

Ontario Energy Board

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

AND IN THE MATTER OF an Application by Toronto Hydro-Electric System Limited for an Order or Orders approving or fixing just and reasonable distribution rates and other charges, effective May 1, 2020 to December 31, 2024.

Energy Probe Research Foundation

Interrogatories to the Distributed Resource Coalition

March 28, 2019

M2-EP-1

Reference: Exhibit M2, “*Electrified Transportation Systems in the Context of Utility Planning: Light-Duty and Heavy-Duty Applications*” by Josipa Petrunić, Anahita Jami, Abhishek Raj, and Anaïssia Franca

Please file CVs of all authors of this document

M2-EP-2

Reference: Exhibit M2, Page 1

- a) Please explain the relationship between DRC and CUTRIC.
- b) Please provide the names of organizations that are members of DRC including any corporate members.
- c) Please provide the names of organizations that are members of or provide funding for CUTRIC including any corporate members and governments.
- d) Please file the engagement letter and the statement of work given by DRC to CUTRIC for the preparation of this document.
- e) Please identify corporate or organizational members of DRC and/or CUTRIC that are in the business of providing equipment or installation of battery storage devices and/or vehicle battery charging stations.
- f) Are any corporations or organizations identified in responses to b, c and e of this interrogatory, or any individuals representing them registered as lobbyists in the Ontario Lobbyist Registry? If the answer is yes, please list them. If the answer is no, please explain why not.
- g) Have any corporations or organizations listed in the responses to b, c, and e, or any individuals representing them, met with the staff of any Ontario government ministry in the past two years in order to promote battery storage devices, vehicle battery charging stations or battery powered vehicles? If the answer is yes, please provide a list of all such meetings. If the answer is no, please explain why not.
- h) Have any corporations or organizations listed in the responses to b, c, and e, or any individuals representing them, met with the staff of any Ontario government ministry to promote alternative technologies for the TTC Downtown Relief Line project. If the answer is yes, please provide the date(s) of such meeting(s) together with information on the technologies that were proposed as alternatives to a conventional subway.

M2-EP-3

Reference: Exhibit M2, Pages 1 and 5.

- a) What does the DRC want the OEB to do?
- b) Has DRC or CURTIC or any of their member organizations or corporations met with OEB Staff or with Toronto Hydro staff over the past two years to promote battery storage devices and/or vehicle battery charging stations. If the answer is yes, please provide a list of all such meetings including the date(s) of meeting(s), persons present and the matters discussed. If the answer is no, please explain why.
- c) Considering that Toronto Hydro in its letter to the OEB of March 28, 2019 indicated that it would not be asking any interrogatories of DRC regarding Exhibit M2, please confirm that there is no written or verbal agreement between Toronto Hydro and DRC or CUTRIC or any of their member organizations or corporate sponsors to not challenge any of the claims made by the authors in Exhibit M2.

M2-EP-4

Reference: Exhibit M2, Page 2

Preamble: *“Customer efficiencies resulting from the progressive integration of heavy-duty and light duty EVs based on intelligently controlled and managed fleets of chargers and allied storage devices given the cheapness of electricity as a propulsion fuel over gasoline and diesel in all instances in Toronto”.*

- a) Please explain what is meant by “customer efficiencies” as used in the above sentence.
- b) Are the authors of this document suggesting that Toronto Hydro invest in and manage “fleets of chargers and allied storage devices”? If the answer is yes, please provide a cost estimate of the investment in fleets of battery chargers and allied battery storage devices that the authors want Toronto Hydro to make. If the answer is no, please explain what the authors want Toronto Hydro to do.
- c) Please describe the types of battery storage devices mentioned by the authors. For each battery type, please explain how it works listing all chemicals used in the battery storage device, the expected battery life, the method and the cost of disposal of the battery at the end of its life.

M2-EP-5

Reference: Exhibit M2, Page 2

Preamble: *“This may also result in: ...increased distribution asset lifecycles, and decreased operations, maintenance and administration (OM&A) costs (due to improved grid management based on charging and storage devices, which enable long-term grid reliability and provide customer choice and savings through charging systems).”*

- a) Please explain what is meant by “*increased distribution asset lifecycles*” as used in this sentence. Specifically list the specific distribution assets that would have increased lifecycles giving the number of years for each asset due to battery charging stations.
- b) Please explain what is meant by “*decreased operations, maintenance and administration (OM&A) costs*” as used in this sentence. By what amount would these costs be decreased each year?
- c) Please explain what is meant by “*long-term grid reliability*”. How would vehicle battery charging and battery storage devices provide long term grid reliability?

M2-EP-6

Reference: Exhibit M2, Page 2

Preamble: “*Improved electricity reliability through the integration and use of BEBs, EVs and storage devices as grid resources in order to capture and optimize surplus baseload power and intermittent renewable power and provide the “fuel” for existing and future transportation propulsion systems (particularly in light of the recently proposed federal EV penetration targets and incentives).*”

- a) Please explain what is meant by “*improved electricity reliability*”.
- b) Please explain how battery powered electric buses, battery powered electric vehicles and battery storage devices would improve electricity reliability.
- c) Please explain how battery powered electric buses, battery powered electric vehicles and battery storage devices would “*capture and optimize surplus baseload power and intermittent renewable power*”.
- d) Please provide the authors’ estimate of the annual surplus baseload power and intermittent renewable power on the Toronto Hydro distribution system in MWhr per year for each year from 2020 to 2024 inclusive.
- e) Please provide the authors’ estimate of the amount of annual surplus baseload power and intermittent power on the Toronto Hydro distribution system that battery powered electric buses, battery powered electric vehicles and battery storage devices would “*capture and optimize*” in MWhr per year

M2-EP-7

Reference: Exhibit M2, Page 2

Preamble: “*Specifically, this may include: Optimization of the distribution network through the use of BEBs, EVs, and allied storage devices, as a reliability and backup resource for electricity distribution systems through an artificially intelligent (AI) network of instantaneously deployed*

DERs to fuel the grid in times of peak requirements or to manage grid-wide variabilities in demand across Toronto Hydro's network throughout any given 24hour period."

- a) Are the authors suggesting that the grid would withdraw power from batteries in plugged-in battery powered electric vehicles during peak times and during a power outage? If the answer is yes, how would the vehicles operate if the grid had withdrawn all of their stored power from their batteries during the outage?
- b) Please confirm that if the authors' proposal is implemented and TTC converted to battery powered electric buses there is a possibility that there would be reduced or no TTC service during peak times or power outages. Please explain your answer.
- c) Please explain what is mean by "*an artificially intelligent (AI) network*". Does Toronto Hydro have such a network? If the answer is no, please provide the authors' estimate of the cost building such a network in Toronto and the time it would take to build it.

M2-EP-8

Reference: Exhibit M2, Page 2

Preamble: "*Specifically this may include: ... Long- and short-term OM&A savings that may emanate from the improved system-wide management of optimized cycling of both onboard batteries in EVs and offboard batteries in stationary devices at the site of chargers, which may minimize grid impacts associated with new transportation electrification demands, and to manage existing industrial and residential loads on the grid.*"

- a) Please explain how "*long and short term OM&A savings would be emanate*" from the activities mentioned in the referenced paragraph. Are these incremental savings net of incremental costs? Please explain your answer.
- b) Would cycling of batteries shorten battery life? Please explain your answer.
- c) Are the authors proposing that Toronto Hydro manage the operation of electric vehicle batteries of all battery powered electric vehicles in Toronto?

M2-EP-9

Reference: Exhibit M2, Page 2

Preamble: "*Distribution system efficiencies that may result from dedicated and/or newly established rate structures or tariffs established for heavy-duty applications, municipally-owned BEBs, and heavy-duty vehicles owned by Toronto Hydro and/or its primary shareholder, the City of Toronto (the City) (including the Toronto Transit Commission (TTC) and City vehicle fleet). City-wide savings may also be achieved through displacing imported diesel and gasoline fuels used for the City fleet with clean, Ontario-produced electricity.*"

- a) Please explain what are “*dedicated and/or newly established rate structures*” that the authors are advocating and how would such rate structures result in distribution system efficiencies.
- b) Considering that Toronto Hydro rate structures are designed to recover all of Toronto Hydro’s costs, are the authors proposing that Toronto Hydro charge TTC less for BEB’s and other customers more for some other services? If the answer is yes, for which services should Toronto Hydro charge more. If the answer is no, please explain why.
- c) Are the authors advocating the use of battery powered transit vehicles as an alternative to electrically powered transit vehicles such as subways and streetcars that do not use batteries?
- d) Considering that most of electricity in Ontario is produced by nuclear power and that nuclear fuel used in Ontario is produced from uranium ore mined in Saskatchewan, and that much of diesel and gasoline fuels used in Ontario are refined from oil produced in Western Canada, including Saskatchewan, why do the authors believe that bringing nuclear fuel from Saskatchewan does not make it “*imported*” but bringing oil from Saskatchewan makes it “*imported*”?

M2-EP-10

Reference: Exhibit M2, Page 3

Preamble: “*If Toronto Hydro or other entities were to support investments in EV charging infrastructure and/or customer benefits plans allied with charging demand management,...*”

- a) Please explain what the authors mean by “*to support investments in EV charging infrastructure*”. Are the authors advocating that Toronto Hydro invest in battery charging infrastructure as rate-regulated assets? Please explain your answer.
- b) If the answer to (b) is yes, are the authors proposing that ratepayers bear the risk of such investments? Please provide reasons for your answer.
- c) Please describe the “*customer benefits plans*” the authors have in mind.

M2-EP-11

References: Exhibit M2, Page 3

- a) What is CUTRIC TRiPSIM© based modelling and why should the OEB have confidence in it?
- b) Please list all assumptions used in the CUTRIC TRiPSIM© based modelling of Toronto including the sources and/or references for all assumptions.

- c) Please provide the calculations that support the \$20,015,800 new revenue claim for Toronto Hydro.
- d) What is the investment needed to generate the \$20,015,800 in new revenues and who would make this investment and when?
- e) Who would be at risk if the \$20,015,800 in new revenues does not materialize after the investment is made?

M2-EP-12

References: Exhibit M2, Page 3

Preamble: *“These revenues could be distributed across the customer base in the form of savings or utilized to offset the costs of utility-owned, operated and maintained EV charging networks of infrastructure.”*

- a) Are the authors proposing that Toronto Hydro own and operate EV charging networks as an OEB rate regulated business in the City of Toronto.
- b) If the answer to (a) is yes, would Toronto Hydro operate this business in competition with other providers of these services that are not OEB rate regulated businesses or are the authors proposing that Toronto Hydro be given a monopoly for EV charging in the City of Toronto. If the answer to (a) is no, please explain what the authors are proposing.

M2-EP-13

Reference: M2, Pages 3 and 4

Preamble: *“With no energy storage integrated into the system to offset peak demand, the 50:25:25 division of off-peak: mid-peak: peak charging hours for EVs creates estimated new revenues for Toronto Hydro from EV electricity customers can be estimated.... Based on these figures, it is reasonable to assume a penetration rate of 5% of all cars in Toronto being EVs (a combination of battery electric and plug-in-hybrids), which could result in new revenues for Toronto Hydro of approximately \$18 million per annum by 2025.”*

- a) Are the authors proposing that energy storage batteries be integrated into the system? If the answer is yes, why is this scenario presented with no energy storage?
- b) What are the authors’ estimates of the current Toronto Hydro revenues from charging batteries of battery powered electric vehicles?
- c) Do the authors claim that Toronto Hydro is currently preventing individuals and businesses from putting in place battery charging facilities for battery powered electric vehicles?

M2-EP-14

Reference: Exhibit M2, Page 5, Table 1

Preamble: The authors provided a summary table of load and revenues generated from the electrification of the TTC bus fleet and privately-owned light vehicles in Toronto.

- a) Please complete the table by adding/including the forecast number of vehicles, infrastructure including transit and public battery charging stations, and any other relevant data.
- b) Please provide a summary table with the assumed utility (not fleet) capital and operating costs for each type of vehicle and related infrastructure

M2-EP-15

Reference: Exhibit M2, Page 5

Preamble: *“Similarly, the integration of energy storage at the side of EV charging network “hubs” that Toronto Hydro may own and operate in the future could help to achieve similar systems-wide savings in terms of demand management for grid health and asset life cycle extension or diminished grid-side investments in infrastructure upgrades to manage peak requirements of EVs.”*

- a) What are “EV charging network hubs”?
- b) Are the authors proposing that each such hub have a large storage battery and that Toronto Hydro own and operate it.
- c) Can network hubs be built without any investments in wires? Please explain your answer.

M2-EP-16

Reference: Exhibit M2, Page 5

Preamble: *“These estimates and the evidence do not presume or advocate for a specific model of ownership of EV, BEB, or charging infrastructure and we expressly note that customer savings, utility efficiencies, and new revenue streams may be achieved regardless of whether the utility pursues a regulated or unregulated EV charging business model.”*

- a) Please confirm that the EB-2018-0165 proceeding is only dealing with regulated services of Toronto Hydro.
- b) Please confirm that unregulated business of Toronto Hydro is outside the scope of the EB-2018-0165 proceeding.

M2-EP-17

Reference: Exhibit M2, Page 7

Preamble: *“Toronto Hydro may wish to develop rates and services for electrified heavy-duty vehicles in order to facilitate systems integration, installation, operation, maintenance and control of high- and low-powered charging systems for BEBs, municipal trucks, and integrated energy storage resources.”*

- a) Please explain the rates and services for battery powered electrified heavy-duty vehicles that the authors are proposing for Toronto Hydro.
- b) How would such rates and services be different than the rates and services Toronto Hydro currently provides to TTC for electric vehicles that are not battery powered such as subways and streetcars?

M2-EP-18

Reference: Exhibit M2, Page 7

Preamble: *“Toronto Hydro may, either directly or indirectly, also wish to consider providing related services to surrounding communities with local distribution companies that do not have the scope or scale to provide related charging infrastructure installation and services.”*

- a) What “related services” are the authors proposing that Toronto Hydro provide to surrounding communities?
- b) Would such services be regulated or unregulated?

M2-EP-19

Reference: Exhibit M2, Page 8

Preamble: *“The recently announced federal EV incentives are likely to further accelerate EV adoption and ICE turnover to EVs in the GTA.”*

- a) Please provide a summary of “the recently announced federal EV incentives”.
- b) Do the authors believe that these incentives are inadequate and that Toronto Hydro should provide additional incentives to “further accelerate EV adoption”. Please explain your answer.

M2-EP-20

Reference: Exhibit M2, Page 9

Preamble: *“Finally, the Toronto Hydro distribution grid may benefit significantly by optimizing EV and charging assets in a manner that responds to customer demand and flexibility requirements.”*

- a) What does “*optimizing EV charging assets*” mean?
- b) Please confirm that “*customer demand and flexibility requirements*” refers to battery powered electric vehicle owners and/or operators only and not to all other customers of Toronto Hydro.

M2-EP-21

Reference: Exhibit M2, Page 10

Preamble: “*First, charging electric cars can serve as stationary power sources with vehicle-to-grid (V2G) capacities and the charging rate can be monitored and controlled remotely and digitally. Therefore, if Toronto Hydro were to put in place Demand Response programs with incentives for users, charging electric cars could serve to buffer the grid load fluctuations. Additionally, energy storage devices can be paired with existing charging infrastructure for additional flexibility and to accommodate unpredictable power variations, such as when electricity is generated from wind power. It would allow for a higher integration of these power sources into the grid, leading to greater greenhouse gas emissions reductions.*”

- a) Are the authors suggesting that Toronto Hydro put in place a system that would monitor the charging of all electric vehicle batteries in Toronto?
- b) Are the authors proposing that Toronto Hydro withdraw power from batteries of electric vehicles that are connected to charging stations if it needs the power for other customers?
- c) Please confirm that battery powered electric vehicles would not be able to operate after Toronto Hydro has withdrawn all power from their batteries.

M2-EP-22

Reference: Exhibit M2, Page 12

Preamble: “*Demand response, demand management and — utility — systems management to reduce electricity prices over time even as demand goes up in future years due to the electrification of transportation overall is a responsibility of the utility and systems operator; to achieve these goals requires utility investments today.*”

Please delineate in more detail the authors’ scenarios for regulated and unregulated infrastructure and service for each of battery powered electric buses and battery powered electric vehicles. For each of regulated and unregulated service, please categorize and provide a summary/list of authors’ recommendations for Toronto Hydro for implementation during the CIR Plan period and beyond.

M2-EP-23

Reference: Exhibit M2, Page 13

- a) For regulated utility services what rate(s) do the authors suggest Toronto Hydro implement to recover revenue and costs on a revenue neutral basis? Please provide an example of the rate design parameters and proposal(s).
- b) Based on authors' 5 year forecast of infrastructure and vehicles, please show for battery powered electric buses and and battery powered electric vehicles the estimated annual utility revenues and costs over the Toronto Hydro CIR period. List all relevant assumptions.