricity and the total load in the PJM Interconnection region in 2013 (Pennsylvania New Jersey Maryland 2014).

46 Thus, $r = 83.19$ denotes a price of approximately \$0.083 per kWh.

47 Thus, $R = 299.96$ represents a monthly fixed charge of approximately \$25.

48 $E\{m(\theta)\} = \int_{\theta_m}^{\overline{\theta}} m(\theta) dG(\theta)$, where $\theta_m = 42.5$ is the smallest realization of θ for which DR is provided both at the solution to [RP] and under the optimal FERC policy in the benchmark setting. The qualitative conclusions drawn below are robust to alternative plausible definitions of peak-load production costs.

49 Formally, $E\{C^P(\theta)\} = \int_{\theta_m}^{\overline{\theta}} C(\cdot) dG(\theta)$.

50 $E\{W\} = \sum_{i=1}^{N} \int_{\underline{\theta}}^{\overline{\theta}} [V_i(x_i^u(\cdot, \theta), \theta) - r x_i^u(\cdot, \theta) + m(\theta) x_i^d(\cdot, \theta)] dG(\theta) - NR$, reflecting Eq. (1).

51 Larger percentage increases in expected welfare arise in the settings analyzed in Brown and Sappington (2016).

52 Reported percentage changes may not reflect the entries in Table 1 exactly because these entries are rounded.

Table 2 Expected welfare as b changes

b	No DR policy	Optimal DR policy	FERC DR policy
0.000585	3.10	3.89	3.50
0.000540	14.29	17.71	15.78
0.000495	14.88	18.22	16.20
0.000450	29.16	34.23	30.27
0.000405	29.90	34.78	30.42
0.000360	31.64	36.52	31.16
0.000315	40.25	45.84	39.35

FERC policy reduces expected peak-load production costs by 26.6 % below the corresponding costs under the optimal DR policy. The optimal FERC policy reduces electricity consumption excessively, causing the value that consumers derive from consuming electricity to decline by more than the corresponding reduction in production costs.

The welfare gains secured under an optimal DR policy typically increase as the convexity of the utility's cost function increases. The enhanced gains arise because the expected cost savings from curtailing peak-load consumption become more pronounced as the utility's marginal cost increases more rapidly with output. To illustrate this more general conclusion, Table 2 reports the levels of expected welfare that arise as b increases and decreases by 10, 20, and 30 % above and below its value (0.00045). In the benchmark setting, holding all other parameter values constant. The table reveals, for example, that when b increases by 20 % (from 0.00045 to 0.00054), the increase in expected welfare secured under the optimal DR policy (relative to the welfare secured in the absence of any DR policy) increases from 17.4 to 23.9 %.[53] In contrast, a 20 % reduction in b (from 0.00045 to 0.00036) reduces this gain in expected welfare from 17.4 to 15.4 %.

When the utility's marginal cost of production increases sufficiently slowly with output, even an optimally designed FERC policy can reduce welfare below the level achieved in the absence of any DR policy.[54] This conclusion is illustrated in the last two rows of data in Table 2. These data indicate that when b declines by 20 or 30 %

[53] Systematic increases in the marginal cost of production (i.e., increases in a) also enhance the welfare gains generated by an optimal DR policy. To illustrate, suppose a increases from 0 to 20, while all other parameters are held constant at their levels in the benchmark setting. (The average value of a in the settings considered in Brown and Sappington 2016 is approximately 23.) The increase in expected welfare that the optimal DR policy generates in this case (relative to no DR policy) rises to 33.6 % (from the 17.4 % generated in the benchmark setting). Bushnell's (2007) estimate of $a = 0$ in the PJM region reflects in part substantial supply by nuclear generators. Some of these generators are scheduled for retirement in the near future, which will tend to increase a. However, increased supply of energy from renewable sources may reduce a.

[54] A value of b substantially below Bushnell's (2007) estimate might arise, for example, from pronounced reductions in the price of natural gas, which often is employed to power peak-load production units. The US experienced sharp reductions in the price of natural gas between 2007 and 2009 (www.infomine.com/investment/metal-prices/natural-gas/all/). The ongoing replacement of (low cost) coal generation by natural gas generation in the PJM region can introduce a countervailing effect on b.

below its level in the benchmark setting, the excessive demand reduction the FERC policy induces reduces the value that consumers derive from consuming electricity by more than it reduces peak-load production costs.

6 Conclusions

FERC Order 745 specifies compensation for DR that reflects the utility's marginal cost of supplying electricity. Critics of Order 745 contend that when the retail price of electricity does not vary with industry conditions, compensation for DR should reflect the difference between the utility's marginal cost of supplying electricity and the prevailing retail price of electricity. The critics also suggest that no compensation for DR is appropriate when real-time pricing ensures that the retail price of electricity reflects the utility's marginal cost of production.

Our formal analysis lends considerable support to the critics' views, but with some qualifications. We found that the optimal regulatory policy reflects the critics' views under streamlined, but arguably plausible, conditions. The optimal policy varies from the policy recommended by the critics in the presence of such factors as limits on feasible fixed charges for electricity, distributional concerns, endogenous baseline consumption levels, and externalities associated with electricity production. The marginal-cost compensation for DR that the FERC advocates generally is not the optimal policy in any of the settings we analyzed.

We also showed that the optimal DR policy can secure significant increases in expected welfare under arguably plausible conditions. The FERC's DR policy often generates a significantly smaller increase in welfare, and can even reduce welfare below the level that arises in the absence of any DR policy. Therefore, the expressed concerns about the FERC's policy would seem to merit serious consideration.

Our illustrations of the performance of the optimal DR policy and the FERC's policy did not account explicitly for losses from externalities associated with electricity production. A full accounting for these losses could alter the relative performance of the FERC's DR policy. Observe from Proposition 5 that, ceteris paribus, the difference between the marginal compensation under the FERC's policy and the corresponding optimal compensation declines as the marginal social loss from externalities associated with electricity production by the utility increases, after adjusting for relevant social losses from externalities associated with increased electricity production by consumers. Accurate estimation of social losses from externalities requires detailed knowledge of the particular technologies being employed to generate electricity at all relevant output levels. Such estimation and development of the associated implications for the relative performance of different DR policies await further research.

In closing, we note four additional extensions of our analysis that merit further research. First, rather than taking the baseline levels of electricity purchases ($\underline{x}_i$) as given, the optimal structuring of these baselines should be analyzed.[55] In practice,

[55] The regulator might also be permitted to specify the terms under which consumers must "buy" their assigned baselines (e.g., in a day-ahead market) before they are eligible to sell demand reduction (e.g., in a real-time spot market) (Bushnell et al. 2009).

regulators likely will want to implement rules for establishing baseline levels that limit strategic manipulation by consumers (Chao 2011).[56] Second, consumer investment in on-site production capacity should be endogenized in order to examine the impact of DR (and other) policies on DG capabilities. Investment in centralized generating capacity might also be analyzed explicitly. More generous compensation for DR may be optimal if the ensuing demand for electricity supplied by the utility both permits a substantial reduction in centralized generating capacity and reduces the utility's short-run supply costs.

Third, additional policy instruments warrant consideration. The optimal design of a DR policy is best viewed as an element of a broader exercise that includes, for example, the optimal design of DG, energy conservation, and renewable energy portfolio policies. The key qualitative conclusions drawn above seem likely to persist in the context of this more general analysis, but the details of the analysis remain to be determined.

Fourth, the optimal DR policy should be characterized in settings where the retail price of electricity partially reflects the utility's marginal cost of production, e.g., in the presence of time-of-day pricing. Our findings in the settings with a fixed retail price and fully state-specific retail pricing (recall Propositions 1, 5 and 6) suggest that the optimal compensation for DR will continue to reflect differences between the utility's marginal cost of production and the prevailing retail price of electricity.[57]

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Appendix[58]

Proof of Lemma 1 (4) implies that when $x_i^d > 0$, the value of $x_i^u > 0$ and the value of $x_i^o > 0$ produced using the dispatchable on-site technology are characterized by:

$$\frac{\partial V_i(\cdot)}{\partial x_i^u} = r + m(\theta) = C_i'(\cdot) \Rightarrow \frac{\partial^2 V_i(\cdot)}{\partial (x_i^u + x_i^o)^2} \frac{d(x_i^u + x_i^o)}{dm(\theta)} = 1 = C_i'(\cdot) \frac{dx_i^o}{dm(\theta)}.$$

Therefore, $\frac{d(x_i^u + x_i^o)}{dm(\theta)} < 0$ and $\frac{dx_i^o}{dm(\theta)} > 0$, and so $\frac{dx_i^u}{dm(\theta)} < 0$ when consumer i employs the dispatchable technology.

Consumer i produces $\overline{x}_i(\theta)$ units of electricity when he employs the non-dispatchable technology. Therefore, x_i^o and x_i^u are not affected by $m(\theta)$. □

[56] Our key qualitative conclusions hold for any specified (exogenous) values of $\underline{x}_i$, and so will hold for the optimal (endogenous) such levels.

[57] Future research might also characterize the optimal DR policy in settings with richer intertemporal structures. In practice, consumers may secure additional benefit from a DR program as their stochastic demand for electricity naturally falls below the established baseline level at various times, or as they intentionally substitute electricity consumption in other periods for consumption foregone while supplying DR (e.g., Graff Zivin et al. 2014).

[58] This Appendix presents the key elements of the proofs of the formal conclusions in the text. Brown and Sappington (2016) provide more detailed proofs.

Proof of Proposition 1 The conclusions follow immediately from Proposition 5. □

Proof of Corollary 1 First suppose $x_i^u < \underline{x}_i$ for some $i \in \{1, \ldots, N\}$. Then (4) and (5) imply that at the solution to [RP] identified in Proposition 1, x_i^u is determined by $\frac{\partial V_i(x_i^u + x_i^0, \theta)}{\partial x_i^u} = r + m(\theta) = C'(X^u(\cdot, \theta))$. Therefore, given the consumption decisions of other consumers, the consumption and DR actions of consumer i are efficient.

Now suppose $x_i^u(\cdot) > \underline{x}_i$. Then (4) and (6) imply that at the solution to [RP] identified in Proposition 1, x_i^u is determined by:

$$\frac{\partial V_i(x_i^u + x_i^0, \theta)}{\partial x_i^u} = r = \frac{\sum_{i=1}^N \int_{\Omega_i^{-D}} C'(X^u(\cdot, \theta)) \frac{\partial x_i^u(\cdot)}{\partial r} dG(\theta)}{\sum_{i=1}^N \int_{\Omega_i^{-D}} \frac{\partial x_i^u(\cdot)}{\partial r} dG(\theta)}.$$

Therefore, given the actions of other consumers, the actions of consumer i are efficient if and only if, for all $\theta \in [\underline{\theta}, \overline{\theta}]$:

$$\sum_{i=1}^N \int_{\Omega_i^{-D}} C'\left(X^u(\cdot, \theta)\right) \frac{\partial x_i^u(\cdot)}{\partial r} dG(\theta) = \left[\sum_{i=1}^N \int_{\Omega_i^{-D}} \frac{\partial x_i^u(\cdot)}{\partial r} dG(\theta)\right] C'\left(X^u(\cdot, \theta)\right).$$

This equality typically will not hold because $x_i^u(\cdot, \theta)$, and thus $X^u(\cdot, \theta)$, vary with θ. □

Proof of Proposition 2 The proof parallels the proof of Proposition 5. □

Proof of Proposition 3 Letting "$\widetilde{\cdot}$" ("$\widehat{\cdot}$") denote variables for consumers who can (cannot) provide DR, expected weighted consumer welfare in this setting is:

$$\begin{aligned} E\left\{U^\alpha(\cdot)\right\} = \widetilde{\alpha} \Bigg\{ \sum_{i=1}^{\widetilde{N}} \int_{\underline{\theta}}^{\overline{\theta}} \Big[& V_i\left(\widetilde{x}_i^u(r, m(\theta), \theta) + \widetilde{x}_i^o(\cdot), \theta\right) - r\widetilde{x}_i^u(\cdot) \\ & + m(\theta)\widetilde{x}_i^d(\cdot) - C_i\left(\widetilde{x}_i^o(\cdot), \theta\right)\Big] dG(\theta) - \widetilde{N}R \Bigg\} \\ & + \widehat{\alpha}\left\{\sum_{i=1}^{\widehat{N}} \int_{\underline{\theta}}^{\overline{\theta}} \left[V_i\left(\widehat{x}_i^u(r, \theta) - r\widehat{x}_i^u(\cdot)\right)\right] dG(\theta) - \widehat{N}R\right\}. \end{aligned} \quad (15)$$

The utility's expected profit is:

$$\begin{aligned} E\left\{\pi^\alpha\right\} = R[\widetilde{N} + \widehat{N}] + \sum_{i=1}^{\widetilde{N}} \int_{\underline{\theta}}^{\overline{\theta}} \left[r\widetilde{x}_i^u(r, m(\theta), \theta) - m(\theta)\widetilde{x}_i^d(\cdot)\right] dG(\theta) \\ + \sum_{i=1}^{\widehat{N}} \int_{\underline{\theta}}^{\overline{\theta}} r\widehat{x}_i^u(r, \theta) dG(\theta) - \int_{\underline{\theta}}^{\overline{\theta}} C\left(\sum_{i=1}^{\widetilde{N}} \widetilde{x}_i^u(\cdot) + \sum_{i=1}^{\widehat{N}} \widehat{x}_i^u(\cdot)\right) dG(\theta). \end{aligned} \quad (16)$$

The regulator's problem, [RP-d], is to choose $\{R,\ r,\ m(\theta)\}$ to maximize $E\{U^{\alpha}(\cdot)\}$ while securing non-negative expected profit for the utility. Let $\lambda_{\alpha} \geq 0$ denote the Lagrange multiplier associated with the utility's participation constraint ($E\{\pi^{\alpha}\} \geq 0$). Then the Lagrangian function associated with [RP-d] is:

$$\pounds_{\alpha} = E\left\{U^{\alpha}(\cdot)\right\} + \lambda_{\alpha} E\left\{\pi^{\alpha}\right\}. \tag{17}$$

Because the value of R does not affect consumption decisions, differentiating (17) with respect to R, using (15) and (16), provides $\lambda_{\alpha} = \frac{\widetilde{\alpha}\widetilde{N}+\widehat{\alpha}\widehat{N}}{\widetilde{N}+\widehat{N}}$.

Because $\frac{\partial \widehat{x}_i^u(\cdot)}{\partial m(\theta)} = 0$ for all $i = 1, \ldots, \widehat{N}$, pointwise optimization of (17) with respect to $m(\theta)$, using (15), (16), Leibnitz' rule, and the continuity of consumer welfare and profit (see the proof of Proposition 5) reveals that:

$$r + m(\theta) - C'(\cdot) = \frac{\widehat{N}[\widehat{\alpha} - \widetilde{\alpha}] \sum_{i=1}^{\widetilde{N}} \widetilde{x}_i^d(\cdot)}{[\widetilde{\alpha}\widetilde{N} + \widehat{\alpha}\widehat{N}] \sum_{i=1}^{\widetilde{N}} \frac{\partial \widetilde{x}_i^u(\cdot)}{\partial m(\theta)}}. \tag{18}$$

(9) follows immediately from (18) because $\frac{\partial \widetilde{x}_i^u(\cdot)}{\partial m(\theta)} < 0$ when $\widetilde{x}_i^d(\cdot) > 0$ and $\frac{\partial \widetilde{x}_i^u(\cdot)}{\partial m(\theta)} \leq 0$ when $\widetilde{x}_i^d(\cdot) = 0$. □

Proof of Proposition 4 Aggregate consumer welfare in this setting is:

$$E\left\{U^{a}(\cdot)\right\} = \int_{\underline{\theta}}^{\overline{\theta}} \sum_{i=1}^{N} w_i(\theta) dG(\theta) - NR - D\left(a_i\right). \tag{19}$$

Because $\sum_{i=1}^{N} w_i(\theta)$ is continuous in θ for all θ (see the proof of Proposition 5), (19) and Leibnitz' rule imply that a_i is determined by:

$$H_i\left(a_i,\ r,\ m(\theta),\ \theta\right) \equiv \int_{\underline{\theta}}^{\widetilde{\theta}_i} m(\theta) \frac{\partial \underline{x}_i}{\partial a_i} dG(\theta) - D_i'\left(a_i\right) = 0. \tag{20}$$

By assumption:

$$\frac{\partial H_i(\cdot)}{\partial a_i} = \frac{d\widetilde{\theta}_i(\cdot)}{da_i} m\left(\widetilde{\theta}_i\right) \frac{\partial \underline{x}_i}{\partial a_i} g\left(\widetilde{\theta}_i\right) + \int_{\underline{\theta}}^{\widetilde{\theta}_i} m(\theta) \frac{\partial^2 \underline{x}_i}{\partial (a_i)^2} dG(\theta) - D_i''\left(a_i\right) < 0. \tag{21}$$

(20) implies:

$$\frac{\partial H_i(\cdot)}{\partial m(\theta)} = \begin{cases} \frac{\partial \underline{x}_i}{\partial a_i} g(\theta) > 0 & \text{if } \theta \in \Omega_i^D, \\ 0 & \text{otherwise.} \end{cases} \tag{22}$$

(20), (21), and (22) imply:

$$\frac{\partial a_i}{\partial m(\theta)} = -\frac{\partial H_i / \partial m(\theta)}{\partial H_i / \partial a_i} \geq 0. \tag{23}$$

The regulator's problem, [RP-a], is to choose $\{R, r, m(\theta)\}$ to maximize $E\{U^a(\cdot)\}$ while securing non-negative expected profit for the utility. Let $\lambda_a \geq 0$ denote the Lagrange multiplier associated with the utility's participation constraint ($E\{\pi^a\} \geq 0$). Then the Lagrangian function associated with [RP] is:

$$\pounds_a = E\left\{U^a(\cdot)\right\} + \lambda_a E\left\{\pi^a\right\}. \tag{24}$$

Let $\frac{dx_i^j(\cdot)}{dm(\theta)} = \frac{\partial x_i^j(\cdot)}{\partial m(\theta)} + \frac{\partial x_i^j(\cdot)}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}$ for $j \in \{u, d, o\}$. For the reasons identified in the proof of Proposition 5, expected consumer welfare and the firm's expected profit are both continuous functions of θ. Consequently, Leibnitz' rule implies that pointwise optimization of (24) with respect to $m(\theta)$ provides:

$$\begin{aligned}&[1-\lambda_a]\sum_{i=1}^{N} x_i^d(r, m(\theta), \theta)g(\theta) - e'\left(X^u\right)\sum_{i=1}^{N}\frac{dx_i^u(\cdot)}{dm(\theta)}g(\theta) - \sum_{i=1}^{N} e_i\frac{dx_i^o}{dm(\theta)}g(\theta)\\ &-\lambda_a C'\left(X^u\right)\sum_{i=1}^{N}\frac{dx_i^u(\cdot)}{dm(\theta)}g(\theta) + \lambda_a\sum_{i=1}^{N}\left[r\frac{dx_i^u(\cdot)}{dm(\theta)} - m(\theta)\frac{dx_i^d(\cdot)}{dm(\theta)}\right]g(\theta) = 0.\end{aligned} \tag{25}$$

Because the value of R does not affect consumption decisions, differentiating (24) with respect to R provides $-N + \lambda_a N = 0 \Rightarrow \lambda_a = 1$. Therefore, (25) can be written as:

$$\left[r - C'\left(X^u\right)\right]\sum_{i=1}^{N}\frac{dx_i^u(\cdot)}{dm(\theta)} = m(\theta)\sum_{i=1}^{N}\frac{dx_i^d(\cdot)}{dm(\theta)}. \tag{26}$$

$\frac{\partial x_i^d(\cdot)}{\partial m(\theta)} = -\frac{\partial x_i^u(\cdot)}{\partial m(\theta)} > 0$ because $\frac{\partial x_i^u(\cdot)}{\partial m(\theta)} = 0$ if $x_i^u(\cdot) > \underline{x}_i$. Also, (4) implies that $x_i^u(\cdot)$ does not vary with $\underline{x}_i$, given r and $m(\theta)$. Therefore:

$$\frac{dx_i^u(\cdot)}{dm(\theta)} = \frac{\partial x_i^u(\cdot)}{\partial m(\theta)} \quad\text{and}\quad \frac{\partial x_i^d(\cdot)}{\partial a_i} = \begin{cases}\frac{\partial \underline{x}_i}{\partial a_i} & \text{if } \; x_i^u(\cdot) \leq \underline{x}_i,\\ 0 & \text{if } \; x_i^u(\cdot) > \underline{x}_i,\end{cases} \tag{27}$$

$$\Rightarrow \frac{dx_i^d(\cdot)}{dm(\theta)} = \left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right| + \delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)} > 0. \tag{28}$$

(10) follows from (26), (27), and (28). □

Proof of Corollary 2 Equation (4) Implies that $x_i^u < \underline{x}_i$ at the solution to [RP-a] identified in Proposition 4 is determined by:

$$\frac{\partial V_i(x_i^u + x_i^o, \theta)}{\partial x_i^u} = r + m(\theta) = \frac{C'(X^u(\cdot, \theta))\sum_{i=1}^{N}\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right| + r\sum_{i=1}^{N}\delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}}{\sum_{i=1}^{N}\left\{\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right| + \delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}\right\}}.$$

Therefore, given the actions of other consumers, consumer i's actions are efficient only if:

$$\frac{C'(X^u(\cdot,\,\theta))\sum_{i=1}^N\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|+r\sum_{i=1}^N\delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}}{\sum_{i=1}^N\left\{\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|+\delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}\right\}}=C'\left(X^u(\cdot,\,\theta)\right)$$

$$\Leftrightarrow\left[r-C'\left(X^u(\cdot,\,\theta)\right)\right]\left[\frac{\sum_{i=1}^N\delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}}{\sum_{i=1}^N\left\{\left|\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\right|+\delta_{i\theta}\frac{\partial \underline{x}_i}{\partial a_i}\frac{\partial a_i}{\partial m(\theta)}\right\}}\right]=0. \tag{29}$$

(28) implies that (29) holds if and only if $r=C'(X^u(\cdot,\,\theta))$ for each $\theta\in[\underline{\theta},\,\overline{\theta}]$. These inequalities typically will not all hold because $x_i^u(\cdot,\,\theta)$, and thus $X^u(\cdot,\,\theta)$, vary with θ. □

Proof of Proposition 5 Let $\lambda\geq 0$ denote the Lagrange multiplier associated with the utility's participation constraint ($E\{\pi\}\geq 0$). Then the Lagrangian function associated with [RP-e] is:

$$£=E\{U(\cdot)\}-E\{L(\cdot)\}+\lambda E\{\pi\}. \tag{30}$$

Pointwise optimization of (30) with respect to $m(\theta)$, using (1), (2), (11), and the envelope theorem provides:

$$[1-\lambda]\sum_{i=1}^N x_i^d(r,\,m(\theta),\,\theta)g(\theta)-e'\left(X^u\right)\sum_{i=1}^N\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}g(\theta)-\sum_{i=1}^N e_i\frac{\partial x_i^o}{\partial m(\theta)}g(\theta)$$
$$-\lambda C'\left(X^u\right)\sum_{i=1}^N\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}g(\theta)+\lambda\sum_{i=1}^N\left[r\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}-m(\theta)\frac{\partial x_i^d(\cdot)}{\partial m(\theta)}\right]g(\theta)=0. \tag{31}$$

Because the value of R does not affect consumption decisions, differentiating (30) with respect to R provides $-N+\lambda N=0\;\Rightarrow\;\lambda=1$. Therefore, (7) holds. Also, $\frac{\partial x_i^d(\cdot)}{\partial m(\theta)}=-\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}$ because $\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}=0$ if $x_i^u(\cdot)>\underline{x}_i$. Therefore, (31) can be written as:

$$\left[r+m(\theta)-e'\left(X^u\right)-C'\left(X^u\right)\right]\sum_{i=1}^N\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}-\sum_{i=1}^N e_i\frac{\partial x_i^o}{\partial m(\theta)}=0. \tag{32}$$

$\sum_{i=1}^N\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}<0$ because $\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}<0$ when $x_i^d(\cdot)>0$ and $\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}\leq 0$ when $x_i^d(\cdot)=0$. Therefore, (12) follows from (32).

Let $\Omega_i^{=}$ denote the set of $\theta\in[\underline{\theta},\,\overline{\theta}]$ for which $\frac{\partial V_i(x_i^u+x_i^o,\,\theta)}{\partial x_i^u}|_{x_i^u=\underline{x}_i}=r+m(\theta)$ at the solution to [RP-e]. Observe that:

$$V_i\left(x_i^u(r,\,m(\theta),\,\theta)+x_i^o(\cdot),\,\theta\right)-rx_i^u(r,\,m(\theta),\,\theta)+m(\theta)\left[\underline{x}_i-x_i^u(r,\,m(\theta),\,\theta)\right]$$
$$=V_i\left(x_i^u(r,\,\theta)+x_i^o(\cdot),\,\theta\right)-rx_i^u(r,\,\theta)\quad\text{for all}\,\theta\in\Omega_i^{=}. \tag{33}$$

Further observe that (1) can be written as:

$$E\{U(\cdot)\} = \int_{\underline{\theta}}^{\overline{\theta}} \sum_{i=1}^{N} w_i(\theta) dG(\theta) - NR \quad \text{where } w_i(\theta) \equiv \begin{cases} w_i^D(\theta) & \text{if } \theta \in \Omega_i^D, \\ w_i^{-D}(\theta) & \text{if } \theta \in \Omega_i^{-D}, \end{cases}$$

$$w_i^D(\theta) \equiv V_i\left(x_i^u(r, m(\theta), \theta) + x_i^o(\cdot), \theta\right) - r x_i^u(r, m(\theta), \theta) + m(\theta)\left[\underline{x}_i - x_i^u(r, m(\theta), \theta)\right] - C_i\left(x_i^o(\cdot), \theta\right), \quad \text{and}$$

$$w_i^{-D}(\theta) \equiv V_i\left(x_i^u(r, \theta) + x_i^o(\cdot), \theta\right) - r x_i^u(r, \theta) - C_i\left(x_i^o(\cdot), \theta\right). \tag{34}$$

Equation (33) Implies that for any $\widehat{\theta} \in \Omega_i^{=}$, $\lim_{\theta \to \widehat{\theta}^-} \sum_{i=1}^{N} w_i^D(\theta) = \lim_{\theta \to \widehat{\theta}^+} \sum_{i=1}^{N} w_i^{-D}(\theta)$ and $\lim_{\theta \to \widehat{\theta}^-} \sum_{i=1}^{N} w_i^{-D}(\theta) = \lim_{\theta \to \widehat{\theta}^+} \sum_{i=1}^{N} w_i^D(\theta)$. Consequently, $\sum_{i=1}^{N} w_i(\theta)$ is continuous in θ for all θ. Corresponding arguments reveal that $\sum_{i=1}^{N} \widetilde{\pi}_i(\theta)$ is continuous in θ for all θ. The established continuity and Leibnitz' rule ensure that differentiation of (30) with respect to r provides:

$$\sum_{i=1}^{N} \int_{\Omega_i^D} \left\{\left[r + m(\theta) - C'\left(X^u\right) - e'\left(X^u\right)\right] \frac{\partial x_i^u(\cdot)}{\partial r} - e_i \frac{\partial x_i^o(\cdot)}{\partial r}\right\} dG(\theta) + \sum_{i=1}^{N} \int_{\Omega_i^{-D}} \left\{\left[r - C'\left(X^u\right) - e'\left(X^u\right)\right] \frac{\partial x_i^u(\cdot)}{\partial r} - e_i \frac{\partial x_i^o(\cdot)}{\partial r}\right\} dG(\theta) = 0. \tag{35}$$

From (4), for $i = 1, \ldots, N$, $\frac{\partial x_i^u(\cdot)}{\partial r} = \frac{\partial x_i^u(\cdot)}{\partial m(\theta)}$ for all $\theta \in \Omega_i^D$. Therefore, (32) and (35) imply:

$$r \sum_{i=1}^{N} \int_{\Omega_i^{-D}} \frac{\partial x_i^u(\cdot)}{\partial r} dG(\theta) = \sum_{i=1}^{N} \int_{\Omega_i^{-D}} \left\{\left[C'\left(X^u\right) + e'\left(X^u\right)\right] \frac{\partial x_i^u(\cdot)}{\partial r} + e_i \frac{\partial x_i^o(\cdot)}{\partial r}\right\} dG(\theta). \tag{36}$$

(13) follows directly from (36). □

Proof of Corollary 3 (4) Implies that $\frac{\partial V_i(x_i^u + x_i^o, \theta)}{\partial x_i^o} = C_i'(x_i^o, \theta)$ at the solution to [RP-e]. Therefore, $\frac{\partial V_i(x_i^u + x_i^o, \theta)}{\partial x_i^o} = C_i'(x_i^o, \theta) + e_i$ if and only if $e_i = 0$. □

Proof of Proposition 6 Expected social losses from externalities are:

$$E\left\{L^s(\cdot)\right\} = \int_{\underline{\theta}}^{\overline{\theta}} \left[\sum_{i=1}^{N} e_i x_i^o(\cdot) + e\left(\sum_{i=1}^{N} x_i^u(\cdot)\right)\right] dG(\theta). \tag{37}$$

Let $\lambda_s \geq 0$ denote the Lagrange multiplier associated the utility's participation constraint ($E\{\pi^s\} \geq 0$). It is readily verified $\lambda_s = 1$ at the solution to the regulator's problem in this setting. Pointwise optimization of the relevant Lagrangian function with respect to $m(\theta)$ provides:

$$[1-\lambda_s]\sum_{i=1}^{N} x_i^d(r(\theta),\ m(\theta),\ \theta)g(\theta) - e'\left(X^u\right)\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}g(\theta) - \sum_{i=1}^{N} e_i\frac{\partial x_i^o}{\partial m(\theta)}g(\theta)$$
$$-\lambda_s C'\left(X^u\right)\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}g(\theta) + \lambda_s\sum_{i=1}^{N}\left[r(\theta)\frac{\partial x_i^u(\cdot)}{\partial m(\theta)} - m(\theta)\frac{\partial x_i^d(\cdot)}{\partial m(\theta)}\right]g(\theta) = 0. \tag{38}$$

Because $\lambda_s = 1$, (38) can be written as:

$$m(\theta) = C'(\cdot) - r(\theta) + e'(\cdot) + \frac{\sum_{i=1}^{N} e_i\frac{\partial x_i^o(\cdot)}{\partial m(\theta)}}{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}}. \tag{39}$$

Corresponding pointwise optimization with respect to $r(\theta)$ provides:

$$r(\theta) = C'(\cdot) + e'(\cdot) + m(\theta)\left[\frac{\sum_{i=1}^{N}\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\cdot)}\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}\right] + \frac{\sum_{i=1}^{N} e_i\frac{\partial x_i^o}{\partial r(\theta)}}{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}. \tag{40}$$

Using (40), (39) can be written as:

$$m(\theta) = \left[\frac{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}{\sum_{i=1}^{N}\left[1+\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\theta)}\right]\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}\right]\left[\frac{\sum_{i=1}^{N} e_i\frac{\partial x_i^o(\cdot)}{\partial m(\theta)}}{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}} - \frac{\sum_{i=1}^{N} e_i\frac{\partial x_i^o(\cdot)}{\partial r(\theta)}}{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}\right]. \tag{41}$$

Using (41), (40) can be written as:

$$r(\theta) = C'\left(X^u\right) + e'\left(X^u\right) + \frac{\sum_{i=1}^{N} e_i\frac{\partial x_i^o(\cdot)}{\partial r(\theta)}}{\sum_{i=1}^{N}\left[1+\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\theta)}\right]\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}$$
$$+\left[\frac{\sum_{i=1}^{N}\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\cdot)}\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}{\sum_{i=1}^{N}\left[1+\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\cdot)}\right]\frac{\partial x_i^u(\cdot)}{\partial r(\theta)}}\right]\frac{\sum_{i=1}^{N} e_i\frac{\partial x_i^o(\cdot)}{\partial m(\theta)}}{\sum_{i=1}^{N}\frac{\partial x_i^u(\cdot)}{\partial m(\theta)}}. \tag{42}$$

Conclusions (i) and (ii) of the proposition follow directly from (41) and (42) because $e_i\frac{\partial x_i^o(\cdot)}{\partial m(\theta)} = e_i\frac{\partial x_i^o(\cdot)}{\partial r(\theta)} = 0$ when consumers do not produce electricity or when their production entails no externalities. Conclusion (iii) of the proposition follows from

(41) and (42) because $\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\cdot)} = -1$, $\frac{\partial x_i^u(\cdot)}{\partial m(\theta)} = \frac{\partial x_i^u(\cdot)}{\partial r(\theta)}$, and $\frac{\partial x_i^o(\cdot)}{\partial m(\theta)} = \frac{\partial x_i^o(\cdot)}{\partial r(\theta)}$ when $x_i^d(\cdot) > 0$ for all $\theta \in [\underline{\theta}, \overline{\theta}]$ and for all $i = 1, \ldots, N$. □

Proof of Corollary 4 (14) follows immediately from (41) because $\frac{\partial x_i^u(\cdot)}{\partial r(\theta)} < 0$, $\frac{\partial x_i^u(\cdot)}{\partial m(\theta)} \leq 0$, and $\frac{\partial x_i^d(\cdot)}{\partial x_i^u(\cdot)} \in \{0, -1\}$. □

Proof of Corollary 5 The proof parallels the proof of Corollary 3. □

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TAB 2

Figure 1.A: No Energy Payments for DR Resources

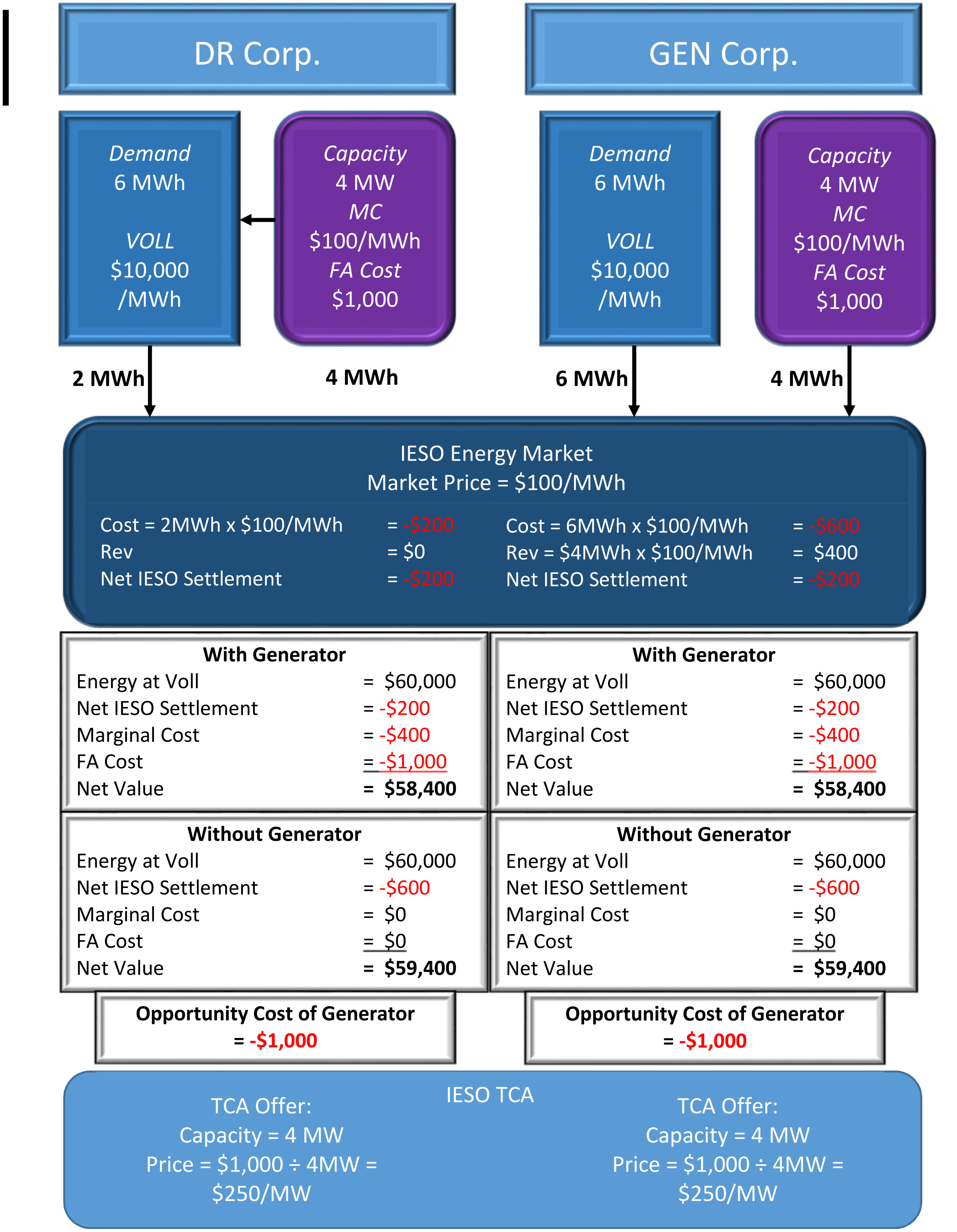


Figure 1.B: Energy Payments for DR Resources

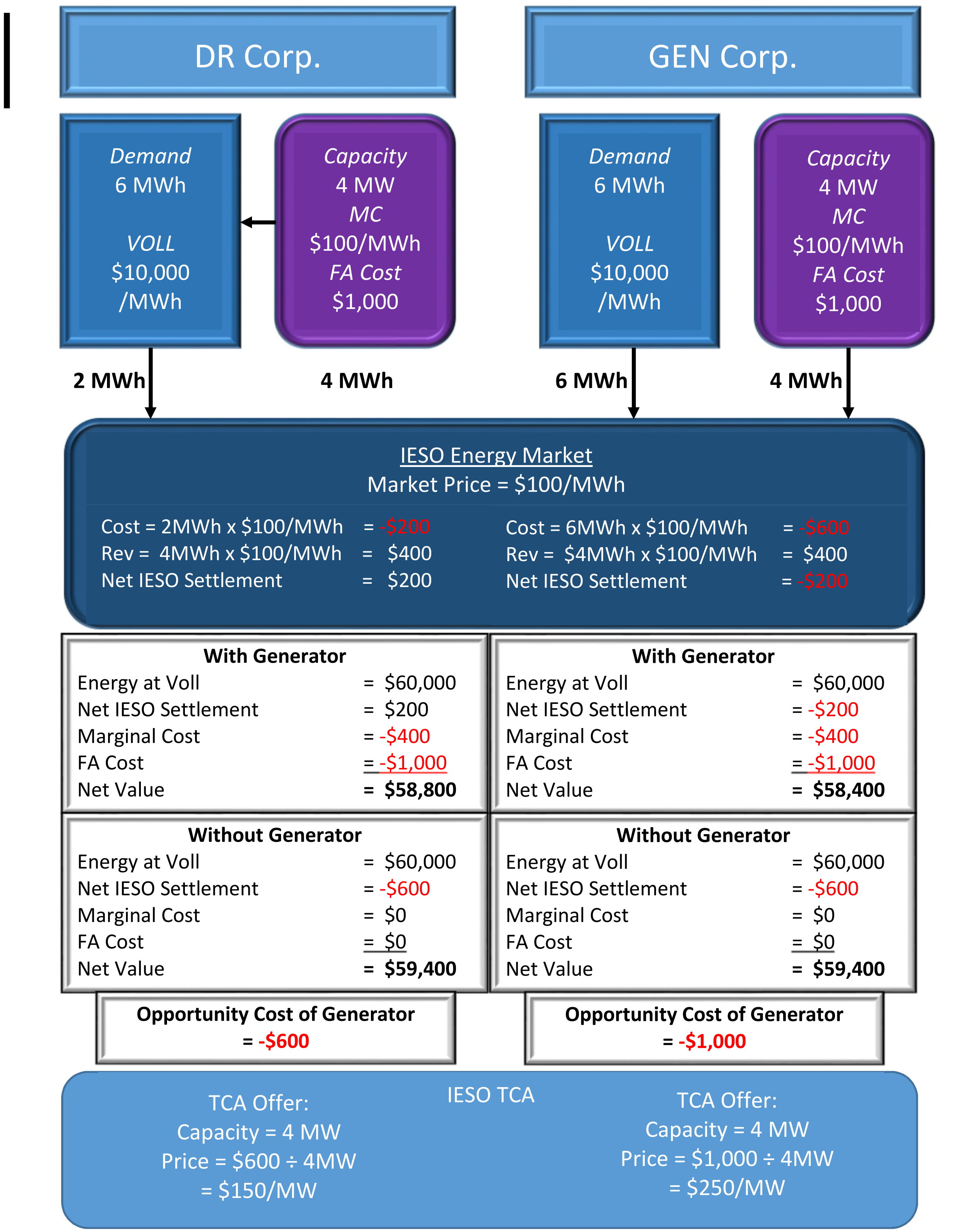


Figure 2.A: No Energy Payments for DR Resources

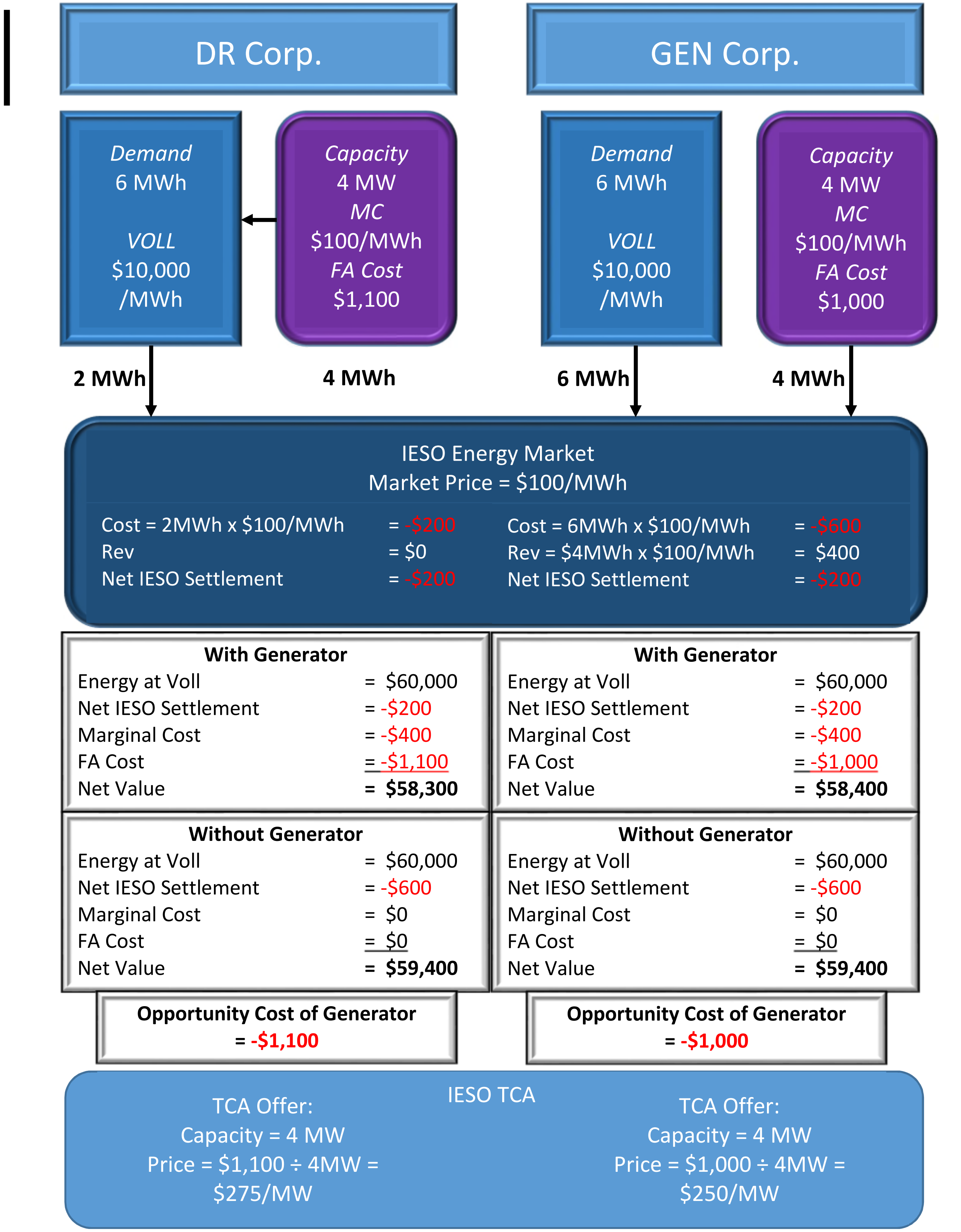


Figure 2.B: Energy Payments for DR Resources

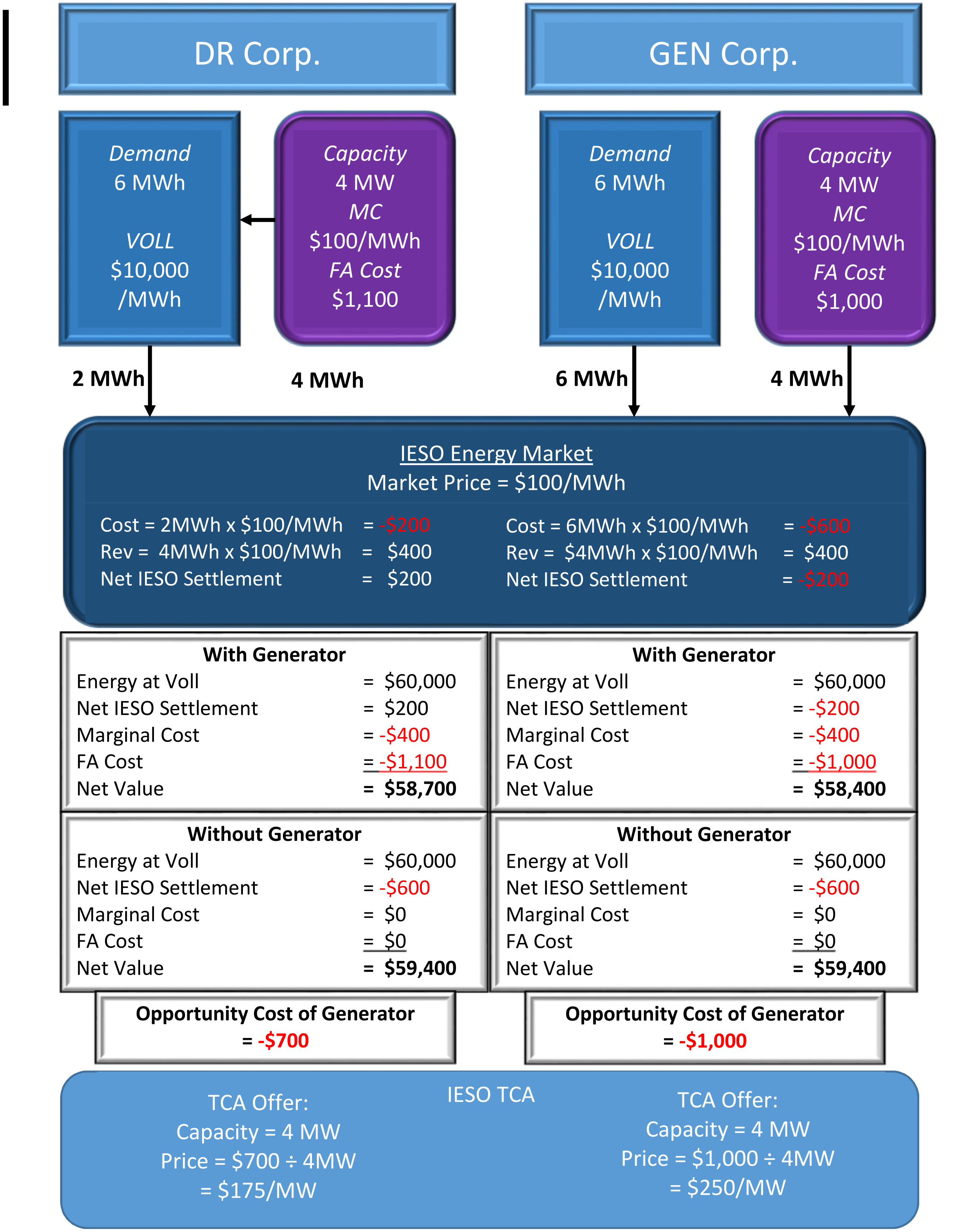


Figure 3.A: No Energy Payments for DR Resources

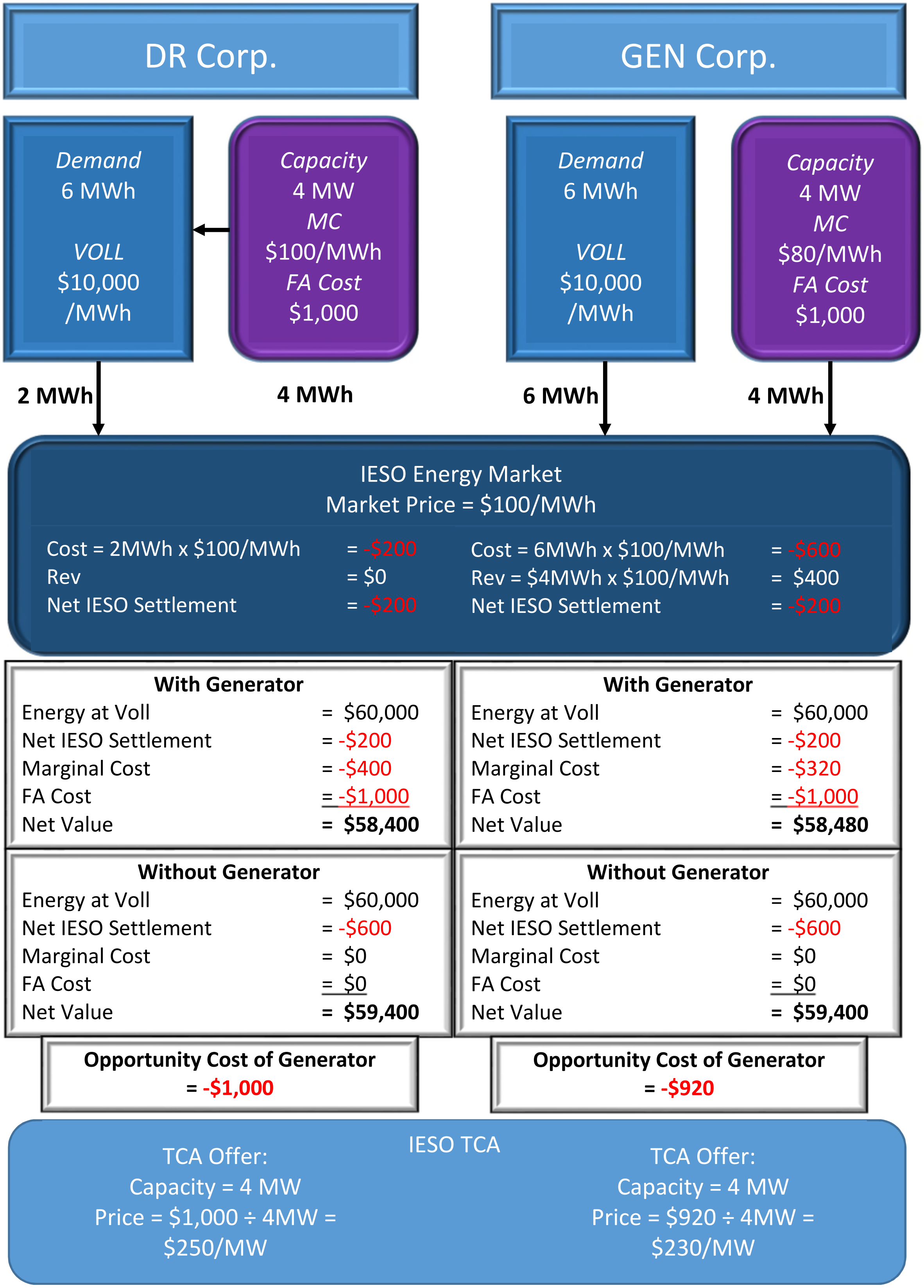


Figure 3.B: Energy Payments for DR Resources

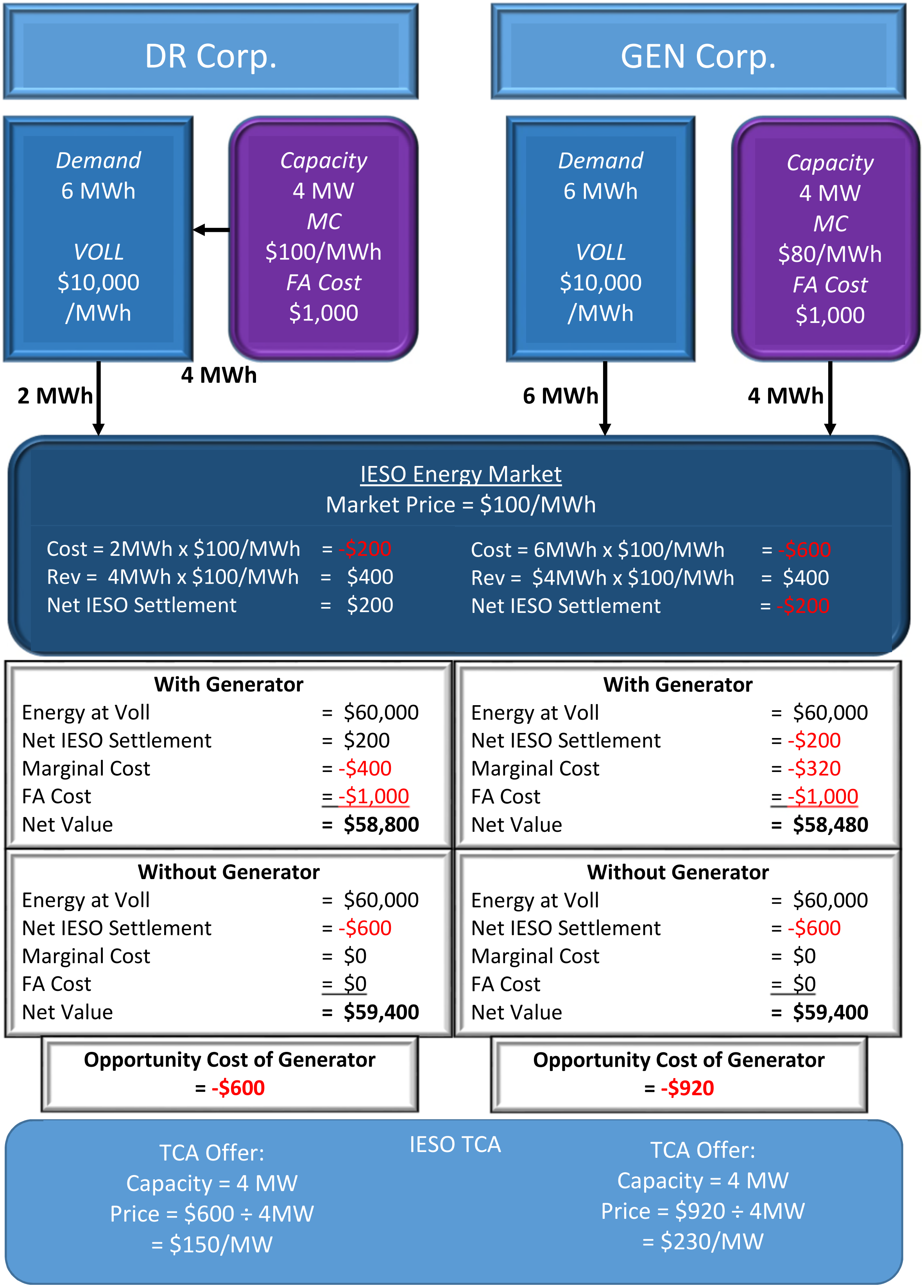


Figure 4.A: No Energy Payments for DR Resources

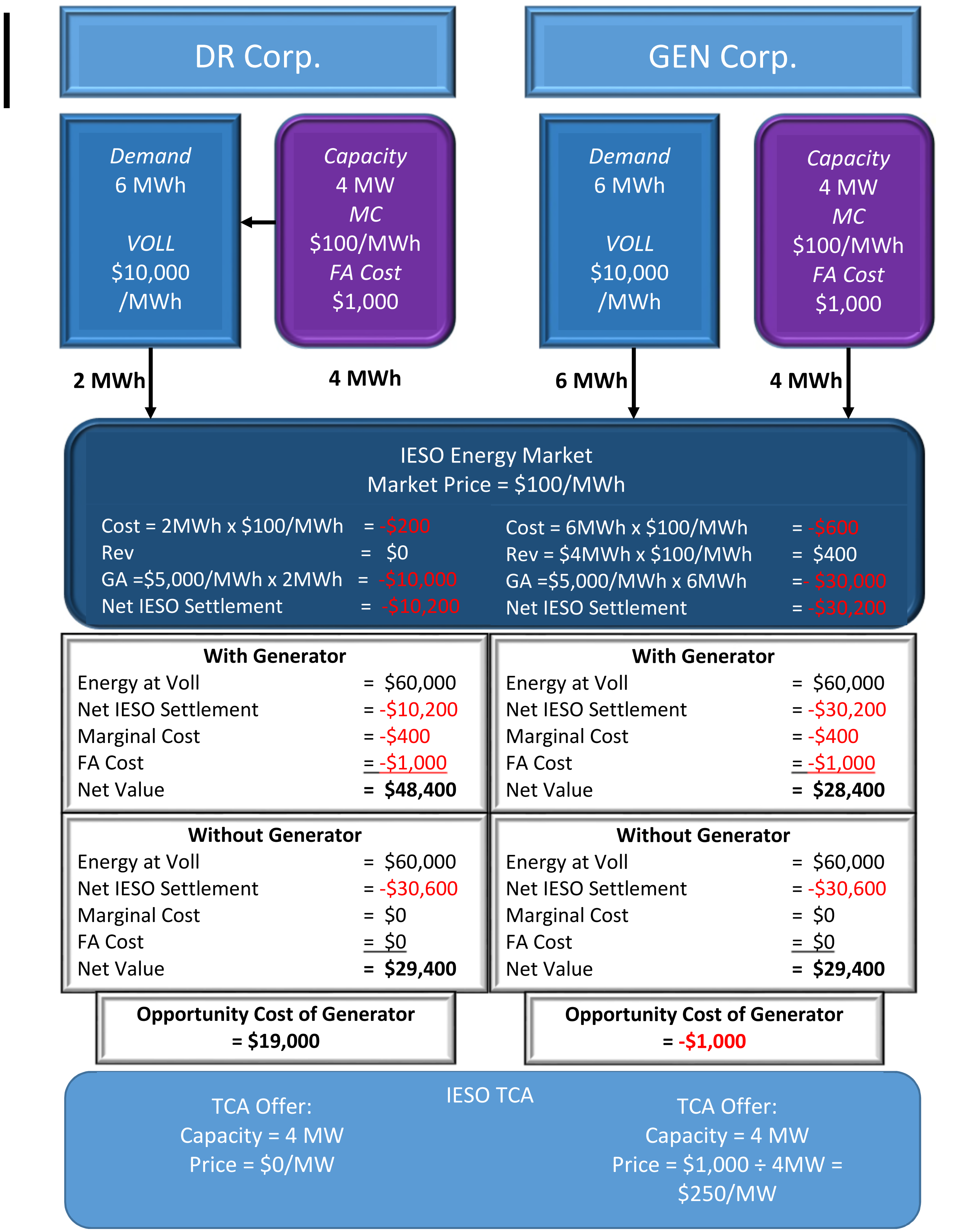
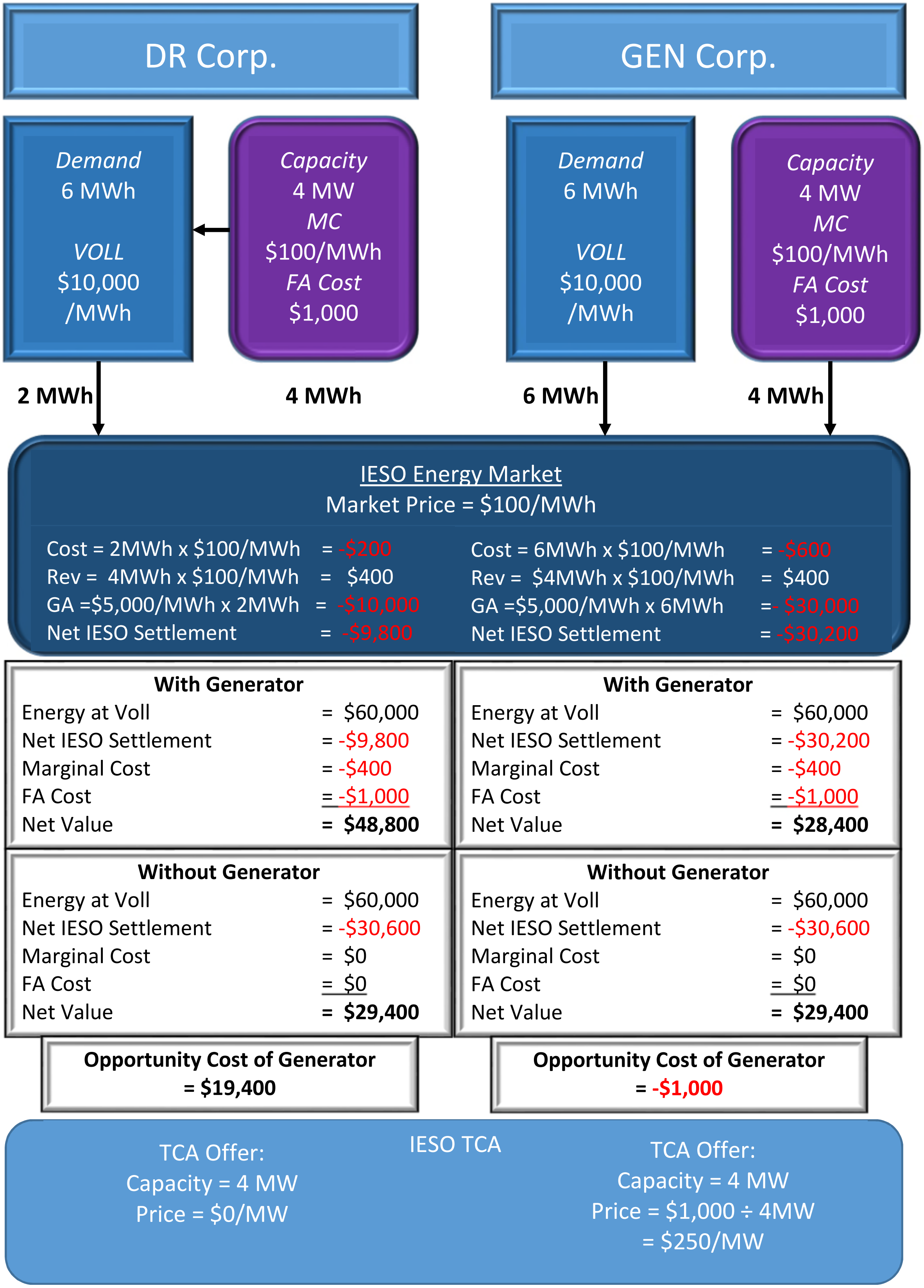


Figure 4.B: Energy Payments for DR Resources



TAB II

Witness Statement of Dr. Brian Rivard

In my examination in chief, I intend, *inter alia*, to respond to two issues raised by Colin Anderson in his witness statement dated November 22, 2019, and further discussed by Mr. Anderson in his subsequent testimony before the Ontario Energy Board on November 25, 2019.

1. **Issue 1:** Does the analysis change when a DR resources does not have behind-the-meter ("BTM") generation?

Response:

The purpose of the examples in my affidavit (as revised November 21, 2019) was to show that the Amendments are consistent with the principle of horizontal equity and by this principle, the Amendments are not discriminatory.

Horizontal equity requires that individuals or corporations that are alike in all relevant respects are treated the same. The examples show how two companies, that are identical in all relevant respects (both demand and supply), and that differ only by the arbitrary placement of a meter, would be compensated the same under the Amendments. This is consistent with horizontal equity. By extension, when the DR resource receives an energy payment (the market price) to curtail demand, the DR resource receives preferable treatment. This is inconsistent with horizontal equity.

Mr. Anderson assumes a different situation in which a DR resource does not have a BTM generator to supply its own demand. This sets up a comparison of two different individuals: a DR resource without a BTM generator to a generator. This comparison requires consideration of the principle of vertical equity, which states that individuals that differ in relevant respects should often be treated differently. The challenge for evaluating what is vertically equitable is in determining a principled basis for the differential treatment. I propose that a constructive way to think about this is to understand what the purpose of the TCA is and hence to evaluate the differential treatment of different participants in the auction against this purpose. The purpose of the TCA as stated in the evidence is to promote or enhance competition and efficiency to the benefit of Ontario consumers.

I offer the following example to show how the Amendments are consistent with the promotion of fair and efficient competition. Attached are Figure 1.A' and 1.B' that illustrate implications on efficiency and competition. The example shows that if a DR resource and a Generation resource each needed to recover a $1,000 fixed avoidable cost in order to be available, the Amendments result in an outcome that is efficient. Both are incented to offer in the capacity auction at a price that just recovers this cost. By this principle, it is vertically equitable.

If instead, DR Resources are paid the market price to reduce demand, then they are incented to lower their bid price to the point where it is indifferent between consuming or being paid not to consume (i.e., $75/MWh). In this scenario, the DR resource forgoes some productive value from consumption, equal to the difference between what it is willing to pay, $150/MWh and the market price it would pay $100/MWh (i.e., $50/MWh) in order to receive a payment of $100/MWh. This would be inefficient from a societal standpoint because the value to society from producing the good ($150/MWh) is greater than cost to society to produce the electricity needed to produce the good ($100/MWh). Paying the DR resource therefore induces inefficiency. Furthermore, it provides the DR resources a competitive advantage in the TCA against a generator that has the same avoidable cost. By this standard, paying DR resources the market price when activated is vertically inequitable.

2. **Issue 2:** Mr. Anderson states:

> Dr. Rivard suggests that providing a DR resource with capacity payments rewards it twice for the same demand reduction if the resource also participates in the Industrial Conservation Initiative (ICI) peak reduction program. Dr. Rivard is mistaken about this. If a DR resource reduces load for the purposes of reducing its peak for ICI calculations, that reduction would by definition be unavailable to the market and the IESO would thus claw back availability payments for the period during which the resource was not available at a 2:1 ratio.

Response:

Mr. Anderson is correct to say that if a DR resource intentionally ignores its obligation under the TCA to benefit from the ICI program, it is subject to a daily Availability Charge for the hours in the day that it was not available to meet its obligation. The Availability Charge is equal to the daily unavailable MWh times the daily availability payment divided by the number of hours in the day the DR resource was obligated to be available. In the peak demand months, this charge is doubled. So, for example, assume the DR resource was obligated to make 1 MW of demand reduction available in 9 hours in a day during a peak month, and the TCA auction provided a daily availability payment of $230/ MW- day (the TCA capacity clearing price). If the DR resource decided that it was in its financial interest to not meet its TCA obligation for the entire day in order to instead benefit from the ICI and avoid the Global Adjustment, it would be subject to an Availability Charge equal to:

Availability Charge = Unavailable MWh x Hourly Availability Payment x Factor of 2

= (1MW x 9hrs) x (($230/MWh – day)/9 hrs) x 2

= $460

However, this does not change the conclusion illustrated in Figure 4 of my affidavit. In all other days, the DR resource would receive an Availability Payment if it makes itself available, that can be used to offset the fixed avoidable cost of being available to reduce system demand. It would have the double incentive to incur the fixed avoided cost because it would allow it to avoid the Global Adjustment charge (which alone covers the $1,000 fixed avoided cost), and it would receive an Availability Payment in all hours that it chose to make itself available. This provides an advantage to the DR resource over the Generation resources, since the Generation resource can only apply the Availability Payment to cover its $1,000 fixed avoided cost.

TAB 1

Figure 1.A': No Energy Payments for DR Resources

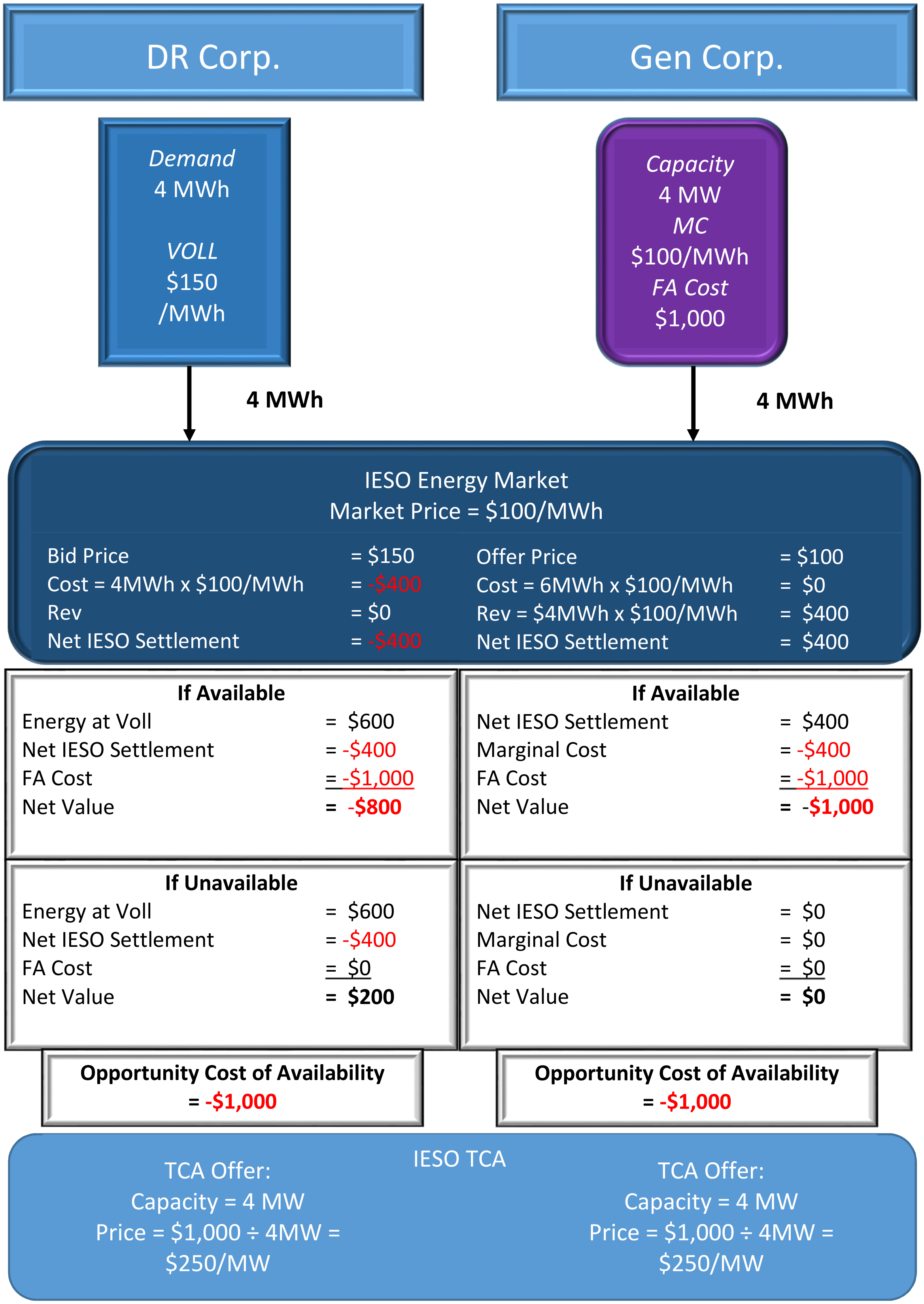


Figure 1.B': Energy Payments for DR Resources