ONTARIO ENERGY BOARD

EB-2022-0074

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

AND IN THE MATTER OF a consultation regarding the design of an optional enhanced time-of-use (TOU) rate

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Written Comments of Environmental Defence In Support of the Optional Enhanced Time-of-Use (TOU) Rate

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March 1, 2022

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Overview

In November of 2021, the Minister of Energy requested a report from the Ontario Energy Board ("OEB") on an optional enhanced time-of-use ("TOU") rate. The OEB is proposing a structure involving a low overnight rate (~2 ¢/kWh) and higher on-peak rates (~20 ¢/kWh). Environmental Defence commends the Ministry of Energy for this initiative and the OEB for its excellent draft proposals. The draft proposal will provide major benefits to consumers including lower electricity costs and highly cost-effective reductions in greenhouse gas ("GHG") emissions.

With respect to the specific details, Environmental Defence recommends that the OEB:

1. Ensure that all utilities allow customers with net meters to participate in the optional TOU rate structure;

2. Appropriately incentivize beneficial load shifting by:

   a. Setting the initial enhanced TOU rates based on the average RPP load profile;

   b. Recovering revenue variances from the pool of all RPP customers (not from each plan separately); and

   c. Using average RPP load profiles for annual TOU rate adjustments; and

3. Ensure that utilities allow residential customers with storage facilities (e.g. electric vehicles with bi-directional chargers) to participate in net metering and the enhanced TOU rates.

Major benefits to electricity system and ratepayers

Discussion question 1 asks whether the proposed price design would be effective at achieving the goals described in the letter from the Minister of Energy. The answer is clearly yes. The proposed price design will provide major benefits to consumers including lower electricity costs and highly cost-effective reductions in greenhouse gas emissions. Although all of the reasons for this will likely be obvious to OEB staff, Environmental Defence asks that they be explicitly laid out in detail in the OEB's public report to the Ministry of Energy, including the following points.

Lower overall electricity costs: The proposed rate design will result in lower electricity costs for Ontarians. This will include lower costs for the generation, transmission, and distribution of electricity. These costs are all driven by the capital infrastructure needed to meet the peak electricity demand. In other words, Ontario needs enough generation facilities and power lines to meet the peak electricity demand on the hottest summer day when air conditioners are running full out. If we can reduce that peak demand, we reduce all the types of electricity costs, including generation, transmission, and distribution.

The proposed rate design will reduce peak demand by giving customers strong incentives to shift demand from peak hours to off-peak hours. This, in turn, will lower costs.

The reductions in peak demand will likely be greater than we have seen in pilots and past attempts because there is now new technology that allows customers to shift their demand from peak to off-peak periods with little or no inconvenience or loss in comfort. The old concept of TOU pricing was that it would encourage people to do energy intensive activities, like laundry, after hours. That, however, is often inconvenient. Fortunately, customers now also have new ways to shift load automatically and without inconvenience, such as the following:

- **Electric vehicles:** Electric vehicles can be automatically set to charge at night without any changes in driving behaviour or inconvenience. This will have a much greater impact than, say, doing laundry in the evening. More savvy customers can take that one step further and set their equipment to charge at night and discharge back to the grid at the peak with bi-directional chargers. For more details on this, see the attached presentation on the potential benefits of bi-directional charging.

- **Thermal storage:** Many customers in Ontario heat with electricity. This number is set to increase with electrification. Thermal storage can flatten the demand from electric heating by using electricity to generate and store heat at night (e.g. in special bricks) and release it during the daytime peak hours. Nova Scotia and Quebec are providing incentives for thermal storage units, including residential units that can be coupled with a heat pump.[1] There are units on the market now that can provide over 80,000 BTU/hr during the day based on a 12-hour nighttime "charge."[2] They are also capable of utility control if desired. This can reduce the electricity used to heat almost any home during the peak daytime hours almost to zero. Most importantly for these purposes, it provides a huge shift in demand from peak to off-peak times without any loss in comfort or convenience.

- **Battery storage:** Like electric vehicles, battery storage can offset demand or feed back into the grid and thereby reduce peak demand without any loss in comfort or convenience.

Past pilots and experience have found positive results from TOU pricing. However, they are not an accurate indicator of the results expected in the future, which will likely be much greater because of the proliferation of equipment that allows peak demand reductions without loss of comfort or convenience.

The new TOU rates will also reduce electricity rates by bringing energy resources closer to customers, thereby further reducing the need for transmission and distribution. This will occur because the TOU rates will help to incentivize certain distributed energy resources.

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[1] Hydro Quebec: https://www.hydroquebec.com/residential/energy-wise/windows-heating-air-conditioning/thermal-storage/; Nova Scotia Power: https://www.nspower.ca/your-home/energy-products/electric-thermal-storage;
[2] Steffes, Off-Peak Heating, https://www.steffes.com/wp-content/uploads/2020/12/Steffes-Forced-Air-Furnace.pdf.

The decline in peak demand and the localization of energy resources will benefit all customers by reducing overall system costs of generation, transmission, and distribution.

Lower heating and transportation costs: The proposed program will also specifically provide a way for Ontarians to lower their heating and transportation costs. This is always a pressing issue and is particularly so in current times with inflation and supply chain issues causing increased prices. If the mid-peak price of 11.3 ¢/kWh is taken as the average, customers will be able to cut their costs of electric transportation and electric heating by approximately 80% when they shift their demand to a low overnight rate of approximately 2 ¢/kWh.

Beneficial electrification: This program can be part of overall efforts to use electrification to lower overall bills. Electrification can reduce energy bills even if it increases the need for new electricity infrastructure as long as it also flattens the demand for electricity (i.e. increases the utilization rate of the infrastructure). The more kWhs that flow through the same wires through higher off-peak consumption, the cheaper those wires are per kWh. Counterintuitively, increased demand for electricity at off-peak times results in lower energy rates. With beneficial electrification, customers save by avoiding the cost of petroleum for cars and gas for heating, and save again by utilizing the electricity system much more efficiently, thus lowering electricity costs.

The new TOU rates can promote beneficial electrification by making investments in distributed energy resources, such as electric vehicles with bi-directional chargers, more cost-effective. This will increase electricity demand at off-peak times, which is a very good thing.

Fairness: The new rate structure will be fairer for customers. The actual cost of electricity during off-peak times is in the range of 2 to 3 ¢/kWh according to the IESO's avoided cost figures, whereas off-peak rates are approximately 8.2 ¢/kWh.[3] This suggests that off-peak rates are disproportionately high. Customers who have made or will make investments or efforts to shift their demand to off-peak times should be rewarded for doing so. That is fair.

Greenhouse gas reductions: The TOU rates will decrease Ontario's GHG emissions. For instance, TOU rates will encourage distributed energy resources that can displace gas generation, such as electric vehicles with bi-directional chargers that can discharge into the grid.

Furthermore, these greenhouse gas reductions will be extremely cost-effective because they rely on price signals, not subsidies. Although they can be combined with subsidies, the rate design will nevertheless have an important and measurable impact at no net cost.

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[3] ESO, 2020 Annual Planning Outlook, Avoided Costs, https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/APO-Fuel-Cost.ashx, Ontario Energy Board, Electricity Rates, https://www.oeb.ca/consumer-information-and-protection/electricity-rates; The IESO's avoided cost figures assume the continued use of gas fired generation, which is inconsistent with Canada's 2040 and 2050 climate targets, as well as its commitment to phase out fossil fuel generation. A movement to renewable energy is inevitable, which could reduce marginal energy costs even further because the operational costs of renewable sources such wind and solar are nearly zero, while also increasing the value of reductions in peak demand.

Include customers with net metering

Discussion question 2 asks for recommendations for improvements. Environmental Defence recommends that the OEB ensure that utilities allow customers with net meters to participate in the optional TOU rate structure. As it currently stands, utilities switch customers to tiered rates from time-of-use rates when they provide a net meter.[4] This means that customers with net metering will not be able to benefit from the new optional enhanced TOU rates. This would rule out a number of proactive customers who might otherwise be interested in the optional rate.

For example, customers with net metering are likely to have a solar installation or solar coupled with a battery. They are likely to be energy-savvy and environmentally conscious. They would therefore be prime candidates for the optional TOU rate. Excluding them would diminish the impact of the program.

Furthermore, net metering customers could provide additional grid benefits by providing additional power to the grid at times of peak demand. For example, a net metered customer with a bi-directional electric vehicle charger or a solar/storage installation could be incentivized to flow power back into the grid when it is needed the most.

In addition, it appears that the practice of switching customers off TOU rates when they receive a net meter is not entirely consistent with the applicable standards and regulations. Under the OEB's *Standard Supply Service Code for Electricity Distributors*, utilities are required to charge time-of-use rates to any customers with capable meters, which would include net meters (unless the customer requests tiered rates).[5] In addition, the formula set out in the net metering regulation (O. Reg. 541/05) requires that the rates for power conveyed from a customer/generator to the grid be "calculated on the same basis as the eligible generator's consumption of electricity." It is clearly worded to allow optional rate structures, including time-of-use rates for both consumption and generation. Instead, the practice is to take that TOU option away from customers.

The historical reasons for forcing net metered customers onto tiered rates is no longer applicable. The initial uptake for net metering was modest. As a result, it was easier to calculate billing manually rather than alter billing systems. This is no longer appropriate as there have been gradual increases in net metered customers over time and the number is likely to increase further with advances in distributed energy resources. Changes are required to the IESO's Meter Data Management and Repository (MDM/R) system and to distribution companies' billing systems. However, those changes are not onerous and would appear to be required or at least contemplated by O. Reg. 541/05 and the OEB's *Standard Supply Service Code for Electricity*

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[4] See, for example, Hydro Ottawa, Net Metering, https://hydroottawa.com/en/accounts-services/generation/net-metering.

[5] OEB, *Standard Supply Service Code for Electricity Distributors*, October 31, 2020 (s. 3.4.1: "Subject to section 3.5, the commodity prices for electricity payable by an RPP consumer that has an eligible time-of-use meter shall be: [formula for time-of-use rates]" Per s. 1.2.1, an eligible meter include any meter that records use data during the time-of-use periods. That includes net meters as they have that capability).

Distributors. It is no longer appropriate in light of the needs of today's electricity system to prohibit net metered customers from participating in time-of-use rates.

Lastly, this change should be made at the same time as the implementation of the optional enhanced time-of-use rates. It is likely to be less expensive to implement the fix for the net metering billing issue at the same time as the billing system updates that will be required for the optional TOU rates.

Appropriately incentivize load shifting

Discussion questions 5, 6, 7, and 8 ask questions regarding cost recovery and price setting. These questions should be examined from the perspective of providing appropriate incentives for customers to act in a way that will minimize system cost and meet the Ministry of Energy's goals.

Commodity costs will need to be recovered from customers in each of the three price plan pools - tiered, TOU, and enhanced TOU. The OEB needs to decide what proportion of the commodity costs will be recovered from each of the three pools. Environmental Defence recommends that the electricity generation costs attributable to customers in the enhanced TOU rate pool be treated as the *ceiling* for the costs recovered from the enhanced TOU customer pool, not the floor.

Some participants argue that the costs allocated to each pool should exactly match the contribution to generation costs by customers in that pool. This is problematic for two reasons. First, residential customers with flatter demand profiles are already paying for a disproportionate portion of electricity system costs because residential distribution charges are levied on a fixed basis for reasons related to convenience and simplicity. Allocating generation costs to the enhanced TOU customer pool exactly equalling their contribution to generation costs misses an opportunity to ameliorate this issue and thus increase fairness.

Secondly, and more importantly, it is both fair and reasonable for customers to be given additional incentives to change their behaviour (e.g. purchase battery or thermal storage) in ways that will benefit the overall system. In other words, distributional fairness is not synonymous with customers being charged amounts that are exactly proportional to their utilization of the electricity system. Instead, distributional fairness requires rewards for customers who take positive steps that benefit the overall electricity system.

In light of this, Environmental Defence makes the following cost recovery / price setting recommendations:

Set the initial enhanced TOU rates based on the average RPP load profile

The incoming rate setting should be based on the average RPP load profile, not on a forecasted load profile for customers likely to opt-in. According to slide 9 of the engagement deck, this will result in temporary "rate-structural under-recovery" because customers who opt into the overnight rate will likely already have a flatter demand profile than the average customer. However, this is appropriate and not something to be avoided. Rate-structural under-recovery reflects increased fairness. The customers with flatter demand profiles who opt into the program should have been paying less for years because they were taking steps to decrease their demand on the system.

In addition, any under-recovery will be trued up and recovered in the next rate period. It is essential that full recovery always occur and our understanding of the OEB's processes are that this will always be the case.

Recover revenue variances from the pool of all RPP customers (question 5)

The TOU rates will cause temporary under-recovery variances because customers will shift load from expensive peak hours to inexpensive off-peak hours. Those variances are recovered in the next rate period. The OEB proposes to continue recovering these annual variances from the pool of all RPP customers, not on a plan-by-plan basis. Environmental Defence strongly supports this proposal. If these variances are recovered only from the pool of customers in the enhanced TOU rate pool, that will unfairly penalize them for taking steps to lower their impact on the electricity system and will blunt the incentives provided by TOU rates. It could neutralize any positive impacts from the proposed rates.

Use average RPP load profiles for annual TOU rate adjustments (questions 6 & 7)

The OEB has proposed to use baseline load profiles in its annual price setting methodology. Environmental Defence agrees that this would be a significant improvement and that the previous methodology is inappropriate. The previous methodology would mean that average cost savings for customers who shift demand to low-cost periods are temporary and prices would be set to reduce such cost savings in subsequent periods. The previous method is untenable for that reason.

The baseline load profile method would allocate costs to the pool of customers based on their historical load patterns (the baseline load profile) to avoid robbing them of the benefits of ongoing load shifting. This is a significant improvement.

However, Environmental Defence recommends that the OEB take one step further and use the overall average RPP load profiles when allocating costs to the pool of customers in the enhanced TOU plan in ongoing annual RPP adjustments. This is necessary because otherwise the rates will not reflect the fact that these customers will likely be coming into the plan with flatter demand profiles. By recalibrating the costs allocated to the enhanced TOU rate pool based on the baseline method, prices will not appropriately reflect the fact that customers entering the pool are already contributing less to electricity system costs because of their flatter incoming demand profiles. The baseline method would be an improvement, but would still over-allocate costs to the enhanced TOU rate pool. Using the average RPP load profiles in annual adjustments would be fairer.

Using the average RPP load profiles would also increase incentives to shift load off the peak and thus be better for the overall electricity system. The enhanced TOU rate plan will be more attractive and more successful in load shifting if costs are not over-allocated to that customer pool.

In addition, it may also be simpler to continue to use the average RPP load provided in annual rate setting.

Allow net metering and TOU rates for residential storage

Question 2 asks for recommendations to improve price design to achieve the goals set out by the Minister of Energy. Environmental Defence strongly recommends that net metering be formally expanded to include storage-only projects by all utilities and not limited to renewable generation. One of the greatest potential benefits of the enhanced TOU rates is to incentivize customers with electric vehicles to purchase bi-directional charges and inject into the grid at peak times. Doing so with direct contracts through an aggregator is cumbersome and involves unnecessary transaction costs. It is far more efficient to encourage customers to do this through enhanced TOU rates wherein customers could absorb energy overnight and export it to the grid at the peak. Once all the cars in Ontario are electrified, they would have six times the discharge capacity necessary to power the entire province at the peak hour.

In its report to the Minister of Energy, Environmental Defence asks that the OEB propose changes to allow residential customers with storage facilities (e.g. electric vehicles with bi-directional chargers) to participate in net metering and enhanced TOU rates even if they do not also have a renewable generation facility (e.g. solar).[6]

Conclusion

As outlined above, Environmental Defence recommends that the OEB:

1. Outline all of the many benefits of an enhanced TOU rate in its report to the Minister of Energy, including those outlined above;

[6] This may require an amendment to O. Reg. 541/05, but that is not clear. Under O. Reg. 541/05, utilities must provide net metering for customers generating electricity from eligible renewable energy source, which does not include stand-alone storage (i.e. storage that is not coupled with solar or another renewable source). However, O. Reg. 541/05 does not prohibit the OEB or utilities from providing net metering to customers with stand-alone storage projects and therefore that goal may be achievable without an amendment to the regulation (e.g. options including amendments to the Distribution System Code)..

2. Ensure that utilities allow customers with net meters to participate in the optional TOU rate structure;

3. Appropriately incentivize beneficial load shifting by:

    a. Setting the initial enhanced TOU rates based on the average RPP load profile

    b. Recovering revenue variances from the pool of all RPP customers;

    c. Using average RPP load profiles for annual TOU rate adjustments;

4. Propose changes to allow residential customers with storage facilities (e.g. electric vehicles with bi-directional chargers) to participate in net metering and the enhanced TOU rates even if they do not also have a renewable generation facility.

We thank you for the opportunity to make these submissions and look forward to positive changes that will lower customer energy bills and achieve highly cost-effective reductions in GHG emissions.

Vehicle-to-Building/Grid

EB-2021-0118

Prepared by Kent Elson

October 21, 2021

Elson Advocacy

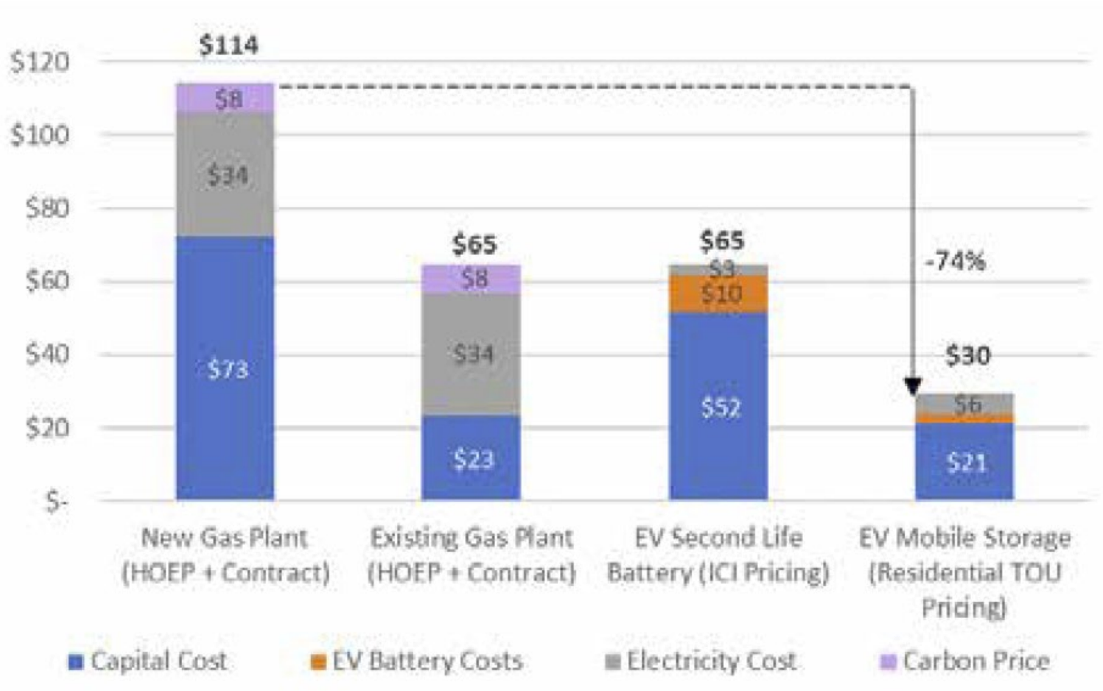
Overview

1. EV batteries with bi-directional chargers produce very inexpensive peak power
2. EVs are an enormous opportunity to lower electricity rates & carbon emissions
3. By 2030, EV discharge capacity will be more than 6 times Ontario's forecast deficit
4. When all cars are electric, their gross discharge capacity (GW) will be more than 6 times Ontario's total peak demand
5. Technical barriers to bi-directional charging have largely disappeared (with more bi-directional-capable cars and chargers and million+ mile batteries)
6. This is urgent – it is cheaper to incentivize bi-directional charging now before millions of "dumb" and "one-directional" chargers are purchased

EV batteries: very cheap peak power

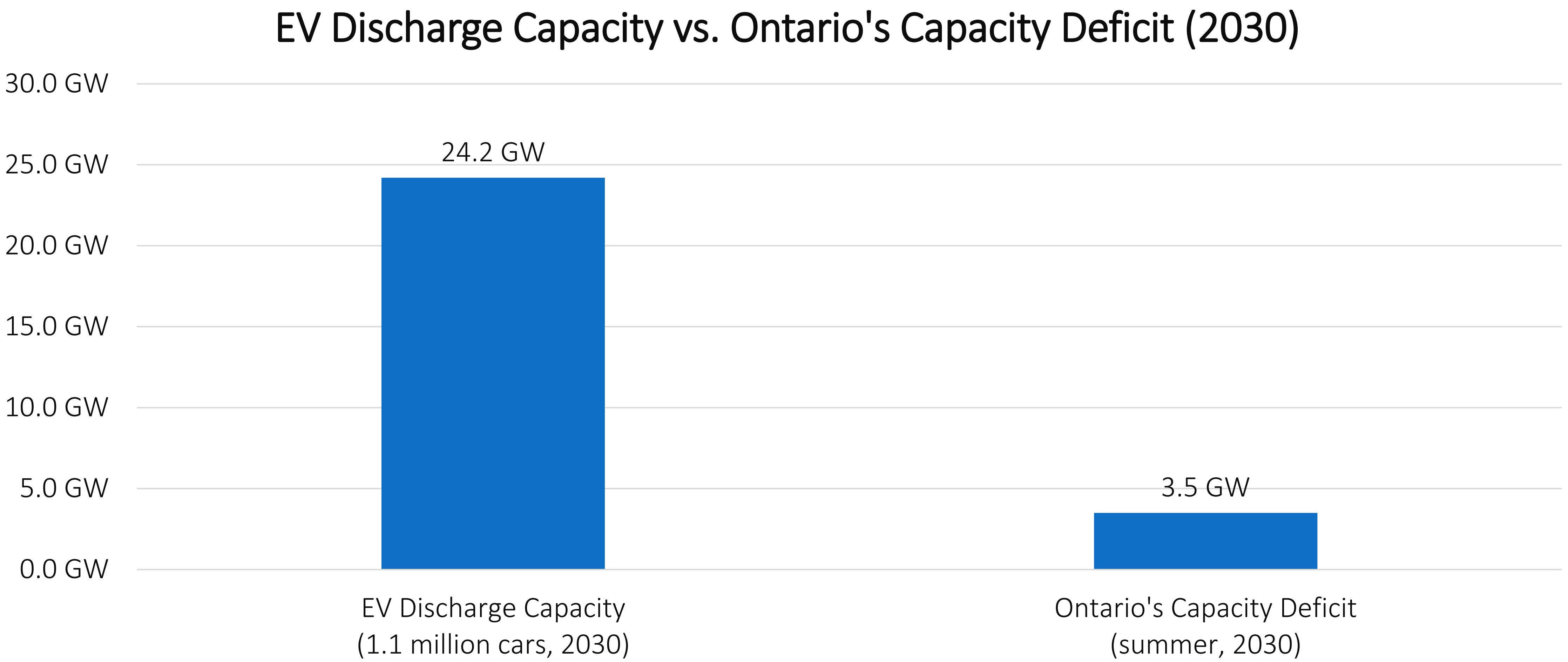
- Bi-directional chargers allow EVs to offset building loads or export to the grid
- This can provide very cheap peak power
- It is much cheaper than gas plants (see right)

Figure 18: Cost Comparison of EV Storage Options with Natural Gas
($/MWh)



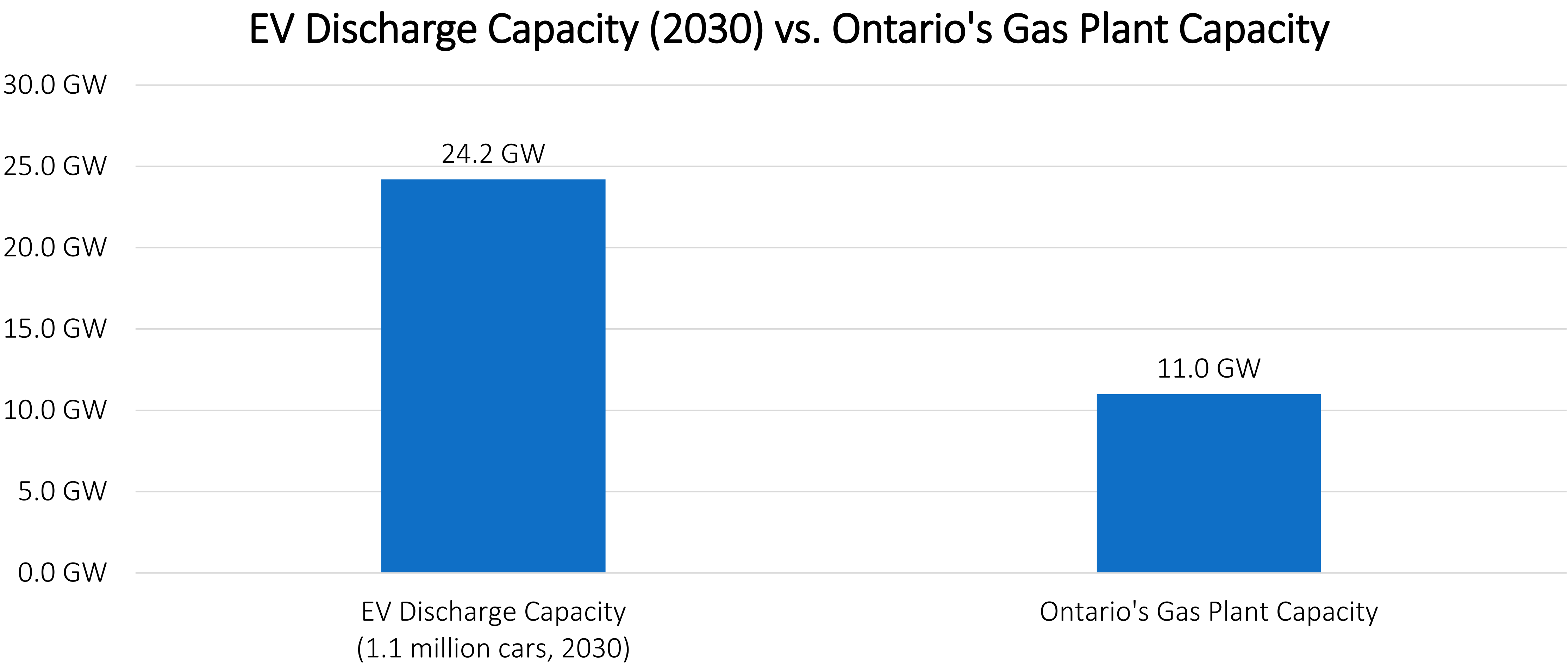
Strategic Policy Economics, *EV Batteries Value Proposition for Ontario's Electricity Grid and EV Owners A Preliminary Cost and Benefit Assessment*, July 2020 (link).

Enormous opportunity



This is an order of magnitude illustration of technical potential, not an achievable potential forecast. See slide 7 for sources and calculations.

Enormous opportunity



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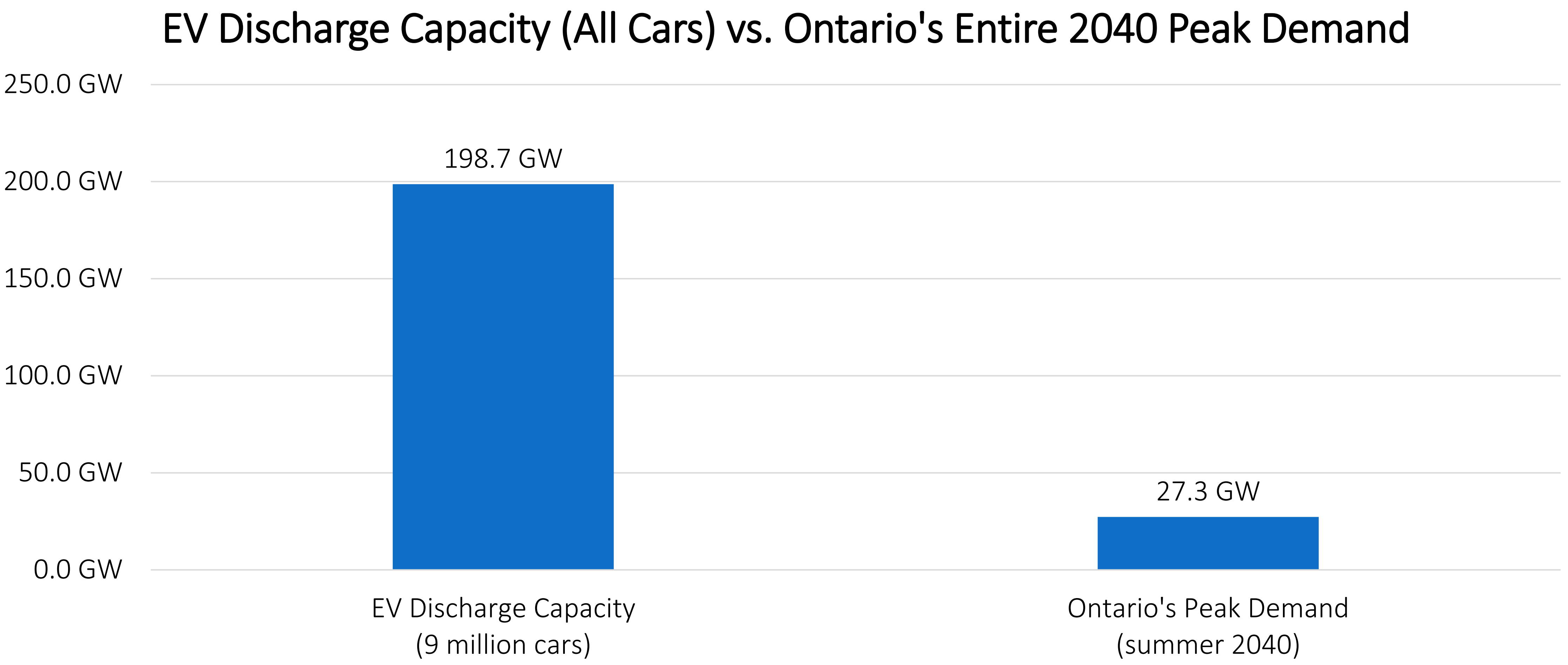
Enormous opportunity



This is an order of magnitude illustration of technical potential, not an achievable potential forecast. See slide 7 for sources and calculations.

Enormous opportunity

Discharge Capacity of EV Batteries (GW)		
	All Cars (2019)	EVs by 2030
Number of Cars	9,031,832[1]	1,100,000[2]
GW Capacity (@ 22 kW) [3]	198.7 GW	24.2 GW

[1] Statistics Canada (link).
[2] Strategic Policy Economics, *EV Batteries Value Proposition for Ontario's Electricity Grid and EV Owners A Preliminary Cost and Benefit Assessment*, July 2020 (link).
[3] Calculation: cars * 22 kW (see slide 6 re example discharge rates). The average discharge rate could be higher or lower than the 22 kW used. In-home discharging will typically be less than 22 kW whereas commercial discharging can be much higher – see slide 6.

Ontario Capacity Needs[1]		
Capacity Deficit (2030)	Peak Demand (2030)	Peak Demand (2040)
3.5 GW	25.5 GW	27.3 GW

[1] IESO, 2020 Annual Planning Outlook (link)

Factors impacting available capacity

- Cars are parked 95% of the time on average
  [Donald Shoup, *The High Cost of Free Parking* (link); Professor Paul Barter, *"Cars are parked 95% of the time"*, (link)]

- The large majority of cars are parked even at rush hour
  [Avg. car commute is 26.3 minutes in Ontario (per Statistics Canada); Most cars are not used for commuting (per Statistics Canada)]

- The number of EVs is increasing

- The number & discharge capacity (kW) of bidirectional EV chargers is increasing
  - Some examples: The new Ford F150 will have a ~10 kW discharge capacity; there are some intermediate DC options with 22 kW including one from Volkswagen and some others; commercial grade chargers can reach higher rates, such as 30 kW, 51 kW, 60kW and 125 kW.

- BUT: Appropriate price signals and procurement is needed

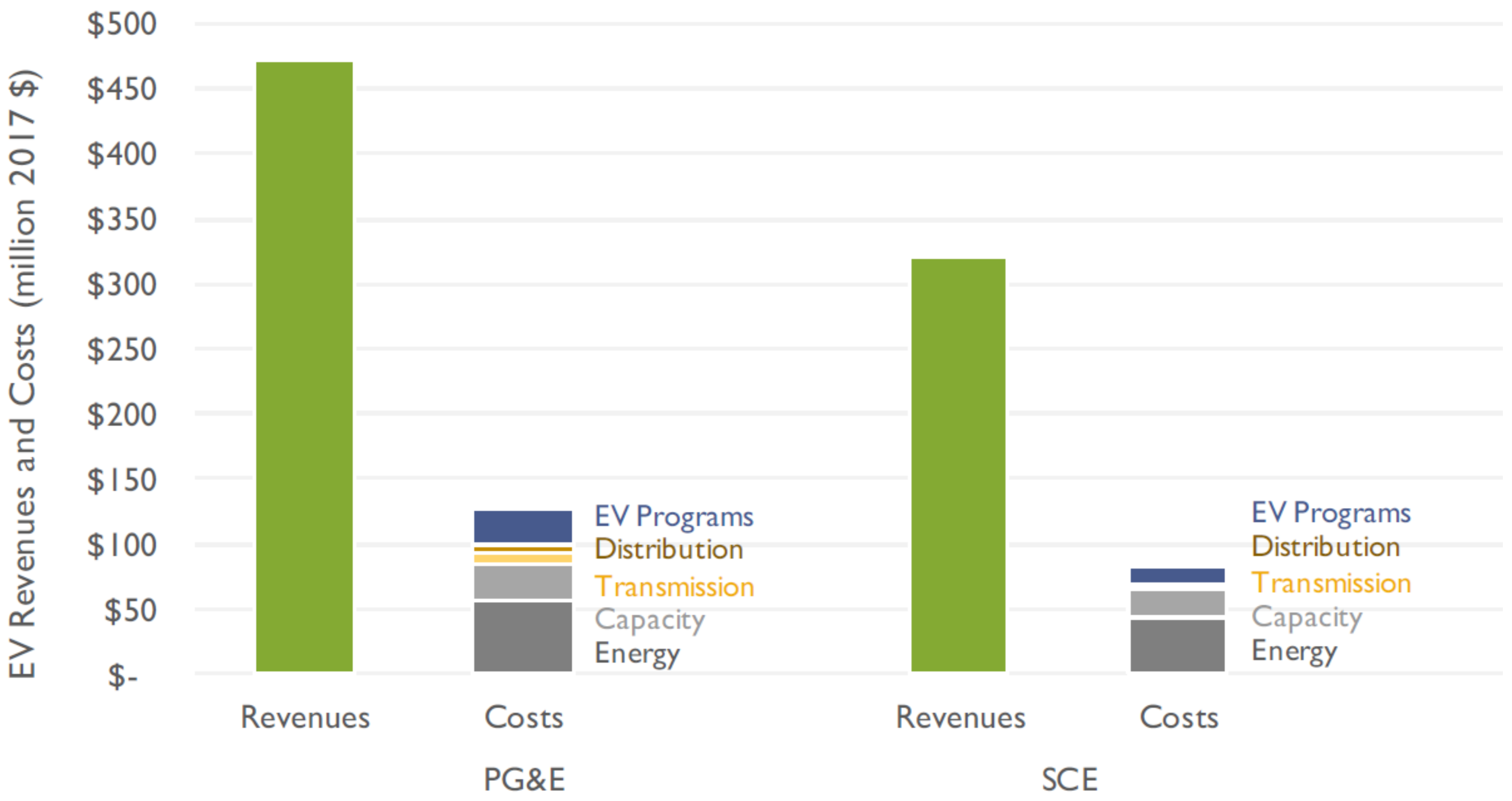
Types and terms

- **One-way smart charging** (V1X), which shifts EV load to off-peak times
- **Bi-directional charging** (V2X), which offsets other loads
  - **Vehicle-to-building** (V2B): Discharging battery to offset other building loads at the peak (often includes vehicle-to-home, which is the residential version of vehicle-to-building)
  - **Vehicle-to-grid** (V2G): Discharging battery to export into the grid to offset other grid loads

Smart charging (V1X) & EV/TOU rates

- Major system benefits opportunity
- EV's saved distribution customers **$584 million** in California (Synapse Energy Study)
- Results transferable to Ontario (Plug'n Drive study)
- Off-peak loads lower electricity costs ($/kW and $/kWh)

Figure 4. PG&E and SCE Revenues and Costs of EV Charging, 2012-2018



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Barriers to V2G/B disappearing

- More EVs available with bi-directional capabilities
  [Including Volkswagen Group EVs starting in 2022 (incl. VW, Audi, etc.), Tesla vehicles (date TBD), the Ford F150 Lightning, and the 2022 Hyundai Ioniq 5. Previously only the Nissan Leaf and Mitsubishi Outlander had official bidirectional capabilities in Canada (for other vehicles there was a risk of voiding the warranty).]
- More chargers available with bi-directional capabilities [See slide 8 for a few examples.]
- "Million mile+" batteries will reduce concerns about reduced battery life
  [Bloomberg, *A Million-Mile Battery From China Could Power Your Electric Car*, June 7, 2020 (link); RMI, *A Million-Mile Battery: For More Than Just Electric Vehicles*, June 24, 2020 (link).]
- V2B is becoming a selling point: Ford is advertising that its new F150 can power your home for up to 10 days
- EVs are expanding faster: The federal government is mandating that 100% of new cars be EVs by 2035

The technology is available now

- UK Power Networks has contracted for 248 MW of capacity from using EV batteries, mainly through Octopus Energy

UK Power Networks
Delivering your electricity

Some programs / pilots

- Nova Scotia Power:
  - $2.2 million; 200 smart chargers; 20 bi-directional chargers of 4 different types
  - Bi-directional Coritech (30kW); Quebec-based Ossiaco, residential units planned
  - David Landrigan, vice-president of commercial for Nova Scotia Power: **"I think we can call it a game-changing resource"**
- Utilities in the United States are piloting vehicle-to-grid, including:
  - San Diego Gas & Electric in California (10 V2G busses, 25 kW/bus, 250 kW)
  - Con Edison in New York (5 V2G busses, 10 kW/bus, 50 kW)
  - EDF Energy in the UK (Customer-facing V2G program based on ABB equipment)
  - National Grid in Rhode Island (Fermata V2G bidirectional pilot, 15-20 kW)
  - Roanoke Electric Cooperative in N. Carolina (Fermata V2G system, 15-20 kW)
  - Green Mountain Power in Vermont (Fermata V2G bidirectional pilot, 15-20 kW)
  - Austin Energy in Texas (V2G/V2B pilot)
  - Snohomish County Public Utility District in Washington State (V2G pilot)
- Building owners are installing and piloting vehicle-to-building systems
- Many, many more – see the list at the V2G hub

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Capacity, NWAs and EV mitigation

- Important as:
  A. Cheap peak demand reduction / capacity that is zero-carbon
  B. A non-wires-alternative (NWA) to traditional capital infrastructure
  C. A tool to manage the impacts of EV expansion on the reserve requirement and on the transmission and distribution grids

Urgent priority

- It is cheaper to incentivize bi-directional charging sooner, before millions of "dumb" and "one-directional" chargers are purchased
- About 1 million customers will start charging EVs at home between now and 2030; many commercial EV chargers will be purchased over that time
- The opportunity to upgrade to bi-directional chargers is greatest before the initial purchase (i.e. the *incremental* cost is lowest)
- The lead time for a vehicle-to-building/grid program is likely long (needs OEB policy changes, LDC program development, program approval by OEB, etc.)

Residential Program Example

- Key design elements:
  - Consumers offered a $X discount on a bi-directional charger
  - Participants must opt-into an EV rate structure
    - The strong TOU price signal increases the incentive to charge off-peak and to discharge to offset household demand on-peak
  - Equipment is pre-set with optimal settings (e.g. discharge threshold levels, timing for charging/discharging, etc.)
  - Consumer has full control over equipment settings and when to charge/discharge
  - Charger is vehicle-to-building (i.e. not exporting to the grid)

Residential Program Example cont.

- Consumer take-up driven by:
  - Desire for back-up power
  - Desire for high-speed charger (at a discount)
  - Reduced household electricity charges from load shifting and load offsetting
  - Upfront incentive payment (i.e. discount on bidirectional charger)
  - Marketing and technical advice
  - Ability to retain full control over vehicle charging/discharging times
- Utility considerations:
  - Very low cost
  - No need for expensive or complicated communication equipment, grid connection, active control, or ongoing contractual arrangements/payments
  - Demand reductions must be modelled in aggregate, similar to CDM programs because the resource is not dispatchable

Commercial Program Examples

- School busses
  - School bus companies paid to install V2G bi-directional chargers
  - Busses have big batteries
  - Commercial DC chargers are very fast (e.g. 125 kW – see right)
  - School buses usually plugged in at peak times
  - Can help pay for fleet electrification
  - 20,000+ school buses in Ontario
- Office buildings:
  - Office buildings incentivized to install bi-directional chargers (V2G or V2B)
  - E.g. see this July 2020 Plug'n Drive Study

On-Street / City Parking Example

- Incentivize municipalities to use grid-connected bi-directional chargers when electrifying on-street parking and city lots
    - Low incremental cost because a new grid connection is likely required regardless
    - Grid connection and protection simplified b/c the connection is not shared with other loads
    - Can leverage existing connections between LDCs and municipalities
    - Can be piloted and then implemented at scale
    - Can help to support electrification of on-street parking and city lots