EB-2023-0195
Toronto Hydro 2025 to 2029 Rates Application

Interrogatories of Environmental Defence

Interrogatory # 1-ED-1

Reference: Exhibit 1B, Tab 2, Schedule 1, Page 10

Question(s):

(a) Enbridge's Pathways to Net Zero forecasts a tripling of demand whereas Toronto Hydro and the IESO forecast demand doubling. Please explain why Enbridge comes up with a significantly different figure and discuss which one Toronto Hydro believes is correct.

Interrogatory # 1-ED-2

Reference: Exhibit 1B, Tab 2, Schedule 1, Page 34

Preamble:

Question(s):

(a) Toronto Hydro states that its proposed Innovation Fund "is the low end of a range found in research of comparable ratepayer-funded initiatives aimed at facilitating innovation by utilities and regulatory bodies in other jurisdictions, as well as general data on utility spending for research and development activities." Please provide this analysis.
(b) If Toronto Hydro were to set its Innovation Fund budget at the mid-range of comparable initiatives, what would the budget be?
(c) What additional activities would Toronto Hydro undertake with a mid-range Innovation Fund budget?
(d) How will the Innovation Fund rate rider be charged to residential customers – variable or fixed?
(e) Is Toronto Hydro open to other Ontario utilities participating in its Innovation Fund pilots and benefiting from the results?

Interrogatory # 1-ED-3

Reference: Exhibit 1B, Tab 3, Schedule 1, Page 38

Question(s):

(a) Please provide a table listing each building owned by Toronto Hydro, how they are heated, their approximate annual gas consumption, the age of any fossil fuel heating equipment, the approximate life left in any fossil fuel heating equipment, the annual fossil fuel costs (all inclusive, including commodity, delivery, and fixed charges), and the annual incremental electricity costs that would arise were the fossil fuel equipment with an appropriate electric heat pump.

(b) If any of its fossil fuel heating equipment reaches the end of its life within the rate term, will Toronto Hydro replace it with electric or fossil fuel equipment?

(c) Please provide a table showing all fossil fuel heating equipment in its buildings that is at the end of its expected useful life or will reach the end of its useful life within the rate term. For each piece of equipment, please indicate whether Toronto Hydro expects to replace it with fossil fuel or electric equipment, and why.

Interrogatory # 1-ED-4

Reference: Exhibit 1B, Tab 3, Schedule 1, Page 47

Preamble:

Question(s):

(a) For historic and planned LDR, please indicate (i) the percent which also provides demand response for provincial capacity purposes, (ii) the percent that involves gas-fired generation, (iii) the percent that involves storage, (iv) the percent that involves the purchase of DR from a pre-existing DER.

Interrogatory # 1-ED-5

Reference: Exhibit 1B, Tab 3, Schedule 1, Page 50

Question(s):

(a) Please quantify the benefits of the proposed NWAs to electricity customers as a whole on a best-efforts basis.

(b) Please provide the underlying calculation spreadsheets for the benefits-cost analysis of the proposed LDR Flexible System Capacity, including any DCF spreadsheets. Please include the lifetime savings.

Interrogatory # 1-ED-6

Reference: Exhibit 1B, Tab 4, Schedule 1, Page 15

Preamble:

Question(s):

(a) How many and what percent of Toronto Hydro customers are unable to connect a DER to the system due to capacity constraints?

(b) Please estimate how many and what percent of Toronto Hydro customers will still be unable to connect a DER to the system due to capacity constraints by 2029 after additional investments by Toronto Hydro?
(c) Please provide a table showing the Toronto Hydro feeders, whether they are constrained, how many customers are attached to each, whether the constraint is short-circuit or thermal, and whether the constraint will be eliminated or lessened within the rate term.
(d) The application states: "Toronto Hydro plans to deploy nine 1 energy storage systems, with an aggregate capacity of 10.2 MW, to enable the connection of forecasted renewable growth on nine high-priority feeders." Approximately how many customers will be impacted by this investment? Please list the relevant feeders, the nature of the restriction, and how many customers will be able install DERs due to the lifting of the restriction.
(e) Does Toronto Hydro provide flexible hosting capacity? If not, when will it do so?

Interrogatory # 2-ED-7

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) Please provide a table showing, for each year from 2025 to 2029, the forecast number of new connections, the forecast contribution to co-incident system peak demand (summer and winter) for those that are gas heated, the forecast contribution to co-incident system peak demand (summer and winter) for those that are electrically heated, the forecast total demand for those that are electrically heated and those that are gas heated.
(b) Please provide the information requested in (a) but for the most recent year of historical data.
(c) Please provide a list of all expected connection requests during the rate period, the forecast peak (summer and winter) and annual demand of each, and how each is forecast to be heated.
(d) If all new construction in Toronto over 2025 to 2029 were to be heated with efficient heat pumps (i.e. no fossil fuels), would Toronto Hydro be able to provide the required electrical service? If not, what would the shortfall be and how would it arise?
(e) If all of the new construction in Toronto over 2025 to 2029 that is expected to be heated by fossil fuels were to switch to heat pumps instead, approximately (i) how much additional revenue would Toronto Hydro collect from those customers due to incremental demand (nominal lifetime and NPV), and (ii) approximately how much additional cost would Toronto Hydro have to invest in its system that would *not* be covered by contributions in aid of construction from the connecting customers?
(f) Please provide a sample of the Appendix B DCF calculations for a typical new condominium construction with geothermal heating versus gas heating? Please indicate (i) the electricity connection capital costs for each heating scenario and (ii) the 25-year revenue offset for the connection costs under Appendix B (i.e. how much more distribution revenue would be paid and thus be used to offset the contribution in aid of construction).

For all of the above, please make and state simplifying assumptions as necessary. Please explain the answer and provide calculations.

Interrogatory # 2-ED-8

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) Please compare the co-incident peak summer electricity demand from a typical commercial or residential tower that is cooled with geothermal versus traditional air conditioning.
(b) Please provide the 20 highest winter demand hours and summer demand hours for each of the past five years for Toronto Hydro's system, including the date, hour, and demand.
(c) On average, what is the peak demand on Toronto Hydro's system in the summer versus the winter?

Interrogatory # 2-ED-9

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) If customer connection costs are higher than forecast, how would Toronto Hydro manage the cost?
(b) The Minister of Energy has asked the OEB to consider customer connection costs, including the revenue horizon. Should Toronto Hydro implement a DVA to track any additional costs that might arise from this initiative?
(c) Please confirm that DSC allows utilities to apply a longer revenue horizon beyond the standard 25-years for calculating contributions in aid of construction. Has Toronto Hydro ever done this? Would Toronto Hydro consider doing this where the customer implements technology that lowers its impact on the system peak (such as geothermal, which lowers summer cooling requirements)?

Interrogatory # 2-ED-10

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) Please complete the following table:

Toronto Hydro Customers – Characteristics by Sector			
	2022	…	2027
Total Customers			
Residential			

Commercial			
Industrial			
Customers with Electrical Space Heating			
Residential			
Commercial			
Industrial			
Annual Consumption (kWh) for Resistance Space Heating for Average Customer			
Residential			
Commercial			
Industrial			
Peak Demand (kW) for Resistance Space Heating for Average Customer			
Residential			
Commercial			
Industrial			
Annual Consumption (kWh) for Resistance Water Heating for Average Customer			
Residential			
Commercial			
Industrial			
Peak Demand (kW) for Resistance Water Heating for Average Customer			
Residential			
Commercial			
Industrial			

(b) Please complete the following table:

Electricity Use – Typical Customer After Conversion to Heat Pumps			
	Average Annual Electricity Consumption – Resistance Heating (kWh)	Average Annual Electricity Consumption (ccASHP & HPWP,	Average Annual Electricity Consumption (GSHP & HPWP, sCOP=5) (kWh)

			HSPF Region 5=10[1]) (kWh)					
	Total – Space/ Water	Space Heating	Water Heating	Total – Space/ Water	Space Heating	Water Heating	Total – Space/ Water	Space Heating	Water Heating
Average or Typical Single-Family Residential Customer									

(c) Please complete the following table:

Winter Peak Demand – Typical Customer After Conversion to Heat Pumps									
	Average Peak Demand – Resistance Heating (kW)			Average Peak Winter Demand (ccASHP & HPWP, HSPF Region 5=10[2]) (kW)			Average Peak Winter Demand (GSHP & HPWP, sCOP=5) (kWh)		
	Total – Space/ Water	Space Heating	Water Heating	Total – Space/ Water	Space Heating	Water Heating	Total – Space/ Water	Space Heating	Water Heating
Average or Typical Single-Family Residential Customer									

(d) Please complete the following table:

Summer Peak Demand – Typical Customer After Conversion to Heat Pumps									
	Average Peak Demand – Traditional Central AC (kW)			Average Peak Winter Demand (ccASHP & HPWP, HSPF Region 5=10[3]) (kW)			Average Peak Winter Demand (GSHP & HPWP, sCOP=5) (kWh)		
	Total – Space/ Water	Space Cooling	Water Heating	Total – Space/ Water	Space Cooling	Water Heating	Total – Space/ Water	Space Cooling	Water Heating
Average or Typical Single-Family Residential Customer									

[1] Equivalent to ~sCOP=2.9 (2.96516)
[2] Equivalent to ~sCOP=2.9 (2.96516)
[3] Equivalent to ~sCOP=2.9 (2.96516)

(e) Please complete this table of cooling efficiencies:

Cooling Efficiencies of Various Equipment Types			
		SEER	EER
Central air conditioners	Average of current stock (best estimate, Toronto Hydro customers or Ontario average)		
	Standard unit		
	Energy Star rated		
	Energy Star – Most efficient of 2021		
Air source heat pumps	Standard unit		
	Energy Star rated		
	Energy Star – Most efficient of 2021		
Air source heat pumps in hybrid systems (if different)	Standard unit		
	Energy Star rated		
	Energy Star – Most efficient of 2021		
Ground source heat pumps – closed loop	Standard unit		
	Energy Star rated		
	Energy Star – Most efficient of 2021		
Ground source heat pumps – open loop	Standard unit		
	Energy Star rated		
	Energy Star – Most efficient of 2021		
Cold climate heat pumps – variable speed	Standard unit		
	Energy Star rated		
	Energy Star – Most efficient of 2021		

Interrogatory # 2-ED-11

Reference: Exhibit 2B, Section A5.2

Question(s):

a) How many electric vehicle charging stations are installed by Toronto Hydro customers now and how many are forecast for each year from 2021 to 2025? Please provide a high-end and low-end estimate.

b) Is Toronto Hydro confident that it is making all the investments needed to facilitate increases in electric vehicles and electric vehicle charging stations even if its high-end forecasts come to fruition?
c) Have any Toronto Hydro customers been unable to install an electric vehicle charging station (e.g. a level 3 station) due to constraints on Toronto Hydro's distribution system? If yes, how many customers each year?
d) Have any Toronto Hydro customers been *delayed* in installing an electric vehicle charging station (e.g. a level 3 station) due to constraints on Toronto Hydro's distribution system? If yes, how many customers each year?
e) Is it Toronto Hydro's goal that all customers will be able to install and use electric vehicle charging stations if they wish to do so? If not, please detail Toronto Hydro's targets in this regard.
f) Is it Toronto Hydro's goal that all customers will be able to install and use electric vehicle charging stations *without delay of more than one month* if they wish to do so? If not, please detail Toronto Hydro's targets in this regard.
g) Please list and describe the investments that Toronto Hydro intends to make over 2021-2025 to ensure readiness for electric vehicles.
h) Please list and describe the ways in which Toronto Hydro is *currently* able to use the battery in electric vehicles as a distributed energy resource to provide a service that benefits the distribution system.
i) Please list and describe the ways in which it is possible to use the battery in electric vehicles as a distributed energy resource to provide a service that benefits the distribution system, *focusing only on those which Toronto Hydro is not yet capable of undertaking*.
j) Is Toronto Hydro able to capitalize on the storage capacity of electric vehicles to reduce distribution system costs by: (i) communicating directly with charging stations to reduce load during peak periods, (ii) communicating directly with charging stations to allow power to be drawn from batteries during peak periods, (iii) drawing energy from car batteries connected to charging stations during peak periods, and (iv) communicating directly with charging stations to ensure energy is drawn from the LDC's system at the optimal times? If not, please explain what additional steps Toronto Hydro is willing to commit to take to explore and implement these things.
k) Is Toronto Hydro willing to offer customers special rates to encourage the expansion of electric vehicles?

Interrogatory # 2-ED-12

Reference: Exhibit 2B, Section A5.2

Question(s):

a) What percent of Toronto's GHG emissions are from the combustion of methane gas?
b) What percent of Toronto's GHG emissions are from the combustion of methane gas in buildings (versus industrial uses)?
c) Please describe potential roles that Toronto Hydro could play in relation to the implementation of electric heat pumps as an alternative to natural gas heating.

d) How many new homes and businesses are forecast to be built in Toronto Hydro's coverage area in the next 10 years? If available, please provide an annual breakdown.
e) How many new customers does Toronto Hydro expect to hook up in the next 10 years? If available, please provide an annual breakdown.
f) What assistance could Toronto Hydro provide to developers to promote the installation of electric heat pumps instead of natural gas furnaces in new construction?
g) Would Toronto Hydro benefit from regulatory changes in order to play a greater role in promoting the expansion of electric heat pumps in lieu of natural gas? If yes, what are those potential changes?
h) Please comment on the report by Ralph Torrie estimating that electricity demand could decline if all heating was converted to electric heat pumps and energy retrofits were increased: https://www.corporateknights.com/channels/built-environment/recovering-stronger-building-low-carbon-future-green-renovation-wave-15875463/.

Interrogatory # 2-ED-13

Reference: Exhibit 2B, Section A5.2

Preamble: An expert report filed in EB-2016-0004 by Dr. Stanley Reitsma, P. Eng., outlined significant benefits to the electricity system in reducing peak demand.[4] See page 5 to 13. For example, Dr. Reitsma concludes:

> "Though geothermal relies on electricity as an input (to power the pump), geothermal system actually reduces electricity demand in the summer, and increases it in the winter, relative to traditional methods of heating and cooling (heating with fossil fuels and cooling with traditional AC systems). For Ontario, a summer peaking jurisdiction, a greater reliance on geothermal would reduce peaking power needs and also reduce surplus baseload generation. Coincidentally, the load profile of a geo system is similar to the production profiles of Ontario wind energy facilities."[5]

> "For the cooling of buildings, Geo HP's use about half the electricity to operate compared to air source heat pumps and AC systems, and, geo's electrical demand doesn't spike as it gets hot outside, since the ground loop temperature remains relatively unchanged. They can reduce the "heat wave" electricity system demand spikes by up to 75%."[6]

Question(s):

a) Does Toronto Hydro agree with the comments in the above-referenced report regarding the benefits that geothermal systems can provide to the electricity system, including a reduction of peak demand? Please explain.

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[4] Dr. Stanley Reitsma, P. Eng., *Ontario's Low Carbon Future: Geothermal Heat Pumps*, March 21, 2016 (http://www.rds.oeb.ca/HPECMWebDrawer/Record/521626/File/document).
[5] *Ibid*. p. 5.
[6] *Ibid*. p. 6.

b) Does Toronto Hydro agree that the expansion of geothermal systems would reduce peak demand on Toronto Hydro's system, on which distribution system capacity is based?
c) Does Toronto Hydro agree that geothermal systems have the capacity to provide important benefits to the electricity distribution system, especially in comparison to traditional baseboard heating?
d) Does Toronto Hydro agree that the benefits of geothermal systems are not reflected in the distribution costs paid by residential consumers because those charges do not vary based on coincident peak demand?
e) Does Toronto Hydro agree that increases in heat pumps would assist the City in achieving its GHG reduction targets?
f) Would Toronto Hydro agree to study the possibility of offering customers with geothermal systems a reduction in their distribution charges that would approximately reflect the benefits those customers provide to the distribution system? Assume the overall rate structure would continue to make Toronto Hydro whole for its revenue requirement.
g) Please provide Toronto Hydro's best information on the number and proportion of its customers with (i) electrical, (ii) natural gas, (iii) propane, (iv) oil, (v) wood, and (vi) other kind of space heating.

Interrogatory # 2-ED-14

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) What is the appropriate role for Toronto Hydro to play with respect to efforts to ensure that customers with on-street parking can access electric vehicle charging?
(b) Does Toronto Hydro agree that there would be benefits to the electricity system if its customers with on-street parking are able to charge their vehicles at night in front of their homes instead of during the day at a third-party charger?
(c) Has Toronto Hydro considered making efforts to facilitate sidewalk charging cable channels, such as the following:
    i. https://www.kerbocharge.com/
    ii. https://www.stormguard.co.uk/stormguard-products/heavy-duty-ev-cable-channel/
    iii. https://www.chargegully.com/
    iv. https://gul-e.co.uk/
(d) If Toronto Hydro has not considered the solution listed in (c), is it willing to do so as a way to promote more charging overnight charging at home (versus charging in the daytime away from home)?

Interrogatory # 2-ED-15

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) Is Toronto Hydro considering technologies that could cost-effectively allow it to throttle electric vehicles chargers of participating customers who have internet-connected chargers?
(b) By 2029, what does Toronto Hydro believe the cost of this kind of software solution may be?
(c) Please describe some of the benefits of curtailable electric vehicle charging for high penetration scenarios (versus time-of-use approaches), such as evenly spreading the demand out over the entire nighttime and avoiding a spike at the beginning of the nighttime low rate.

Interrogatory # 2-ED-16

Reference: Exhibit 2B, Section A5.2

Question(s):

(a) Please provide a breakdown of Toronto Hydro's customers by customer type with as much detail and granularity as possible (e.g. industrial, commercial, residential). Please also include a breakdown of the residential customers by type as possible (e.g. detached, semi-detachment, units in buildings, single-meter large buildings, etc).
(b) Please provide a table showing the peak (summer and winter) and annual demand for each of customer type.

Interrogatory # 2-ED-17

Reference: Exhibit 2B, Section A5.2 (this is also revenant to D4)

Question(s):

(a) On a best estimate basis, please provide Toronto Hydro's best estimate of the number of residential customers with different electrical panel sizes (e.g. 60 amp, 100 amp, 200 amp, etc.). Please include houses (i.e. detached and semi-detached) but exclude large buildings (condos).
(b) On a best estimate basis, please provide Toronto Hydro's best estimate of the largest electrical panel that can be supported by the conductor leading to each residential customer (e.g. 60 amp, 100 amp, 200 amp, etc.). Please include houses (i.e. detached and semi-detached) but exclude large buildings (condos). In other words, we are looking for the percentage of homes with different conductor sizes leading to them.
(c) Customers can sometimes avoid installing a larger electrical panel when installing an electric vehicle charger by using a switch that allows a circuit in the existing panel to be shared as between the vehicle charger and, for instance, a clothes dryer. The switch will stop power flowing to one device (typically the charger) when the other device is on. Is Toronto Hydro familiar with this kind of device, and if yes, can it provide some examples available in the Ontario market?

(d) If a customer installs a switch described in (c), or many customers install such a switch, would that have an impact on distribution capacity needs as estimated by Toronto Hydro (i.e. reducing the needs in comparison to an alternative scenario where a panel is upgraded to allow the new charger connection)? Please describe the mechanism by which this change would show up in Toronto Hydro's capacity forecast (e.g. through reduced peak load measurements used to forecast future load?). If there is an impact, how big is it?
(e) If the switches described in (c) have a benefit in terms of distribution load management, would Toronto Hydro consider providing an incentive for customers to install those instead of upgrading their electrical panel? Alternatively, would Toronto Hydro provide all panels seeing an electrical upgrade information regarding that option?
(f) If a customer upgrades their electrical panel, how would that impact the distribution capacity needs as estimated by Toronto Hydro? Please describe in detail. For instance, how far upstream of the electrical panel would potentially be impacted (between the pole-mounted transformer versus the feeder)?
(g) If a customer installs a heat pump or an electric vehicle charger within their existing electrical panel, how would that impact the distribution capacity needs as estimated by Toronto Hydro? Please describe in detail.
(h) Please describe how Toronto Hydro sizes equipment at different levels of the distribution system (e.g. service conductor, pole-mounted transformer, feeders, etc.).

Interrogatory # 2-ED-18

Reference: Exhibit 2B, Section A5.2 (also relevant to questions on service charges)

Question(s):

(a) Please provide all charges/fees levied by Toronto Hydro for a residential panel upgrade (e.g. fixed fee, conductor replacement if necessary, pole-mounted transformer replacement if necessary, etc.).
(b) Please create a table to compare the charges in (a) to those charged by Alectra, Hydro Ottawa, and Elexicon Energy.
(c) Please provide excerpts from the Toronto Hydro conditions of service and the DSC that allow Toronto Hydro to levy the charges/fees described in (a).
(d) Please provide all studies and calculations justifying the fixed fees for a panel upgrade charged by Toronto Hydro.
(e) Does Toronto Hydro agree that the fixed fees for panel upgrades must not be greater than the actual costs for that service on an aggregate basis? Please provide all the applicable regulatory criteria governing such fees/charges?
(f) When were Toronto Hydro's current fixed fees for panel upgrades first set? Please provide the documentation provided at the time to justify the quantum of fee.
(g) For each year from 2018 to 2023, please provide (i) the number of residential panel upgrades, (ii) number of each the upgrade type (e.g. 100 to 200 amps), (iii) the aggregate distribution system costs, (iv) a breakdown of those distribution system costs (e.g. conductor replacement, etc.), and (v) the aggregate amount charged to the upgrading customer.

Interrogatory # 2-ED-19

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) If all Toronto Hydro residential customers were to convert to cold climate air-source heat pumps over the next 15 years, please provide a general description of the distribution system equipment that would need to be upgraded, including various conductors and transformers at different parts of the electrical system.
(b) Please provide a high-level cost for replace the equipment described in (a) both as a gross figure and as a cost per kWh for the forecast incremental load over 40 years?
(c) Please described some measures that Toronto Hydro could take to reduce those costs and the work that is being done to explore those options.
(d) Please confirm that there are electric thermal storage units available in Ontario (e.g. those from SSi Energy, Stash, and Steffes).[7]
(e) If all homes were electrified, how much could the peak winter demand (MW) be reduced through electric thermal storage units (e.g. those from SSi Energy, Stash, and Steffes)?[8]
(f) If all homes were electrified, how much could the peak winter demand (MW) be reduced through bi-directional chargers for electric vehicles?
(g) Please describe the incentives available for Electric Thermal Storage in Quebec, Nova Scotia, and PEI.

Interrogatory # 2-ED-20

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) If all Toronto Hydro residential customers were to install electric vehicle chargers, please provide a general description and approximately cost of the distribution system equipment that would need to be upgraded, including various conductors and transformers at different parts of the electrical system under the following two scenarios:
    i. No panel upgrades are necessary; and
    ii. All upgrades are achieved with a circuit sharing smart switch.[9]

    Please assume that all cost-effective measures to manage this load are undertaken.

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[7] See https://www.ssie.ca/products/, https://stash.energy/en/product/, and https://www.steffes.com/ets/comfort-plus-forced-air/.
[8] See https://www.ssie.ca/products/, https://stash.energy/en/product/, and https://www.steffes.com/ets/comfort-plus-forced-air/.
[9] Customers can sometimes avoid installing a larger electrical panel when installing an electric vehicle charger by using a switch that allows a circuit in the existing panel to be shared as between the vehicle charger and, for instance, a clothes dryer. The switch will stop power flowing to one device (typically the charger) when the other device is on.

Interrogatory # 2-ED-21

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) For all of the lines and transformers that Toronto Hydro plans to replace to build new over the rate term, what percent would need to be replaced to accommodate full electrification of heating and transportation? Please assume that all cost-effective measures to manage these new loads are undertaken.

Interrogatory # 2-ED-22

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) Knowing that Toronto is summer-peaking, approximately how many homes and what percent of homes could convert to air-source heat pumps without requiring substantial investments in incremental distribution system infrastructure? Please do not include potential individual service line replacements that may be needed and assume a relatively even distribution of conversions across the city.

Interrogatory # 2-ED-23

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) Please provide the historic 5-year and forecast 10-year forecast of peak demand attributable to electric water heaters.
(b) How much would it cost per home to implement an electric water heater demand response program for CTA-2045 enabled water heaters. Please provide a breakdown by (i) incremental equipment/installation costs, (ii) advertising, and (iii) incentives. If only (i) is available, please provide just that figure. Please provide a breakdown of the equipment/installation costs.
(c) Please estimate the cost of (b) by 2030.
(d) What investments would be needed today to lower that cost?

Interrogatory # 2-ED-24

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) Modern electrical water and space heating systems can be connected to the internet through a thermostat (e.g. for air source heat pumps) or built-in connectivity (e.g. smart water heaters). This allows for utility control though TCP/IP protocol without any incremental customer installation. Please describe all efforts that Toronto Hydro is taking to explore this option and all the results of this exploration thus far.
(b) Please confirm whether Toronto Hydro is considering use of equipment described in (a) for demand response (e.g. holding off on heating a water tank during coincident demand periods or slightly reducing or delaying space or water heating during those periods).
(c) Is Toronto Hydro currently able to conduct a demand response program using the equipment described in (a)? If yes, what is the cost to implement it per customer (please provide a breakdown).
(d) Does Toronto Hydro agree that electric space and water heating equipment will be internet connected in greater and greater numbers over time? What percent penetration of internet connection electric space and water heating does Toronto Hydro predict by 2029 and 2035?
(e) What open standards exist today to allow for cross-vendor communication for utility control of electric heating equipment?
(f) Please compare the equipment and software cost for controlling internet-connected electric space and water heating equipment now, versus the forecast cost in 2029 and 2035?

Interrogatory # 2-ED-25

Reference: Exhibit 2B, Section A5.2 / D4

Question(s):

(a) What barriers exist to installing EV chargers in existing multi-residential buildings?
(b) What roles does Toronto Hydro typically play with respect to the installation of EV chargers in the parking area of multi-residential buildings.
(c) Please provide a breakdown of the number of and percent of multi-residential buildings in each rate class, with a description of how distribution charges are levied in each class (fixed, per kWh, or per kVA?).
(d) If distribution system upgrades are required to allow a multi-residential building to install EV chargers, how are the costs to be paid by the building customer calculated? Is the forecast incremental revenue from the incremental load considered as part of those calculations? If not, why not. Please describe two cases: (i) with individual meters for each unit and (ii) a single meter for the property.
(e) How many and what percent of multi-residential buildings have a meter for each unit?
(f) What additional steps could Toronto Hydro take to ease the connection of EV chargers in multi-residential buildings?

Interrogatory # 2-ED-26

Reference: Exhibit 2B, Section D4 (also relevant to questions on service charges)

Question(s):

(a) Please provide all charges/fees levied by Toronto Hydro for microgeneration connection.
(b) Please create a table to compare the charges in (a) to those charged by Alectra, Hydro Ottawa, and Elexicon Energy.
(c) Please provide excerpts from the Toronto Hydro conditions of service and the DSC that allow Toronto Hydro to levy the charges/fees described in (a).
(d) Please provide all studies and calculations justifying the fees charged by Toronto Hydro in (a).
(e) Does Toronto Hydro agree that the fees charged for micro connections must not be greater than the actual costs for those connections on an aggregate basis? Please provide all the applicable regulatory criteria governing such fees/charges?
(f) When were Toronto Hydro's current fixed fees for micro connections first set?
(g) For each year from 2018 to 2023, please provide (i) the number of microgeneration connections, (ii) the aggregate distribution system costs, (iii) a breakdown of those distribution system costs, and (iv) the aggregate amount charged by the customer installing the DER.

Interrogatory # 2-ED-27

Reference: Exhibit 2B, Section D4

Question(s):

(a) Does Toronto Hydro require customers with net meters to move to tiered rates? If not, how is the billing accomplished in light of the SME not collecting and remitting generation information? If yes, what changes are necessary to allow customers to remain on TOU rates if they have a net meter.
(b) What is the monthly incremental cost to a customer for a net meter? Please fully justify this cost with details of the incremental costs to Toronto Hydro.

Interrogatory # 2-ED-28

Reference: Exhibit 2B, Section D4

Question(s):

(a) Approximately how many vehicles are owned by Toronto Hydro customers?
(b) If approximately 20% of all cars in Toronto were connected to bi-directional chargers with a 10 kW export capability, what would their collective capacity be?

Interrogatory # 2-ED-29

Reference: Exhibit 2B, Section D4

Question(s):

(a) Please comment on the potential for car batteries to be used to reduce building loads with bi-directional chargers at the time of distribution peaks and thus reduce the need for distribution infrastructure.
(b) Please describe all steps Toronto Hydro is taking to (a) assist its customers in installing or purchasing electric vehicle chargers and (b) install electric vehicle chargers for its own use.
(c) With respect to Toronto Hydro's efforts to install electric vehicle chargers, what proportion will be bi-directional chargers?
(d) Nova Scotia Power is undertaking a bi-directional charger pilot project involving 20 bi-directional chargers of 4 different types. David Landrigan, vice-president of commercial for Nova Scotia Power stated as follows: "I think we can call it a game-changing resource". Would Toronto Hydro consider a similar pilot? Would this require additional regulatory approvals if it were to occur prior to 2029?
(e) The following utilities are piloting bi-directional chargers:
    - 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)

    Is Toronto Hydro considering similar pilots? If not, why not. Would this require additional regulatory approvals if it were to occur prior to 2029? Please explain.
(f) Please provide 6 examples of bi-directional charges available in North America (3 AC and 3 DC) and list their charge/discharge rate (kW) and approximate price. This could include chargers from wallbox, dcbel, ABB, Fermata, Siemens, etc.
(g) Please compare the price of bi-directional chargers to one-directional chargers. Is this price differential expected to decrease?
(h) Please comment on the following potential non-wires-alternative to traditional infrastructure and whether Toronto Hydro would consider pursuing this if cost-effective:
    - School bus companies incentivized to install V2G bi-directional chargers
    - The bus batteries can be used to serve the grid during distribution peaks
    - Busses have big batteries
    - Commercial DC chargers are very fast (e.g. 125 kW)
    - School buses usually plugged in at peak times
    - Can help pay for fleet electrification
    - 20,000+ school buses in Ontario
(i) Please comment on the following potential non-wires-alternative to traditional infrastructure and whether Toronto Hydro would consider pursuing this if cost-effective:
    - 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

(j) Please comment on the following potential non-wires-alternative to traditional infrastructure and whether Toronto Hydro would consider pursuing this if cost-effective:
- 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)
- 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:
  - Reduces distribution peaks and increases reliability
  - 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

(k) Please comment on the following reasons why bi-directional chargers should be a priority and could be a lost opportunity if not pursued early:
- 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.)

(l) Does Toronto Hydro have an EV Charging Station Technical Installation Guide akin to this one from Hydro Quebec: https://www.hydroquebec.com/data/electrification-transport/pdf/technical-guide.pdf? If not, why not? Is one under consideration?

Interrogatory # 2-ED-30

Reference: Exhibit 2B, Section D4

Question(s):

(a) Please provide a table showing the forecast spending on distributed energy resources (DER) in each year, and total over the five-year term, with a breakdown by (i) type of DER (efficiency, demand response, storage, etc.), (ii) cost amount by source of funding (ratepayers, government, etc.), (iii) capital versus operational spending, and (iv) whether the spending is likely to be on new DERs facilities versus existing DERs (e.g. contracting for an addition service from a pre-existing generator).

Interrogatory # 2-ED-31

Reference: Exhibit 2B, Section D4

Question(s):

(a) Please discuss how forecast customer connections are factored into Toronto Hydro's demand forecasting for the purpose of capacity planning. Please explain in detail.
(b) For the purposes of capacity planning, how does Toronto Hydro account for incremental connections of single-family dwellings with 200 amp service? For instance, how many kW are assumed (either explicitly or implicitly) to be added to co-incident system peak for such a dwelling? For instance, would that be the maximum kWs the dwelling could consume, the average, or some other number?

Interrogatory # 2-ED-32

Reference: Exhibit 2B, Section D4

Question(s):

(a) Please describe what DERMS are.
(b) Please describe the difference in cost and characteristics between utility-grade DERMS equipment and standard internet-connected power control systems (PCS).
(c) Is Toronto Hydro considering software that would allow it to control smaller DERs through an internet-connected PCS at the customer site? What additional investments are needed by Toronto Hydro to make this possible? What are the barriers and how is Toronto Hydro exploring solving them.

Interrogatory # 2-ED-33

Reference: Exhibit 2B, Section D4

Question(s):

(a) Please describe all the steps that Toronto Hydro is considering implementing to increase the capacity of its system to to connect DERs but which it has not yet decided to implement. For each, please indicate when a decision is likely to be made and whether incremental funding from what is sought in this application would be needed.
(b) Please confirm that Toronto Hydro is allowed to treat applications with over 10 kW nameplate capacity as a microgeneration connection under the DSC. Would Toronto Hydro consider raising its internal threshold for microgeneration connections in order to facilitate the connection of use cases somewhat larger than 10 kW (like solar battery combinations)?

Interrogatory # 2-ED-34

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) Does Toronto Hydro agree with the following sources suggesting that Ontario's RNG potential is roughly 2.5% of the current fossil-based gas consumption:

Feasible RNG Potential – Percent of Current Fossil Gas Consumption	
Canadian Biogas Association Study	2.5%[10] (Ontario)
IESO, Pathways to Decarbonization Study (Interpreting Torchlight Bioresource Report)	2.5%[11] (Ontario)
Canada Energy Regulator, Canada's Energy Future 2023	3%[12] (Canada-wide)

(b) Does Toronto Hydro agree with out interpretation of those reports?

Interrogatory # 2-ED-35

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) Under the "system transformation" scenario, what percent of Toronto's current gas use is replaced with RNG?
(b) Did Element Energy conduct an assessment of whether that is actually feasible?

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[10] Hearing Transcript Vol. 2, p. 100, lns. 1-5 (link); Canadian Biogas Association study, p. 71 (link, Ex. K2.2, PDF p. 184); cited by Guidehouse in Exhibit I.1.10-ED-35 (link, Ex. K2.2, PDF p. 99).
[11] IESO Pathways to Decarbonization Study, Appendix B, p. 27 (link, Ex. K2.2, PDF p. 221); IESO Correspondence (link, Ex. K2.2, PDF p. 221); Hearing Transcript Vol. 2, p. 106, lns. 13-24 (link);
[12] Hearing Transcript Vol. 5, p. 176, ln. 3 to p. 177, ln. 8 (link).

Interrogatory # 2-ED-36

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) Please comment on the analysis in the following submissions starting at page 6 suggesting that decarbonization of building heating is likely to take place mostly through electrification, not low-carbon gases: https://www.rds.oeb.ca/CMWebDrawer/Record/815078/File/document
(b) Please ask Element Energy to comment on the analysis in the following submissions starting at page 6 suggesting that decarbonization of building heating is likely to take place mostly through electrification, not low-carbon gases, including each specific reason provided therein: https://www.rds.oeb.ca/CMWebDrawer/Record/815078/File/document

Interrogatory # 2-ED-37

Reference: Exhibit 2B, Section D4, Appendix B, Figure 5

Question(s):

(a) The report states: "The resulting peak network load for Toronto Hydro is shown in Figure 5, which illustrates how the two most ambitious decarbonization scenarios (Consumer Transformation and Net Zero 2040) have the lowest peak demands by 2050 when the full benefits of appliance and building fabric efficiency measures, demand side flexibility and renewable generation." Pease provide the full underling calculations and a table showing the quantify of peak demand reduction achieved by each measure.
(b) For each scenario shown in figure 5 please provide, for each 5-year interval (i) the percent of buildings with gas, electric, or hybrid heat and (ii) the average demand per building for heating per heating type.
(c) Please provide a table showing the differences as between the consumer transformation and consumer transformation low scenarios in terms of both inputs and outcomes.
(d) Please provide a table showing the differences as between the net zero 2040 and new zero 2040 low scenarios in terms of both inputs and outcomes.
(e) The net zero 2040 scenario winter peak demand reaches a peak in 2040 or so before declining. What causes the winter peak to decline at that stage.
(f) Please provide a table breaking down the incremental peak demand for each scenario by (i) customer growth, (ii) electrification of transportation, and (iii) electrification of buildings.

Interrogatory # 2-ED-38

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) At a very high level, what is the approximately difference in distribution system costs (gross $, $/kWh, and $kW) as between the consumer transformation scenario and the consumer transformation low scenario?
(b) Are the investments outlined in the Toronto Hydro's application sufficient for the electricity system to be ready for the consumer transformation scenario? If not, what investments need to be added?
(c) Please reproduce figure 5 showing summer and winter demand (GWh) instead of peak demand (GW).

Interrogatory # 2-ED-39

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) Please rank the scenarios in figure 5 for overall societal cost-effectiveness. Please explain and quantify as best as possible.
(b) Which of the scenarios in figure 5 are most likely to come to pass. Please explain.
(c) Please provide the full calculations and spreadsheets underlying the Element Energy report.

Interrogatory # 2-ED-40

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) After reviewing the following, would Element Energy agree that heat pumps are usually the cheapest way to heat buildings:
    - Energy Futures Group Report - see p. 23.
    - Dr. McDiarmid Report - see p. 11.
    - Corporate Knights Report
    - Ministry of Energy Paper - see pp. 10 & 11. Note, page 10 indicates that the lower cost numbers in the figure on page 11 are for heat pumps.
    - November 2020 Ontario Auditor General Report - see p. 18. This refers to heat pumps as an alternative to gas "that is both lower cost and consistent with the government's Environment Plan."
    - Enbridge evidence in recent gas expansion cases - see pdf p. 17. This evidence shows that heat pumps are cheaper than gas heating. But it underestimates those savings. If assumptions are corrected (such as accounting for the savings from avoiding fixed gas charges by getting off gas completely), the savings from heat pumps grow and it becomes clear that heat pumps with on electric backup are cheaper than heat pumps with a gas backup. For those additional details, see Hearing Transcript Vol. 5, p. 172, ln. 17 to p. 174, ln. 7.

- OEB DSM Decision - see page 28 and 30. The decision notes that heat pumps are cost-effective. It also allocates efficiency funding to heat pumps. That funding is restricted to cost-effective measures.
- OEB Decision re Enbridge Rates - see page 38. It says "the operating cost of a new all-electric house using a cold climate air source heat pump for space heating, is lower than a new gas and electricity serviced house."

(b) What is the average cost per home and payback period for the retrofits described on page 36?

Interrogatory # 2-ED-41

Reference: Exhibit 2B, Section D4, Appendix B, p. 64

Question(s):

(a) What additional investments or steps does Element Energy recommend that Toronto Hydro take within the rate period with respect to V2G and V2B technology?
(b) What costs are associated with those steps?

Interrogatory # 2-ED-42

Reference: Exhibit 2B, Section D4, Appendix B

Question(s):

(a) For each scenario, please provide the assumptions for the use of gas versus electricity in new construction between now and 2030. Please compare that to Toronto Hydro's actual forecasts based on current realities.

Interrogatory # 2-ED-43

Reference: Exhibit 2

Question(s):

a) How does Toronto Hydro's rate of distribution system energy losses compare to other leading LDCs inside and outside of Ontario? Please provide a comparison with equivalent peer utilities in Ontario.
b) How does Toronto Hydro compare to other LDCs in terms of its efforts to reduce distribution system energy losses? In what ways is or isn't Toronto Hydro a leader in this regard?
c) What are the most important steps that Toronto Hydro has taken in the past 20 years to reduce distribution system energy losses?
d) Where does Toronto Hydro believe the greatest opportunities are to make additional reductions in distribution losses in the next 20 years?

e) Does Toronto Hydro quantify and consider the potential value of distribution loss reductions for different options when procuring equipment (e.g. transformers) and deciding on the details of demand-driven capital projects (e.g. the type and sizing of conductors)? If yes, please explain how and provide documentation detailing the methodology used.
f) If Toronto Hydro is considering the value to its customers of distribution loss reductions for planning purposes, how does it calculate the dollar value ($) of said loss reductions (kWh)? Is the value calculated based only on the HOEP or on all-in cost of electricity (e.g. including the GA)?
g) Please list and describe the operational measures that Toronto Hydro takes to cost-effectively reduce distribution losses.
h) Please provide a table listing the technically available measures to cost-effectively reduce distribution losses and describe for each the respective responsibilities of Toronto Hydro, the IESO, and Toronto Hydro.
i) Please complete the following table

Value of Toronto's Distribution System Energy Losses - Historic						
	2020	2021	2022	2023	2024	Total
Electricity Purchases (MWh)						
Electricity Sales (MWh)						
Losses (MWh)						
Losses %						
All-In Cost of Electricity in ($/Mwh) – Annual Average						
Cost of Losses ($)						

j) Does Toronto Hydro anticipate the value of losses on its system to be materially higher or lower over the next five years?
k) Please complete the following table:

GHG's from Toronto's Forecast Distribution System Energy Losses						
	2021	2022	2023	2024	2025	Total
Forecast Losses (MWh)[13]						
Carbon Intensity of Electricity[14] (CO2e/MWh)						

[13] If no better numbers are available, the losses from 2019 or the average over 2015 to 2019 could be used for the purpose of this row of this response.
[14] Please base this figure on the IESO's January 2020 Annual Planning Outlook - http://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Annual-Planning-Outlook-Jan2020.pdf?la=en; see

GHGs (CO2e)						

l) Is Toronto Hydro willing to review its operational measures, investment planning, and other practices to consider whether it could be taking additional measures to cost-effectively reduce the energy losses occurring in its distribution system?

Interrogatory # 2-ED-44

Reference: Exhibit 2

Question(s):

(a) In EB-2019-0261, Hydro Ottawa agreed to, and the Board approved, the following: "Between 2021 and 2025, Hydro Ottawa shall endeavour to maintain its five-year average total system losses below the target of 3.02% set by the OEB in EB-2005-0381 through cost-effective measures." Is Toronto Hydro willing to agree to the same terms? If not, what commitments can Toronto Hydro make to the Board in this regard? In particular, please indicate what target Toronto Hydro is willing to meet.

(b) In EB-2019-0261, Hydro Ottawa agreed to, and the Board approved, the following: "In addition, over the course of 2020-2021, Hydro Ottawa shall prepare a plan to reduce distribution losses as much as possible through cost-effective measures. The utility shall file the plan with the OEB when complete. In 2022-2025, Hydro Ottawa shall implement as many of the cost-effective measures set out in its plan as possible (e.g. any changes to planning and procurement processes to better mitigate losses, investments that can be made within current budgets, operational measures, etc.). All other cost-effective measures will be incorporated into the utility's next rebasing application and DSP." Is Toronto Hydro willing to agree to the same terms? If not, what commitments can Toronto Hydro make to the Board in this regard?

(c) In EB-2019-0261, Hydro Ottawa agreed to, and the Board approved, the following: "Finally, as described in Hydro Ottawa's response to undertaking JT 3.10, a pilot of a Grid Edge Volt/VAr Control ("VVC") solution will be complete by the end of 2020. If this pilot is successful, Hydro Ottawa shall increase the deployment of these (or equivalent) units by conducting an analysis in 2021 to identify potential suitable locations and by deploying these units in a subset of locations which are deemed to be suitable and cost-effective, with an estimated investment of up to $1.0M over the five-year test period. The cost of these investments will be accommodated within the overall approved capital budget." Is Toronto Hydro willing to agree to implement similar technology through an equivalent commitment? If not, what commitments can Toronto Hydro make to the Board in this regard?

Interrogatory # 8-ED-45

Reference: Cost Allocation Model, Sheet O2 Monthly Fixed Charge Min & Max

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also the data tables at http://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Annual-Planning-Outlook-Data-Tables-Jan2020.xlsx?la=en.

Question(s):

a) Does Toronto Hydro agree that shifting costs for commercial and industrial customers from fixed charges to variable charges would incentivize positive customer behaviour such as shifting load off the peak, installing distributed energy, and implementing energy efficiency? Please explain.
b) Does Toronto Hydro agree that setting the fixed monthly charges for commercial and industrial customers at the level of avoided cost would represent a shift of costs from fixed charges to variable charges?
c) Does Toronto Hydro agree with Board Staff that setting fixed monthly charges at the level of avoided costs has benefits, including that avoided costs "are easiest to determine, are subject to minimal judgment and thus more accurate"?[15]
d) Would Toronto Hydro agree to set its commercial and industrial fixed monthly charges to equal avoided costs going forward? If not, would Toronto Hydro agree to study and consider this issue for potential implementation in its next annual rate application?
e) Please confirm that the balance between fixed and variable charges does not and should not impact Toronto Hydro being made whole for its revenue requirement. Please explain.
f) Please confirm that Toronto Hydro has proposed fixed monthly charges for commercial and industrial customers that is above the maximum level.
g) Please explain why Toronto Hydro is proposing fixed monthly charges for commercial and industrial customers that are above the maximum level. Please include a detailed breakdown quantifying and explaining for each rate class the difference between the proposed fixed charges and the maximum fixed charges.
h) Please provide the methodology, calculations, and any underlying documentation showing how Toronto Hydro calculates the fixed monthly charge for its commercial and industrial customers.
i) Please provide the percent difference between the proposed monthly fixed charge for commercial and industrial customers and the Board minimum and maximum figures (i.e. Customer Unit Cost per month - Avoided Cost; Customer Unit Cost per month - Directly Related; and Customer Unit Cost per month - Minimum System with PLCC Adjustment). Please calculate the percentage based on an average weighted by the number of customers in each class.
j) For the most recent year available, please provide the number of customers in each of the commercial and industrial rate classes.
k) Please complete the following table calculating the total annual amount of fixed charges by customer class (actual and forecast).

Total Fixed Charges Collected by Customer Classes ($) – Commercial & Industrial								
	GS <50	…	…	…	…	…	…	Total

[15] EB-2007-0667, Board Staff Discussion Paper: On the implications arising from a review of the electricity distributors' cost allocation filings, June 28, 2007, pp. 26-27.
60 Ibid

2020 (actual)								
…								
2029 (forecast)								