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April 15, 2019

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319, 27th Floor
2300 Yonge Street
Toronto, ON M4P 1E4

Dear Ms. Walli:

Re: Toronto Hydro-Electric System Limited
Application for order or orders approving or fixing just and reasonable distribution rates and other charges, effective January 1, 2020 to December 31, 2024
Board File No. EB-2018-0165

We are counsel to the Distributed Resource Coalition (**DRC**) in the above-referenced proceeding. Further to Procedural Order No. 6 and our correspondence dated April 12, 2019, please find enclosed DRC's responses to the interrogatories received from the Energy Probe Research Foundation.

Yours very truly,

Lisa (Elisabeth) DeMarco

c. Charles Keizer and Arlen Sternberg, Torys LLP
Andrew Sasso and Daliana Coban, Toronto Hydro
Distributed Resource Coalition

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-1

Reference: Exhibit M2

Question(s): Please file CVs of all authors of this document

Response(s): DRC filed Dr. Petrunić's curriculum vitae with the Board on February 12, 2019. The curriculum vitae of her supporting authors are attached as Appendix A.

Anahita Jami

Highlight of Qualifications

- Extensive experience in environmental policy analysis; conducted research projects to evaluate renewable energy policies and identified current and emerging policy matters requiring legislative reform in the Ontario renewable energy project approval process
- Strong background in conducting research by deploying both qualitative and quantitative methodologies
- Skillful in project management; managed waste reduction projects by utilizing Six Sigma methodology which resulted in over $1,000,000 cost saving
- Proficient computer skills including MS Office, MS Project, Minitab, and NVivo

Research Experience

Mitacs Elevate Postdoctoral Fellow **Current Position**

Canadian Urban Transit Research & Innovation Consortium and University of Toronto, Toronto, Ontario

- Managing concurrent research projects, providing advice and establish partnerships with key stakeholders to work on transportation-related environmental policy initiatives; e.g., leading consultation sessions with stakeholders to develop a strategy for Cap & Trade investments in green transportation in Ontario
- Leading transportation research projects: Gathering and interpreting data from various sources, presenting the results, and drafting technical reports, charts, and summaries in support of policy and program decision-making
- Developing a life cycle assessment model for electric and diesel buses
- Policy mapping of potential cost challenges and revenue generation capabilities for transit agencies by reviewing carbon pricing mechanisms in various jurisdictions, calculating Ontario transit agencies' greenhouse gas emissions, and recommending solutions for reducing GHG emissions

Research Assistant **2014-2016**

Ryerson University, Toronto, Ontario

- Analyzed the factors that affect the financial success/ failure of clean-tech firms: Identified the opportunities and challenges for new business to move from the idea stage (innovation) to the marketplace (commercialization)
- Investigated the effectiveness of Aboriginal Energy Participation Programs in encouraging renewable energy projects for First Nation communities; conducted a case study involving life cycle analysis and net present value determination and presented the socio-economic comparison of renewable energy alternatives

Principal Investigator **2012-2016**

Ryerson University, Toronto, Ontario

- Led research on the role of public participation in wind energy project development in Ontario; reviewed and analyzed federal and provincial legislation/regulations (i.e., *Environmental Assessment Act* and *Environmental Protection Act*), assessed the factors that affect the social acceptability of renewable energy projects in Ontario, and solicited input on my proposed policy framework from key stakeholders
- Studied the integration of quality and environmental management systems; applied the principles of Six Sigma to environmental management systems

- Conducted comparative business policy research on wind energy development and environmental governance in Ontario, Germany, and Texas

Project Intern **Fall 2013**

s2e Technologies Inc., London, Ontario

- Developed a conceptual policy framework to provide strategic advice to senior management for the deployment of a collaborative and consensus-building approach in renewable energy development decision-making processes
- Conducted socio-economic analysis for developing a Smart Community in London, Ontario
- Presented solutions to address the concerns of different stakeholder groups

Industry Experience

Environmental Coordinator **December 2009- December 2011**

ViridisTech Inc. - Natural Gas Industry, Markham, Ontario

- Coordinated and planned environmental activities including liaising with regulatory agencies, communicating with the stakeholders and clients, and ensuring compliance with statutory requirements
- Coordinator of the ISO 14001 team; supported the project team to ensure sound environmental practices were deployed, technical reviews were completed, and standards were met by preparing the audit checklist, performing internal audits, managing follow-up activities for detected nonconformities, and updating process documents

Senior Quality Expert **January 2007- June 2008**

Renault-Nissan - Automotive Industry, Iran

- Conducted perceived quality audits in Renault-Nissan tier I suppliers
- Liaised with plant partners to address expectations, coordinate work activities, and provide overall direction
- Created and monitored key performance indicators of perceived quality
- Prepared quality performance reports for Quality Director
- Developed corrective action plans and tracked performance to verify corrective actions were implemented by the timeline

Quality Expert **December 2001-December 2006**

IKCo. Industrial Group - Automotive Industry, Iran

- Led the paint shop quality team to develop strategies and ensure the continuous improvement of quality programs
- Deployed a wide variety of problem-solving methodologies and skills to investigate root causes of defects, prepare action plans, and to monitor progress
- Provided technical guidance to the EHS Dept. (Environment, Health & Safety), e.g., assisted in obtaining environmental permits and approvals in the paint shop
- Trained, coached, and mentored more than 100 technicians and junior quality experts in problem-solving methodologies and perceived quality with satisfaction factor 4.8 of 5
- Managed Six Sigma projects:
    - Reduced number of scrapped bodies in paint shop by 80% within three months
    - Reduced thinner consumption in paint shop's pre-mixing room by 40%

Anahita Jami

Teaching & Course Development Experience

Course Instructor **2014-2016**
Ryerson University, Toronto, Ontario

Teaching Assistant (TA) **2012-2016**
Ryerson University, Toronto, Ontario

School of Professional Communication, Ryerson University **2015**

- Assisted in developing "Introduction to Professional Communication" online course

Education

Doctor of Philosophy **2012-2016**
Environmental Applied Science and Management, Ryerson University

Master of Applied Science **2009-2011**
Environmental Applied Science and Management, Ryerson University

Master of Science in Urban Management **2006-2008**
Allameh Tabatabaei University, Tehran, Iran

Bachelor of Science in Chemistry **1995-1999**
Shahid Beheshti University, Tehran, Iran

Sample Publications

- Jami, A., and Walsh, P. (2017). "From consultation to collaboration: A participatory framework for positive community engagement with wind energy projects in Ontario, Canada" *Energy Research & Social* Science, 27, 14-24; http://dx.doi.org/10.1016/j.erss.2017.02.007
- Jami, A., and Walsh, P. (2016)"Wind power deployment: The role of public participation in the decision-making process" *Sustainability Journal,* 8, 8, 713; doi:10.3390/su8080713
- Jami, A., and Walsh, P. (2014). "The role of public participation in identifying stakeholder synergies in wind power project development: The case study of Ontario, Canada" *Renewable Energy Journal*, 68, pp. 194-202; http://dx.doi.org/10.1016/j.renene.2014.02.004
- Jami, A., Searcy, C., and Jenab, K. (2012). "Applying the principles of Six Sigma to environmental management systems" *International Journal of Applied Decision Sciences*, 5, 3, 215-232; http://dx.doi.org/10.1504/IJADS.2012.047668

Conference Presentations

- Jami, A., Petrunic, J., Mlakar, K., Shalaby, A. "Greenhouse Gas Emission Modelling for the Transit Sector" EV2018, Ottawa, Ontario, April 2018.
- Jami, A., "Electrified and Electric Vehicle Policy Movements: Implications for Vehicular Innovation" 2017 Motive Power Professional Development Conference, Guelph, Ontario, June 2017.
- Jami, A. "The role of a third-party broker in managing controversies in wind energy siting" ONSEP 2017 Annual Workshop, Picton, Ontario, April 2017.
- Jami, A., and Walsh, P. "Wind energy and the public: From consultation to collaboration" the 33rd USAEE/IAEE North American Conference, Pittsburgh, USA, October 2015.

- Jami, A., and Walsh, P. "Corporate social responsibility in the wind energy industry in Ontario: A study of stakeholders involvement" Centre of Corporate Responsibility and Sustainable development Symposium, Toronto, Canada, June 2015.
- Jami, A., and Walsh, P. "Wind power deployment: The role of public participation in the decision-making process" The 14th IAEE European Energy Conference, Rome, Italy, October 2014.
- Jami, A., and Walsh, P. "Enhancing the role of public participation in identifying stakeholder synergies in wind power project development: The case study of Ontario, Canada." The Inaugural European Conference on Sustainability, Energy & the Environment, Brighton, UK, July 2013.

Certificates

Project Management Professional Certification **In Progress**
Project Management Institute

Environmental Professional Certification **2016**
ECO Canada

SEDA-UK Professional Development in Teaching Certificate (Level 1 and 2) **2015**
UK Staff and Educational Development Association

Professional Development in Teaching Certificate (Level 1 and 2) **2014-2015**
Ryerson University

Instructional Skills Workshop (ISW) Certificate **2014**
Ryerson University

EMBA Certificate **2006**
Industrial Management Institute, Tehran, Iran

Six Sigma Certificate **2004**
Indian Statistical Institute, India

Selected Awards

MITACS Elevate Postdoctoral Fellowship Award	**2017**
WiRE (Women in Renewable Energy) Student Grant	**2016**
Ryerson Graduate Fellowship	**2014**
Connect Canada Research Award	**Winter 2013 & Spring 2014**
Centre for Urban Energy & Toronto Hydro Research Award	**Winter 2013 & Spring 2014**
MITACS Accelerate	**Fall 2013**
Ontario Graduate Scholarship	**2010-2011 & 2011-2012**
Ryerson Graduate Award	**2010-2011 & 2012-2013**
Ryerson Graduate Scholarship	**2009-2010 & 2013-2014**
Six Sigma Excellency Award	**2004**

Volunteer Activities

Serving on Standard Council of Canada: SMC/ISO/TC207/SC4 - Environmental Performance Evaluation Mirror committee

Abhishek Raj

Summary of qualifications

- Developed novel particle sampling technique for counterflow flames by leveraging domain knowledge of aerosol synthesis, heat transfer and fluid mechanics along with design skills
- Designed combustion systems for in-flame synthesis of nanoparticles along with hands-on experience in equipment fabrication, sub-systems and component integration as manifested in the development of a controllable metallic precursor loaded methane counterflow flame system
- Well-versed in modeling thermo-fluidic processes involving heat and mass transfer which include multi-component reacting flows and combustion process under various operating conditions through numerical techniques like computational fluid dynamics and multiphysics modeling
- Acquired effective combination of design and project management skills, and used them on multi-stakeholder projects like reactor installation and the fabrication of standardized diagnostic equipment
- Gained expertise in evaluating, designing and operating conventional and alternative energy systems to optimize energy delivery against costs and emissions for a 30 MW district cooling project
- Developed a bid for a Pan-Canadian consortium comprising of public transit agencies, local municipal government and equipment manufacturers to receive funding from Canadian Federal Government for achieving electrification of public transit

Education

- **PhD in Mechanical Engineering,** University of Waterloo, Canada in October 2017
- **Masters of Science in Mechanical Engineering,** Masdar Institute, Abu Dhabi, UAE in 2012
- **Bachelor of Technology in Mechanical Engineering,** VIT University, Vellore, India in 2010

Software/ Equipment Used

- **Software:** FLUENT, Solidworks, Comsol Multiphysics, C/C++, MATLAB, CAD, MS Project, MS Office, LabView,
- **Equipment:** Gas Chromatographer, FT-IR, Mass Spectrometer, TGA-DSC, Mobility Particle Sizer, Fixed bed reactor

Relevant Experience

- **Doctoral Researcher** in University of Waterloo (May 2013- Oct 2017)
  - Prioritized research activities against timelines and resources; estimated resource requirement and optimized their utilization by leveraging project management and managerial skills
  - Established performance parameters for evaluating efficiency in research projects, developed an online lab inventory management system and operating manuals for operating key equipment
  - Successfully designed and developed a system for analysis of metal doped counterflow flames by integrating mechanical, pneumatic and electronic sub-systems and components
  - Designed experimental procedure to extract and quench particles from counterflow flames for measuring particle diagnostics
  - Combined discrete mathematical models simulating actual processes into single unified mechanism for realistic and accurate prediction using both commercial software and self-developed code
  - Leveraged project management skills in coordinating the assembly and installation of combustion reactor in University with multiple agencies within budgetary limits
  - Managed strategic communication between stakeholders and developed time-based research funding plans to establish a Canada-wide research network involving academia and industry

- **Research Assistant** in Institute Centre for Energy at Masdar Institute of Science and Technology, Abu

Dhabi as part of Masters studies (July 2010-May 2013)

- Analyzed the performance of Hydrogen fuel cells in vehicles under different driving cycles through a multi-physics model integrating fluid dynamics with electrochemistry and electrical design
- Integrated off-the-shelf electrical and fluidic components to develop a 30-fuel cell test rig capable of simulating the impact of varying electrical loads, representative of the driving cycle
- Utilized data analytics skills to regress the output and water distribution to various operational parameters at different stages of driving conditions
- Established the online inventory management system and procedures for operating key equipment
- Carried out HVAC design and Life Cycle Assessment analysis of 30 MW district cooling system to replace conventional air conditioning in a cooling district in collaboration with city authorities

- **Junior Project Development Officer (Contractual)** in Canadian Urban Transit Research and Innovation Consortium (Nov 2017-till date)
  - Developed mathematical models to conduct dynamic simulation of diesel and electric public transit bus operation on specified transit routes using the technical specifications provided by manufacturers and provide output parameters like state of charge and carbon footprint
  - Conducted an outreach exercise for CUTRIC to rope in public transit agencies, utility companies, local and provincial governments and equipment manufacturers in order to develop a joint bid to Natural resources Canada to receive funding for purchasing overhead electric chargers for public transit
  - Managed communication between industry, government and academia to develop Canada-wide collaborative projects focusing on electrification of transit systems

- **Teaching Assistant** in Mechanical and Mechatronics Engineering department and Waterloo Professional Development Program (WATPD) in University of Waterloo (Sept 2013-till date)
  - Undertook tutorial classes and back-up classes, laboratory teaching and grading for Thermodynamics, Fluid Mechanics and Calculus courses
  - Managed online administration of the course for 150+ students with tasks involving handling online content, conducting student assessment and providing detailed feedback to students
  - Developed case-studies based assignments complying to course curriculum incorporating instructor's requirements and students' feedback
  - Revamped the student assessment criteria while complying with the course objectives in order to accommodate requests by students involved in external projects

- **GRADventure specialist** in Graduate Student Office(GSO) at University of Waterloo (Sept 2016-Dec 2016)
  - Liaisoned with other University departments to gather financial, human and infrastructure resources to organize graduate level leadership workshops
  - Envisioned University's in-house graduate professional skill development program along with GSO officials and conducted feasibility analysis on it by applying program evaluation skills
  - Conducted environmental scan of existing professional development programs, business skills development program, industrial mentorship programs in Canadian Universities and developed multiple format options for them to be implemented at University of Waterloo
  - Assessed client sentiment and conducted market research by organizing focus group sessions and developing surveys for qualitative analysis
  - Acted as hiring manager for the recruitment process of three other GRADventure specialists

- **President** of the graduate student body Mechanical and Mechatronics Engineering Graduate Association (MMEGA) at University of Waterloo (Sep 2014-Sept 2015)
  - Participated in solving problems concerning students with University staff and faculty and provided consultancy services to students related to their issues

- Negotiated on policy development and implementation, resource allocation and procurement with multiple internal and external agencies resulting in improved infrastructure, more equitable distribution of part-time job opportunities to students and more networking events for students
- Delegated duties including event planning, information outreach, budget estimation, external funds sourcing, student representation, supplies procurement and management of student lounge among executive members resulting in the provision of better services to the students
- Navigated the student body through a funding crunch and salvaged its finances by successfully restructuring the debt and sourcing additional funding

- **Course Assistant (Part-time)** in an online course titled Professionalism and Ethics in Engineering Practice in Waterloo Professional Development Program (WATPD) in University of Waterloo (May 2015-till date)
  - Developed case-studies based assignments complying to course curriculum incorporating instructor's requirements and students' feedback
  - Interacted with out-station co-op students and addressed their requirement of flexibility regarding submission deadlines by assisting in formulating a "late days" system and by restructuring the evaluation criteria to give higher weightage to their in-job experience

Professional Development/Awards

- Waterloo Institute of Technology Nanofellowship Award valued at CAD 10000, 2016
- Student Leadership Program Certificate, University of Waterloo, 2015
- Fundamentals of Project Management certificate by Mitacs Canada, 2016
- Hong Kong PhD Fellowship**,** Research Grants Council Hong Kong, 2012 (Declined)

Publications

Journal papers

- **Raj A.**, Zhu D., Wen J.Z., Tan Z., Croiset E. Particle sampling and analysis of the particle evolution process in an iron pentacarbonyl loaded counterflow natural gas flame. *Combustion and Flame,* Vol 194, Pp. 1-14, 2018.
- **Raj A.**, Wen J.Z., El Sayed A., Croiset E. Numerical analysis of hydrocarbon and Nitric oxide emission reduction from iron pentacarbonyl loaded counterflow natural gas flame. *Fuel*, Vol. 216, Pp. 768-780, 2018.
- **Raj, A.**, Pan K., Qi H., Zhu H., Wen J.Z., Croiset E. Effects of an iron pentacarbonyl additive on counterflow natural gas and ethanol flames. *Energy & Fuels,* Vol.29, Issue 8, Pp. 5361-5371, 2015.
- **Raj A.**, Sasmito AP., Shamim T. Numerical investigation of the effect of operating parameters on a planar solid oxide fuel cell. *Energy Conversion and Management*, Vol.90, Pp. 138-145, 2015.
- **Raj A.**, Shamim T. Investigation of the effect of multidimensionality in PEM fuel cells. *Energy Conversion and Management*. Vol.86, Pp.443-452, 2014.
- Gomez A., **Raj A.**, Sasmito AP., Shamim T. Effect of operating temperatures on the transient performance of a polymer electrolyte membrane fuel cell stack with a dead-end anode. *Applied Energy,* Vol.130, Pp. 692-701, 2014.

Conference papers

- **Raj A.**, Wen J.Z., Croiset E. (2016). Impact of iron precursor injection modes on emission reduction in counterflow methane diffusion flame. Proceedings of Combustion Institute (Canadian Section), Waterloo.
- **Raj A.**, Wen J.Z., Croiset E. (2015). Influence of iron pentacarbonyl on emissions from ethanol combustion. Proceedings of Combustion Institute (Canadian Section), Saskatoon, Sakatchewan.
- Saffarini, R., **Raj, A.**, Jung, L.W., Sgouridis, S. Comparative lifecycle assessment of district and distributed cooling systems for middle-eastern climatic conditions. International Conference on Applied Energy, Johannesburg, 2013.

ANAISSIA FRANCA

MASc candidate, EIT

PROFILE

- Research Strategy Manager at Canadian Urban Transit Research and Innovation Consortium (CUTRIC)
- Junior Projects Development Officer at Canadian Urban Transit Research and Innovation Consortium (CUTRIC), main role consists in leading electric bus modeling and simulations
- Master of Applied Science in Mechanical Engineering
- 3 years of active research experience in low-emission transportation technologies (fuel cells and battery) and 1 year of teaching experience in heat transfer and HVAC technologies
- Mechanical Engineer In Training (EIT) with a specialization in Energy Systems

EDUCATION

Master of science, mechanical engineering (MASc), University of Victoria, BC. 2015-2018
GPA: 8.25/9 (92.5%). Thesis title "Electricity consumption and battery lifespan estimation for transit electric buses: drivetrain simulations and electrochemical modelling"

Bachelor of engineering in mechanical engineering with distinction (BEng), University of Victoria, BC. 2012-2015
GPA: 8.1/9 (91%). Specialization: Energy systems.

KEY COMPETENCE

Technical skills

- Programming languages: Python, Matlab, Fortran, C and C++
- GUI: Python, Matlab
- Modeling: Comsol, Gridlab-D, Ansys
- CAD: SolidWorks, Geomagic
- Database management: SQL server
- Version control: GIT/GITHub
- Machine usage: FDM 3D Printer, wood tools, lathe and mills

Communication skills

- Excellent written and verbal communication skills (English and French)
- Public speaking (in small and large groups)
- Enthusiastic presenter and active listener
- Languages: English (fluent), French (native), Italian (Intermediate), Spanish (beginner)

Innovation skills

- Curious researcher
- Team builder
- Project starter
- Student representative in various groups on campus
- Engineering students mentor

ENGINEERING RESEARCH EXPERIENCE

Research contractor, CUTRIC, Victoria BC. Nov 2016-May 2017
Worked for the Canadian Urban Transit Research & Innovation Consortium (CUTRIC), which supports zero and low emissions transportation technologies in Canada, including electric buses, by developing industry-academic collaborations

- Performed a techno-economic analysis based on a general service electricity rate to showcase the potential savings of deploying electric buses instead of using conventional diesel bus in Matlab and Excel
- Lead and coordinated the academic team to facilitate collaborative work

ENGINEERING RESEARCH EXPERIENCE … cont'd

Research assistant, University of Victoria, Victoria BC. Oct 2015-Present
Created a model to estimate the energy consumption and battery lifetime of electric buses depending on its driving pattern to support the long-term adoption of the technology

- Developed and validated a battery degradation model coupled with an energy consumption numerical tool using Python and Fortran to simulate the decrease in battery capacity with time of an electric bus under typical driving conditions
- Wrote technical directed studies reports on battery electrochemistry to communicate my findings and learning outcomes
- Worked collaboratively with my team and gave regular work updates through team meetings and one-on-one meetings
- Interacted with businesses across Canada to build partnerships, including with major electric bus manufacturers

Research assistant, University of Victoria, Victoria BC. May 2013-Jan 2015
Assisted a PhD candidate in the post-processing of a model integrating wind power into smart grid systems

- Created a post-processing interface to plot data resulting from a large scale smart grid simulation using Matlab to assess the effect of including wind power into our electric grid
- Assisted in debugging the grid modeling tool developed by Gridlab-D, written in C++
- Co-wrote a paper in pending evaluation "Smart grid and demand response system for wind power integration: greenhouse gas mitigation and reduction of generator cycling" which include all the plots generated by the interface I created

Research assistant (Co-op), University of Victoria, Victoria BC.
Developed a model predicting the performance of a PEM Hydrogen Fuel cell subjected to tensile stress tests May 2013-Mar 2014

- Used COMSOL to create a 2D PEM fuel cell model introducing a tensile stress which accounted for the transport of mass, gas species, charged species, heat and liquid water
- Built a graphical user interface on Matlab to run and link Comsol simulation with Matlab post-processing tools

RELEVANT ENGINEERING PROFESSIONAL EXPERIENCE

MITACS Fellow (intern), CUTRIC, Victoria BC. Jul 2017 - Feb 2018
MITACS is a program that combines work experience and applied research to fulfill the company's (CUTRIC's) needs.

- Worked on improving the electric bus energy consumption model developed during my masters and run the model for various transit agencies across Canada that are planning to purchase electric buses
- Lead the UVic research team in charge of performing the techno-economic analysis to deploy electric buses
- Interacted daily with the largest Canadian bus and charger manufacturing companies (New Flyer, ABB, Siemens), electricity suppliers and transit agencies
- Added an Hydrogen Fuel cell bus model feature to the original model
- Studied the impact of charging battery electric buses in BC with fast charging stations

RELEVANT ENGINEERING PROFESSIONAL EXPERIENCE… cont'd

Modeling and Simulation Technician (Co-op), AFCC, Burnaby BC. Jan-Apr & Sept-Dec 2014
Worked in the modeling and simulation group of a company created by Ford and Daimler aiming to develop a hydrogen fuel cell vehicle

- Developed features on a 2D performance model implemented in Matlab and Python to predict the performance of hydrogen fuel cells which were used by all the employees of the company
- Revised the version of the performance model written in Fortran 77 to correct for bugs
- Created database standards for saving lab test results to facilitate the access of test data using an SQL server

PUBLICATIONS AND CONFERENCES

A.Franca, J. Petrunic , P. Amid, A. Jami, G. Duffy, J. Fernandez, C. Crawford and N. Djilali. "Predicting the operating costs and emission savings of battery electric buses". Poster. Generate 2017 Conference, Vancouver BC. Nov 2017

A.Franca, J. Fernandez, C. Crawford and N. Djilali. "Assessing the impact of an electric bus duty cycle on the battery pack life span". IEEE ITEC 2017 Conference, Chicago. Jun 2017

T. Broeer, F. Tuffner, A. Franca, and N. Djilali. "Smart grid and demand response system for wind power integration: greenhouse gas mitigation and reduction of generator cycling". Manuscript submitted for publication. Oct 2016

Attended EWB conference "Unite to Unlock" in Montreal as a co-president of the UVic chapter Jan 2015

RELEVANT TEACHING EXPERIENCE

Teaching Assistant, University of Victoria, Victoria BC. Sept 2016 - Aug 2017

- Taught a fourth year mechanical engineering elective class called "Thermo design systems" with a strong focus on heat exchangers and piping systems, which involved creating the class content and exams and grading the exams for the students
- Managed laboratory experiments with multiple groups of students and graded laboratorial reports for a third year heat transfer course

RELEVANT LEADERSHIP AND COMMUNITY EXPERIENCE

Member of the Sustainability Advisory Committee, University of Victoria, Victoria BC. Sept 2016-Oct 2017
Participated in meeting with Directors, Associate Directors, staff, faculty and students from different disciplines to provide advice, feedback, and to help shape some of the many sustainability initiatives that are underway or in discussion on campus.

IESVic Student Representative, University of Victoria, Victoria BC. May 2016-Mar 2018
Organized social activities for the research institute for Integrated Energy Systems of Victoria, regrouping 60+ students and faculty members. Organized events have involved a sailing/camping trip to Sidney Island for 20 people, an information session for undergraduate students to learn about the research done by the peers and lab tours. Currently organizing a ski trip on the Island for the group.

RELEVANT LEADERSHIP AND COMMUNITY EXPERIENCE… cont'd

Co-president, Engineers Without Borders (EWB), University of Victoria, Victoria BC. Oct 2014-Aug 2015
Restarted the EWB chapter including:

- Built a national and local network to start the venture
- Organized group event for the first time at UVic including the run to end poverty, fair trade pancake breakfast, kick-off meetings and professional talks. This included managing a team, helping members implementing their ideas and delegating tasks
- Run and lead weekly meetings for the 20 members
- Setup the shared folder and made sure every member had access to the right information
- Fundraised by giving presentations to professional organizations such as ASHRAE
- Setup early goals for the chapter and ensured to distribute tasks

AWARDS AND SCHOLARSHIP

Graduate Awards, University of Victoria, Victoria BC. Jan 2016-Present
Award from the faculty of graduate studies, for graduate students of high academic standing

Plint scholarship, University of Victoria, Victoria BC. May-Aug 2014
GPA based scholarship for outstanding students in mechanical engineering having completed a minimum of 10 courses over two semesters of their third year

Jamie Cassels Undergraduate Research Awards (JCURA), University of Victoria, Victoria BC. Sept 2013–Mar 2014
Award designed to provide support for conducting the research project to model a 2D hydrogen fuel cell

Merit based scholarship, SKEMA EAI, Antibes France. Sept 2011-Apr 2012
Award for having the best academic standing in engineering

MEDIA COVERAGE

"Fuel cell-powered studies – coops confirm international student's career choice in engineering", by Suzanna Ahearne. Cover article of "The Ring" magazine, University of Victoria's newspaper. Nov – Dec 2015
Regular print run 4,200 copies distributed throughout Canada.

INTERESTS

- Swimming
- Homemade Vegan Food
- Engineers Without Borders
- Hiking
- Crochet
- French Poetry
- Sailing
- Group Fitness
- Meditative Yoga

REFERENCES

Available upon request.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-2

Reference: Exhibit M2, Page 1

Question(s):

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.

Response(s):

a) CUTRIC is independent of the DRC. It was retained by counsel to DRC to undertake TRiPSIM© modelling and analysis and provide the evidence set out at Exhibit M2.

b) Please see DRC's notice of intervention dated October 16, 2018, counsel for Toronto Hydro's letters dated November 1 and 9, 2018, and subsequent DRC correspondence with the Board dated November 7 and 9, 2018 all of which are attached as Appendix A and may be found in the Board WebDrawer for this matter. The members of DRC for the purposes of this proceeding are the Electric Vehicle Society (end-use EV electricity customers) and Plug'n Drive.

c) CUTRIC is a Canada-wide, not-for-profit entity. Its research, mission and activities are focussed on the electrification of transportation. Its members are wide ranging and include academia (23 academic institutions), government entities (8), transit agencies (22), consultants,engineering firms and private sector entities (48), utilities (8), non-profit and other entities (7). A list of names of CUTRIC participating organizations is attached as Appendix B.

d) CUTRIC was engaged by counsel to DRC to use the TRiPSIM© model to undertake the high level analysis and consider: customer efficiencies that may be effected through progressive integration of EVs into electricity distribution systems; potential of EV, BEB, and EV related DER charging infrastructure as a reliability resource, and related operations and maintenance implications. Instructions from counsel to DRC, which we understand are subject to privilege, were provided by conference

calls with DRC and DRC counsel on January 14, 2019 and February 22, 2019. The cost estimate of approximately $15,000 to $25,000 to complete the work was provided to the Board on February 12, 2019.

e) Virtually no members of CUTRIC are solely in the business of providing equipment or installation of battery storage devices and/or vehicle battery charging stations. A number of CUTRIC's members may undertake related activities, including Siemens, ABB Group, e-Camion, Newmarket-Tay Power Distribution Ltd., and York Region Transit. We do not, however, have full knowledge of all of the EV, battery, and EV-related DER activities that CUTRIC members may be involved in.

f) Out of an abundance of caution CUTRIC has registered as lobbyist organization in Ontario in relation to consortium-led projects, such as the Pan-Canadian Electric Bus Demonstration & Integration Trial with Brampton Transit and York Region Transit. We expect that a number of CUTRIC academic, transit, government, utility, and other members may reasonably undertake specific government relations activity, however, CUTRIC neither tracks nor has knowledge of all members activities and government relations initiatives. DRC is not registered as lobbyist.

g) This question appears to be beyond the scope of the CUTRIC evidence. We do not, however, have full knowledge of all of the EV, battery, and EV related DER activities that CUTRIC members may be involved in. We expect that a number of CUTRIC academic, transit, government, utility, and other members may reasonably undertake specific government relations activity, however, CUTRIC neither tracks nor has knowledge of all members activities and government relations initiatives. DRC is not registered as lobbyist.

Out of an abundance of caution CUTRIC has registered as lobbyist organization in Ontario in relation to the Pan-Canadian

Electric Bus Demonstration & Integration Trial with Brampton Transit and York Region Transit. The lobbyist registry of the provincial Office of the Integrity Commissioner contains the listing of related meetings.

h) CUTRIC has no involvement in the TTC Downtown Relief Line Project. CUTRIC has no knowledge of any related member activities. This question appears to be well beyond the scope of the CUTRIC evidence.

DEMARCO ALLAN LLP

Jonathan McGillivray
Associate

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October 16, 2018

Filed on RESS and Sent via Courier

Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319, 27th Floor
2300 Yonge Street
Toronto ON M4P 1E4

Dear Ms. Walli:

Re: Toronto Hydro-Electric System Limited
Application for order or orders approving or fixing just and reasonable distribution rates and other charges, effective January 1, 2020 to December 31, 2024
Board File No. EB-2018-0165

We are counsel to the Distributed Resource Coalition (**DR Co.**). Please find enclosed DR Co.'s Notice of Intervention requesting intervenor status and cost eligibility in the above-noted proceeding.

Sincerely,

Jonathan McGillivray

ONTARIO ENERGY BOARD

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

AND IN THE MATTER OF an application by Toronto Hydro-Electric System Limited (**Toronto Hydro**) for an order or orders approving or fixing just and reasonable distribution rates and other charges, effective January 1, 2020 to December 31, 2024.

EB-2018-0165

NOTICE OF INTERVENTION

OF

DISTRIBUTED RESOURCE COALITION

(DR Co.)

October 16, 2018

A. Application for Intervenor Status

1. The Distributed Resource Coalition (**DR Co.**) hereby requests intervenor status in the matter of the application of Toronto Hydro for an order or orders approving or fixing just and reasonable distribution rates and other charges, effective January 1, 2020 to December 31, 2024. This notice of intervention is filed pursuant to Rule 22 of the Board's Rules of Practice and Procedure.

2. Toronto Hydro is seeking approval of its proposed (i) electricity distribution rates and other charges effective January 1, 2020 and (ii) Customer Price Cap Index framework to set distribution rates effective for the period January 1, 2021 to December 31, 2024.

3. DR Co.'s participation would focus on the following issues, if the Board accepts its application for intervenor status:

   (a) connection of distributed energy resources (**DERs**) to the electricity grid;

   (b) DERs as a reliability resource for Toronto Hydro;

   (c) integration of DERs into local distribution system planning and related O&M considerations;

   (d) DER considerations for rate design;

   (e) DER considerations for cost allocation.

B. DR Co. and its Interest in the Proceeding

4. DR Co. is a group of electricity customers and consumers that consists of end-use residential customers, small- and medium-sized commercial and industrial customers, non-profit organizations, and owners' associations that are directly affected by and interested in (i) optimizing existing energy assets, (ii) efficiently facilitating the integration of existing and innovative DERs to achieve customer and grid solutions, and (iii) providing input on direct customer needs and local distribution company opportunities relating to DERs. DR Co. hopes to further these interests for the benefit of each and all of end-use customers, DER providers, utilities, and the regulatory regime.

5. DR Co. has a direct and substantial interest in the proceeding in that its members are directly affected by the rates, services, and approaches being proposed in Toronto Hydro's application and specifically in the Customer Price Cap Index framework. DR Co.

anticipates significant integration of DERs into the Toronto Hydro grid and customer base during the 2021 to 2024 period covered by the Customer Price Cap Index framework. DR Co. therefore has a substantial interest in the proceeding, including insofar as it addresses integration of DERs into local distribution system planning (including O&M considerations), rate design, and cost allocation.

6. The members of DR Co. in connection with this proceeding are Toronto Hydro customers that include, subject to further update, the Electric Vehicle Society (end-used electric vehicle electricity customers), Plug'n Drive, Energy Storage Canada, and Spark Power Corp.

7. DR Co. hopes to provide the Board with the currently absent, unique perspective of DER residential customers, small commercial and industrial customers, as well as DER-related non-profit organizations, owners, and developers, each of which may be materially affected by the outcome of this proceeding.

Background on DERs

8. The Independent Electricity System Operator (**IESO**) defines DERs as "electricity-producing resources or controllable loads that are directly connected to a local distribution system or connected to a host facility within the local distribution system."[1] DERs may include electric vehicles, energy storage, net-metering, solar panels, smart grid technologies, combined heat and power plants, natural gas-fuelled generators, and controllable loads (HVAC systems and electric water heaters). These resources are typically smaller in scale than the traditional generation facilities that serve most of Ontario demand.

9. Technological advancements, climate change realities, and growing consumer opportunities are leading to an increase in DERs across North America. The deployment of renewable distributed generation and energy storage facilities is increasing across Ontario. The number of electric vehicles and related charging stations in Toronto and Ontario has increased exponentially. Year-over-year Ontario EV sales grew by 273% in the second

[1] Independent Electricity System Operator, *Ontario's Power System*, "Distributed Energy Resources", available online at: http://www.ieso.ca/en/Learn/Ontario-Power-System/A-Smarter-Grid/Distributed-Energy-Resources.

quarter of 2018, as compared to the second quarter of the previous year.[2] DERs are anticipated to grow at a significant annual rate during the 2021 to 2024 period covered by Toronto Hydro's Customer Price Cap Index framework.

10. Output from DERs may offset and/or inform the pacing of distribution asset decisions and facilitate efficiency. This is creating both new opportunities and challenges for the electricity sector that would benefit from the Board's purview informed by the insight of DR Co.

11. DERs can also offer greater customer choice. Specifically, the IESO reports that through its regional planning process, certain communities expressed a preference for DERs to address regional demand growth or to replace aging assets.[3] DERs may also present opportunities to optimize overall system investments and provide a range of grid services that are also financially beneficial to utilities. The IESO also indicates that visibility of DER activity is important and that the Ontario electricity system may benefit from DERs for the provision of reliability services and incorporation into electricity markets.[4]

12. A number of innovative DER pilot programs and procurements also stand to enhance the relevance of ensuring a DER perspective in utility proceedings. They include: a demand response pilot,[5] aggregated distributed solar and battery resources,[6] and energy storage procurement.[7]

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[2] Eric Schmidt, "Electric Vehicles Sales Update Q2 2018, Canada", FleetCarma (August 10, 2018), available online at: https://www.fleetcarma.com/electric-vehicles-sales-update-q2-2018-canada/.
[3] Independent Electricity System Operator, *Ontario's Power System*, "Distributed Energy Resources", available online at: http://www.ieso.ca/en/Learn/Ontario-Power-System/A-Smarter-Grid/Distributed-Energy-Resources.
[4] Independent Electricity System Operator, *Ontario's Power System*, "Distributed Energy Resources", available online at: http://www.ieso.ca/en/Learn/Ontario-Power-System/A-Smarter-Grid/Distributed-Energy-Resources.
[5] Independent Electricity System Operator, *Markets and Related Programs*, "Demand Response Pilot", available online at: http://www.ieso.ca/Sector-Participants/Market-Operations/Markets-and-Related-Programs/Demand-Response-Pilot.
[6] Alectra Utilities, "POWER.HOUSE", available online at: https://www.powerstream.ca/innovation/power-house.html.
[7] Independent Electricity System Operator, *Energy Procurement Programs and Contracts*, "Energy Storage", available online at: http://www.ieso.ca/Sector-Participants/Energy-Procurement-Programs-and-Contracts/Energy-Storage.

C. Nature and Scope of DR Co.'s Intended Participation

13. DR Co. intends to be an active participant in this proceeding and will act responsibly to coordinate with other intervenors where common issues may arise and be otherwise addressed. DR Co. otherwise intends to participate actively in order to test evidence in accordance with the stipulated processes and timelines, and provide argument. It reserves the right to adduce evidence should the Board's procedures provide for same.

D. Costs

14. DR Co. is, in accordance with s. 3.03(a) of the Board's *Practice Direction on Cost Awards* (the **Practice Direction**), eligible to seek an award of costs as DR Co. is a party that primarily represents the direct interests of consumers (residential customers, small- and medium-sized commercial and industrial customers) in relation to services that are regulated by the Board. DR Co. is also, in accordance with s. 3.03(b) of the Practice Direction, eligible to seek an award of costs as DR Co. represents organizations that have a policy interest in electricity conservation and demand management, implementation of a smart grid in Ontario, promotion of the use of electricity from renewable energy sources, each of which are components of the Board's mandate and relevant to the proceeding.

15. DR Co. therefore requests cost eligibility in this proceeding as its comments will serve an important and unique interest and policy perspective relevant to the Board's mandate, which has heretofore not been represented or heard.

E. DR Co.'s Representatives

16. DR Co. hereby requests that further communications with respect to this proceeding be sent to the following:

Electric Vehicle Society
9 Industrial Pkwy S
Aurora, ON L4G 3V9

Attention: Wilf Steimle
Email: wilf@steimle.ca

AND TO

Plug'n Drive
1126 Finch Avenue West, Unit 1
North York, ON M3J 3J6

Attention: Iris Spitz
Telephone: 647-717-6941
Email: iris@plugndrive.ca

AND TO

Energy Storage Canada
MaRS Cleantech, Suite 420
101 College St.
Toronto, ON M5G 1L7

Attention: Patricia Phillips
Telephone: 416-997-3095
Email: pat.phillips@energystoragecanada.org

AND TO

Spark Power Corp.
1315 North Service Road East, Suite 300
Oakville, ON L6H 1A7

Attention: Gord Reynolds
Telephone: 416-732-2200
Email: greynolds@sparkpower.ca

AND TO ITS COUNSEL

DeMarco Allan LLP
Bay Adelaide Centre
333 Bay Street, Suite 625
Toronto, ON M5H 2R2

Attention:	Lisa (Elisabeth) DeMarco
Telephone:	647-991-1190
Facsimile:	1-888-734-9459
Email:	lisa@demarcoallan.com

Attention:	Jonathan McGillivray
Tel:	647-208-2677
Facsimile:	1-888-734-9459
Email:	jonathan@demarcoallan.com

ALL OF WHICH IS RESPECTFULLY
SUBMITTED THIS
16th day of October, 2018.

Lisa (Elisabeth) DeMarco
DeMarco Allan LLP
Counsel for Distributed Resource Coalition

TORYS LLP

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November 1, 2018

Ontario Energy Board
P.O. Box 2319
27th Floor, 2300 Yonge Street
Toronto, ON M4P 1E4

Attention: Ms. K. Walli, Board Secretary

Dear Ms. Walli:

Re: EB-2018-0165 – Toronto Hydro Electric System Limited ("Toronto Hydro") Custom Incentive Rate Application 2020-2024

We are counsel to Toronto Hydro in the above-noted matter. We are in receipt of Procedural Order No. 1 issued by the Ontario Energy Board (the "Board") on October 25, 2018, which indicated that the Distributed Resource Coalition ("DRC"), among others, had been approved for intervenor status. We are also in receipt of an intervention request from Mowat Energy dated October 26, 2018.

In brief, and for the reasons set out below, Toronto Hydro asks that the Board: (a) deny Mowat's request for intervenor status; and (b) reconsider its Order and deny intervenor status to the DRC unless the membership is revised to exclude Spark Power and Energy Storage Canada ("ESC").

(a) Mowat Energy

Mowat applied for intervenor status in Hydro One Distribution's current multi-year distribution rate application (EB-2017-0049). In Procedural Order No. 1 in that proceeding, the Board considered and denied Mowat's request. The Board held:

> While the OEB appreciates Mowat's research function, a distribution utility's rate case is not a research forum and it is important for the OEB to ensure that the time and resources allocated to a rate case are as time and cost efficient as possible.[1]

Nothing about Mowat's function as a research hub has changed since the Board's decision in EB-2017-0049 and it remains equally true that this rate application is not a research "forum." Toronto Hydro submits that the Board's decision in EB-2017-0049 applies here, and Mowat should be denied intervenor status.

(b) Distributed Resource Coalition

The Procedural Order indicates that the Board received an application for intervenor status from the DRC, that Toronto Hydro did not object to that application, and that DRC was approved by the Board as an intervenor. Toronto Hydro has reviewed its records. DRC did not provide Toronto Hydro with its application for intervenor status and the utility was entirely

[1] Procedural Order No. 1, EB-2017-0049, p. 6

unaware of the application until receipt of the Procedural Order.

Toronto Hydro has now reviewed DRC's application on the Board website. The application indicates that DRC is a coalition made up of several entities including Spark Power Corp. and ESC. While Toronto Hydro does not in principle object to coalitions obtaining intervenor status, it observes that the membership of any coalition is an important factor in this regard. Here, Toronto Hydro's understanding is that the DRC is comprised, at least, in part of commercial interests some of which have no customer relationship with Toronto Hydro.

Spark Power is a commercial enterprise. Its shares are publicly traded, and its description of itself on its website makes its commercial nature clear:

> Spark Power provides electrical power services and solutions to North American industrial, commercial, institutional, renewable, and agricultural customers, as well as utility markets including municipalities, universities, schools, and hospitals.
>
> The power and energy sector is transforming from a unilateral monopoly into an integrated, networked ecosystem with consumers becoming producers. The emergence of new technologies, consumer demand, regulatory environment and innovative businesses creating new power alternatives are driving and accelerating this change. Spark Power, with diversified interests in the power services and renewable power sectors, is helping to revolutionize the way electricity infrastructure services are delivered.

Spark Power is not a Toronto Hydro customer.

ESC is itself a separate coalition or association made up of largely commercial interests in the energy storage space.[2] Some, such as Sigma Energy Storage, Boralex and Stem Energy Superintelligence equally are not customers of Toronto Hydro. Sigma, for example, appears to be a Quebec based company.

ESC applied for intervenor status in EB-2017-0049. The Board considered and initially denied that request, stating that it was "unclear how ESC members will be directly and materially affected by the outcome of this hearing, except potentially with respect to commercial interests, which are not part of the mandate of the OEB to consider."[3]

Ultimately, in response to an unopposed motion to review, the Board revised its decision and granted ESC intervenor status but circumscribed its eligibility for costs.[4] The Board based its revised decision on new information provided by ESC to the effect that energy storage providers were "within the class of customers directly and materially affected by … rates being set in the Proceeding."[5] In other words, evidence showing that ESC's members were Hydro One customers.

In Toronto Hydro's submission, the following relevant principles emerge from the Board's decisions in EB-2017-0049:

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[2] www.energystoragecanada.org

[3] Procedural Order No. 1, EB-2017-0049, p. 6

[4] Decision on Motions to Review Intervention Request Decisions, November 2, 2017, EB-2017-0049, p. 2. As the Board held, "any interest that ESC may have in alternatives to Hydro One's plans for its distribution system would generally be commercial in nature and not eligible for cost awards."

[5] EB-2017-0049, ESC letter to the OEB dated September 6, 2017

1. Protection of a commercial interest does not form part of the Board's mandate and that interest does not justify a request for intervenor status.

2. Where a commercial enterprise is also a consumer of electricity its interest as a consumer may justify intervention.

3. Even where intervention has been granted, the commercial enterprise will not be eligible for costs in relation to matters concerning its commercial interest.

Had Toronto Hydro been aware of DRC's request for intervenor status it would have objected to that request. In Toronto Hydro's submission, the application of the principles from EB-2017-0049 leads to the conclusion that DRC is not an appropriate party. Spark Power is clearly caught by principle 1. above and not saved by 2. The same is equally true for at least some of the members of ESC, such as Sigma and the companies identified above, compromising ESC's status as a proper party. The fact that these parties have elected to apply for intervenor status through a coalition does not change the fact that their commercial interests are not "part of the mandate" of the Board, that they have no customer relationship with Toronto Hydro and are unaffected by the rates set in this proceeding. Put simply, they should not be permitted to do indirectly – intervene through the DRC – what they could not do directly. Moreover, even in relation to those ESC members who are Toronto Hydro customers it is unclear how their interests are not already adequately protected by other, proper intervenors

Toronto Hydro respectfully submits that unless the DRC confirms that Spark Power and ESC have been removed from the coalition and confirms that they will not participate directly or indirectly in the coalition's intervention, then the Board should deny DRC intervenor status.. For clarity, Toronto Hydro notes that in the event these members are no longer part of the coalition, it does not object to the intervention request of DRC.

As a final matter, earlier this week Toronto Hydro received signed undertakings with respect to confidentiality from counsel for the DRC. Toronto Hydro will await direction from the Board regarding the matters set out above before sending confidential matters to counsel.

Yours truly,

Crawford Smith

DEMARCO ALLAN LLP

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November 7, 2018

Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319, 27th Floor
2300 Yonge Street
Toronto ON M4P 1E4

Dear Ms. Walli:

Re: EB-2018-0165: Response to letter of November 1, 2018 and submissions on confidentiality requests

We are counsel to the Distributed Resource Coalition (**DRC**) in the EB-2018-0165 distribution rates proceeding (the **Proceeding**) and in receipt of Mr. Smith's letter dated November 1, 2018 (the **Letter**). We write in response to the Letter, to provide the DRC's submissions on the confidentiality requests made by the Applicant in accordance with Procedural Order No. 1 (**PO1**), and to provide an administrative correction.

Response to Letter

In the Letter, Mr. Smith objects to the Board's approval of DRC as an intervenor after the Board's deadline for doing so, apparently on the basis that DRC includes certain commercial customers directly or indirectly in its broad membership (the **Late Objection**). Spark Power Corp. (**Spark Power**) is no longer participating in DRC for the purpose of the Proceeding. Energy Storage Canada (**ESC**) is a collective of energy storage entities, many of which are customers of the Applicant.

The Late Objection appears to be based on the grounds that Spark Power, ESC, or certain of ESC's members, are commercial customers and not end-use consumers. The Late Objection is therefore at odds with the Applicant's acceptance of other commercial/industrial intervenor groups, and curious given the long-standing history of commercial and industrial customer interests being appropriately represented in Ontario Energy Board rate proceedings that may impact them. Specifically, each and all of AMPCO, BOMA, and SEC are, and have been, approved, cost eligible intervenors. None of these intervenors met with objection.

Similarly, we note that not all members of AMPCO, BOMA, and SEC are direct customers of the Applicant. Therefore, if the Board were to accept the direct customer rationale in the Letter, none of AMPCO, BOMA, SEC, or IGUA would be permitted the right to be heard in accordance with the procedural fairness that has, and should continue to be, afforded to them for the benefit of all ratepayers in a wide variety of Board proceedings. Further, the Letter appears to rely upon Board jurisprudence that supported ESC's customer/intervenor status and cost eligibility in EB-2017-0049. In that proceeding, the Board reversed its initial exclusion of ESC, and upheld ESC's intervenor status and cost eligibility.[1] Moreover, the exclusion of the customers included in ESC appears to be inconsistent with section 22.02 of the Board's *Rules of Practice and Procedure*, as revised (the **Rules**), which would allow for the grant of intervenor status to entities that have a substantial interest, and will participate actively and responsibly, in the proceeding.[2] The inclusion of ESC is also supported by common law jurisprudence, which confirms that an entity whose legal rights or interests will be directly affected by a regulatory decision should generally be afforded standing to participate in a tribunal's decision-making process on the matter.[3]

Finally, DRC submits that its coalition model may best support the Board's enhanced efficiency and customer protection mandates, and the Applicant's prudent initiatives to address reliability, affordability, innovation, and related challenges. DRC confirms that it:

- has a direct and substantial interest in the Proceeding, in that members of DRC are directly affected by the rates, services, and approaches being proposed in Toronto Hydro's application and specifically in the Customer Price Cap Index framework;

- anticipates significant integration of DERs into the Toronto Hydro grid and customer base during the 2021 to 2024 period covered by the Customer Price Cap Index framework; and

- therefore has a substantial interest in the Proceeding, including insofar as it addresses integration of DERs into local distribution system planning (including O&M considerations), rate design, and cost allocation.

We therefore request that the Board clarify that ESC as a group of commercial/industrial customers, including customers of the Applicant, is generally appropriately included as a potential intervenor. We nonetheless note that ESC will not be taking an active role in DRC for this Proceeding, but reserves the right, subject to the Board's approval, to intervene actively in future similar proceedings. Alternatively, the Board may wish to understand how commercial industrial customers represented by all other relevant intervenors are afforded standing when other commercial customers are not. In the event that the Board is, in fact, considering excluding only one type of commercial/industrial customer from having standing in a proceeding that directly affects them and the rates and fees that they pay, the Board may wish to seek the input of all potentially impacted customer groups in this Proceeding (including, without limitation, AMPCO, SEC, BOMA) in order to avoid unintended and perverse outcomes that impede the Board's customer service mandate.

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[1] EB-2017-0049, Decision on Motions to Review Intervention Request Decisions (November 2, 2017) at 2.
[2] Ontario Energy Board *Rules of Practice and Procedure* (last revised October 28, 2016), section 22.02.
[3] Sara Blake, *Administrative Law in Canada*, 6th ed (LexisNexis, 2017) at 28; see generally *Corp. of the Canadian Civil Liberties Association v Ontario (Civilian Commission on Police Services)*, [2006] OJ No 4699 (ONCA), leave to appeal refused [2007] SCCA No 40; *Alberta Wilderness Association v Alberta (Environmental Appeal Board)*, [2013] AJ No 72; *Pembina Institute v Alberta (Environment and Sustainable Resources Development, Director)*, [2013] AJ No 1047.

Procedurally, the Late Objection is also at odds with the timing and process dictated by the Board in PO1 and the Rules. The Applicant was made aware of DRC's intent to intervene in writing on October 3, 2018 and DRC filed its Notice of Intervention requesting status and cost eligibility (the **Notice**) with the Board on October 16, 2018. The Notice was filed in accordance with the Rules and through the RESS system, which we understood to effect service on counsel. No objection was received on or before the timelines dictated by section 22.07 of the Rules, and in fact a further nine (9) days passed after the requisite date for objections before the Letter was filed. We therefore request that the Board give minimal weight and consideration to the Late Objection given its timing and impact on the orderly procedures set out by the Board in this Proceeding and the Rules, and the clarifications provided in this letter.

Confidentiality Requests

The Letter also advises of counsel's departure from the Board's direction in PO1, the Rules, and normal practice on confidentiality claims. PO1 requires the Applicant to provide the confidential materials to all counsel who have signed the Declaration and Undertaking with respect to confidential information. This includes counsel for DRC, who have signed the Declaration and Undertaking. However, the Letter indicates that Mr. Smith has unilaterally determined that the materials need, and will, not be provided to DRC counsel without further direction of the Board. DRC has therefore been deprived of the procedural rights afforded to it and the other Board-approved intervenors to make full response on the confidentiality claim and hereby reserves the right to do so once provided with the materials. In the absence of the specific filings that the Board ordered disclosed, and the inability to better assess the Applicant's confidentiality claim, DRC only generally relies upon the Rules to submit that the process should favour openness, transparency, and disclosure. DRC therefore submits that the materials should be disclosed, and where need be, the Applicant should be afforded the ample protections of the confidentiality and undertaking process.

Administrative Matters

Please update the Board's contact information for this Proceeding to reflect the correct telephone number for Mr. Steimle of the Electric Vehicle Society, which is 416.230.9271.

Sincerely,

Lisa (Elisabeth) DeMarco

c. Crawford Smith and Charles Keizer, Torys LLP
Andrew Sasso, Toronto Hydro
Distributed Resource Coalition

TORYS LLP

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November 9, 2018

Ontario Energy Board
P.O. Box 2319
27th Floor, 2300 Yonge Street
Toronto, ON M4P 1E4

Attention: Ms. K. Walli, Board Secretary

Dear Ms. Walli:

Re: EB-2018-0165 – Toronto Hydro Electric System Limited ("Toronto Hydro") Custom Incentive Rate Application 2020-2024

We are counsel to Toronto Hydro in the above-noted matter. We write further to our letter dated November 1, 2018 and in response to letters received from Mowat Energy and counsel for the Distributed Resource Coalition ("DRC").

(a) Mowat Energy

Mowat concedes its request for intervenor status was denied by the Ontario Energy Board (the "Board") in EB-2017-0049. It tries to justify a different result here by taking issue with the Board's characterization of Mowat's role in that case. As it says, "[t]he fact is that Mowat is not proposing to engage in the subject case as a research organ, but rather as an organization that has engaged in highly focused analysis on subjects that are directly relevant to the Toronto Hydro Application." Respectfully, this is a distinction without a difference, necessarily so. Mowat is a research hub and its only interest in Toronto Hydro's application could be further to that function. But, the Board has already decided that "a distribution utility's rate case is not a research forum..." and Mowat's request should be denied.[1]

(b) Distributed Resource Coalition

In our letter dated November 1, 2018 we set out Toronto Hydro's position that the Board should deny the DRC intervenor status unless its membership was revised to exclude Spark Power and Energy Storage Canada ("ESC"). We based our submission on principles relating to intervention which emerge from the Board's decisions in EB-2017-0049 at first instance and on motion to review. Those principles bear repeating:

1. Protection of a commercial interest does not form part of the Board's mandate and that interest does not justify a request for intervenor status.

2. Where a commercial enterprise is also a consumer of electricity its interest as a consumer may justify intervention.

3. Even where intervention has been granted, the commercial enterprise will not be eligible for costs in relation to matters concerning its commercial interest.

[1] Procedural Order No. 1, EB-2017-0049, p. 6

DRC's response by letter dated November 7, 2018 is confusing and inconsistent with these principles. While stating that Spark Power is no longer a member of the DRC,[2] DRC is cryptic about ESC's role. The letter says ESC "will not be taking an active role in DRC for this Proceeding." What this means is entirely unclear as nothing about the DRC – how it is organized, provides instructions, formulates questions, develops or takes positions, shares materials with coalition members or prepares argument – is explained either in the letter or intervention request. The only conclusion that can be drawn is that however active, ESC remains a member of the DRC for the purpose of this proceeding. Toronto Hydro submits that this alone should be sufficient to disqualify DRC from intervenor status.

To meet the requirements of Rule 22 of the Board's *Rules of Practice and Procedure*, an intervenor must have a "substantial interest" in the proceeding. Consistent with (1) above, that interest cannot be commercial. But that is precisely the interest of ESC's commercial energy storage members, a number of which are not Toronto Hydro customers (or even Ontario businesses). Confirming that other DRC members have a direct interest in the proceeding misses the point. So do references to case law that would support the right of those parties to intervene. The inescapable problem is ESC is founded on the purpose of advancing the commercial interest of its members as providers of energy products and services. ESC is very upfront about this point on the front page of its website where it states, "Energy Storage Canada (ESC) is the voice of leadership for energy storage and the only industry association in Canada that focuses on advancing opportunities and building the market for energy storage. ESC leverages the strength of our diverse membership to drive market development in Canada."[3] (emphasis added) ESC is attempting to shelter the commercial interest of its members as part of a coalition. As set out in our November 1 letter, ESC should not be permitted to do indirectly – intervene through the DRC – what it could not do directly. To permit otherwise would fundamentally undermine the purpose and requirements of Rule 22.

Likewise, comparisons to AMPCO, BOMA, and SEC do not assist the DRC and are not at all analogous. These other intervenors represent groups of consumers, gathered together in their common interests as consumers. They are not commercially active in the energy sector. They do not sell electricity products and services to consumers. They do not have a mission of "building the market" for services that are similar to or compete with Toronto Hydro.

With respect to service, DRC did not serve notice of intervention on October 3. On that day, counsel sent an email to Toronto Hydro about a possible intervention by a group that had yet to be defined in name or membership. Its intention to intervene was never confirmed, and no notice of intervention ever provided. Ultimately, the utility only became aware of DRC's intervention on review of Procedural Order No. 1. It moved promptly thereafter to register its concerns with respect to that intervention.

The issues pertaining to DRC's membership and request for intervenor status have created a delay in the process set out in the Board's Order. In the event the Board confirms DRC's intervenor status, DRC may require time to make a submission with respect to confidential information. Toronto Hydro proposes that the Board provide DRC with 5 days to make that submission following the Board's decision concerning DRC's status, and that the Board extend Toronto Hydro's deadline to file the final submission regarding confidential information to a date that is 2 days following the DRC submission date.

[2] Addressing the first of Toronto Hydro's two objections to DRC's intervention request.

[3] http://energystoragecanada.org/

Yours truly,

Crawford Smith

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November 9, 2018

Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319, 27th Floor
2300 Yonge Street
Toronto ON M4P 1E4

Dear Ms. Walli:

Re: EB-2018-0165: Response to letter of November 9, 2018

We are counsel to the Distributed Resource Coalition (**DRC**) in the EB-2018-0165 distribution rates proceeding (the **Proceeding**) and in receipt of Mr. Smith's letter of today's date.

It is with the greatest respect that we submit that Mr. Smith's submissions appear to be supported neither by fact nor law, and are also inconsistent with his November 1, 2018 letter. His assertions regarding DRC's founding principles are both not within his knowledge nor factual.

Energy Storage Canada (**ESC**) is a small, non-profit association of energy storage-interested entities, including direct customers of the Applicant. DRC's letter of November 7, 2018 clearly indicates that ESC will not be participating in DRC for this Proceeding. Mr. Smith's attempt to exclude all of DRC (including the two groups of electric vehicle-focused electricity consumers) from the Proceeding is entirely inconsistent with his November 1, 2018 letter and not supported by law.

Thank you for your accurate consideration of the above and our letter dated November 7, 2018.

Sincerely,

Lisa (Elisabeth) DeMarco

c. Crawford Smith and Charles Keizer, Torys LLP
Andrew Sasso, Toronto Hydro
Distributed Resource Coalition

CUTRIC Member List
(as of April 1, 2019)

Academia	Consultants, Engineering Firms and Private Sector	Government Entities	Transit Agencies	Utilities	Non-Profit / Other
Brock University	2getthere	Capital Area Transit Coordinating Committee	Belleville Transit	Burlington Hydro	Association du transport urbain du Québec (ATUQ)
Carleton University	ABB Group	Cochrane (Town of)	Brampton Transit	Enbridge Gas Distribution Inc.	Canadian Urban Transit Association (CUTA)
Centennial College	Advanced Technology Emissions Solutio	City of Red Deer	Burlington Transit	ENMAX	EnergieInstitut- The Energy Institute of the Johannes Kepler University
Concordia University	Alstom	Oxford County	Calgary Transit	Fortis BC	InnovÉÉ
Conestoga College	ATCO Electric	City of Surrey	Red Deer Transit	Manitoba Hydro	Ontario Good Roads Association (OGRA)
Lambton College	Ballard Power Systems Inc.	Transport Canada	Durham Region Transit	Newmarket-Tay Power Distribution	Ontario Public Transit Association
OCAD University	Bombardier Transportation	Vancouver (City of)	Grand River Transit	Ontario Power Generation	Ontario Society of Professional Engineers (OSPE)
Queen's University	Brens North America	York Region Rapid Transit Corporation (YRRTC)	Halifax Transit	Toronto Hydro	
Red River College	Canadian Nuclear Laboratories (CNL)		Kingston Transit		
Ryerson University	Carlsun 7GFUEL		Le Service de Transport en Commun de Trois-Rivières		
Sheridan College	Dentons Canada LLP		London Transit		
St. Clair College	dynaCERT Inc.		Milton Transit		
Université du Québec à Trois-Rivières (UQTR)	EasyMile		MiWay		
University of Alberta	eCAMION		St. Catharines Transit Commission		
University of British Columbia Okanagan (UBCO)	Electric Tractor Inc.		Thunder Bay Transit		
University of Calgary	ELIX Wireless		Toronto Transit Commission		
University of Manitoba	EllisDon		TransHelp		
University of Ontario - Institute of Technology	GreenPower Bus		Transit Windsor		
University of Toronto	GV Energy Inc.		TransLink		
University of Waterloo	Heliox		Winnipeg Transit		
University of Windsor	HiHo Mobile		Woodstock Transit		
Western University	Hydrogenics		York Region Transit		
York University	InvertedPower				
	Logistrics				
	Microgreen Solar Corporation				
	MUVE				
	NAVYA				
	New Flyer Industries				
	Nova Bus/Prevost				
	Pacific Western Transit				
	Pantero Group				
	Pantonium				
	Pink Slip Group				
	Proterra Inc.				
	s2e Technologies				
	Sandler Consultancy				
	Siemens Canada				
	SmartCone Technologies Inc.				
	SP North America				
	Stantec Consulting Ltd.				
	StarPower ON Systems Inc.				
	Tech-K.O.				
	Thales				
	The Energy Conservation Group Corporation (TECGC)				
	Tokmakjian Group				
	ViriCiti				
	FPInnovations (PitGroup)				
	Winnipeg Airports Authority				

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-3

Reference: Exhibit M2 / p. 1 and 5

Question(s):

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.

Response(s):

a) Please refer to our responses to interrogatories M2-Staff-1 and M2-Staff-3.

b) CUTRIC has undertaken the Exhibit M2 modelling and analysis and prepared the evidence independently on behalf of DRC as instructed by DRC counsel. CUTRIC undertakes academic, economic, and modelling analysis in relation to the electrification of transportation. It does not “promote battery storage devices and/or vehicle battery charging stations”. It has not met with the Board or Toronto Hydro on this matter.

c) Please see our response to interrogatory M2-EP-2(b). CUTRIC has no agreement with Toronto Hydro in relation to the evidence in Exhibit M2 and does not believe there to be any such agreement.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-4

Reference: Exhibit M2 / p. 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".

Question(s):

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.

Response(s):

a) In this context, "customer efficiency" refers to customers and fleets being able to achieve overall energy savings that may include distribution savings and broader bill reductions.

b) Please see our response to interrogatory M2-Staff-1 and M2-Staff-3.

c) This question is beyond the scope of the evidence provided by CUTRIC. There are a number of organizations that provide foundational information on energy storage including battery energy storage including the US-based Energy Storage Association: http://energystorage.org/energy-storage/energy-storage-technologies

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-5

Reference: Exhibit M2 / p. 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)."

Question(s):

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?

Response(s):

a) CUTRIC refers to optimizing the useful life of distribution assets in part by providing EV-related DER alternatives and harnessing benefits that may result from EVs, including over-night and seasonal charging, particularly given the use of bidirectional energy flow. Specific data would be contingent on Toronto Hydro's specific DSP planning and implementation.

b) CUTRIC refers to potentially reduced OM&A costs that may result in part from EV-related DER alternatives and harnessing benefits that may result from EVs including over-night and seasonal charging, particularly given the use of bidirectional energy flow. Specific data would be contingent on Toronto Hydro's specific DSP planning and implementation.

c) CUTRIC refers to service reliability as such term is referenced in the Handbook to Utility Rate Applications and the Board's Report on Electricity Distribution Systems: Reliability Measures and Expectations (EB-2014-0189). We also note that the Board has recently approved, with encouragement and direction, the use of distributed energy storage resources to enhance reliability in its EB-2017-0049 Decision and Order. Please see our response to interrogatory M2-Staff-1.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-6

Reference: Exhibit M2 / p. 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)."

Question(s):

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

Response(s):

a) Please see our response to interrogatory M2-EP-5(c).

b) EVs may be used backup storage devices or effective distributive energy generators. They may provide emergency power, smartly deployed storage charging when the grid is cheapest and power is lowest emitting. Artificial intelligence "smart controls" exist and will allow many EVs and BEBs to power at a time that is optimal for the grid. Smart deployment of EVs and allied storage devices may assist in overall cost savings and grid management.

c) The OPG reports that surplus baseload generation (which is comprised largely of the cleanest and cheapest hydro power in the province) was associated with losses in the range of 5.9 TWh and 4.7 TWh of hydroelectric generation during 2016 and 2017, respectively. These figures are not broken down by service area.

d) Please see our response to interrogatory M2-EP-6(c).

e) Please see our response to interrogatory M2-EP-6(c).

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-7

Reference: Exhibit M2 / p. 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."

Question(s):

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.

Response(s):

a) Yes. The grid may withdraw power from batteries in plugged-in battery-powered electric vehicles during peak times and during a power outage. Vehicles and related charging

equipment allow customers and the utility to withdraw power from a vehicle or fleet of vehicles for grid or demand management purposes. The level and extent of power withdrawal from EVs may be the subject of advanced agreement on the residual state-of-charge between the vehicle or vehicle fleet owner/electricity customer (typically the same) and the utility. For example, a customer may choose to have maximum emergency household back up power and subscribe to full EV depletion in the interest of home power. Other customers/homeowners may subscribe to a 50% depletion program to leave a residual state of charge in the vehicle for use regardless of whether the grid has been restored. With smart controlled systems, customers have considerable discretion to set their personal or fleet-based preferences and Toronto Hydro could offer differing incentive programs for a deeper state of charge depletions. This type of dynamic incentivization may be used for a variety of grid management purposes but during and beyond emergencies.

b) Please see our response to interrogatory M2-EP-7(a). The CUTRIC evidence does not include reducing TTC service during peak periods or power outages. CUTRIC considered the integration of EV-related DER charging and storage equipment to enable cost effective 24-hour charging and assist in grid management.

c) “AI” refers to use of computer systems that are able to perform tasks that normally require human intelligence, including specified decision-making. Many versions of “AI” in the energy sector fall under the general category of “smart controls”. Many utility “smart grid” investments enable further integration of AI to facilitate grid optimization. The nature, extent, and status of Toronto Hydro’s smart grid/AI integration initiatives are not within the scope of the CUTRIC evidence.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-8

Reference: Exhibit M2 / p. 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."

Question(s):

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?

Response(s):

a) Please refer to our response to interrogatory M2-EP-7(c).

b) Cycling of batteries may shorten battery lifespan. Differing chemistries and battery structures may perform differently. In the case of a typical sub-100 kWh battery for a heavy-duty bus load, for example, a lifecycle of approximately seven to eight years is a fair estimate. Usage of the battery more than the manufacturers' predicted usage rates may decrease that lifespan; less usage may lengthen it. However, several analyses have suggested that some battery chemistries are out-living expected lifespans in practice. Further, the lifecycle

of a battery relates not only to the battery chemistry but also the battery management system (BMS).

c) CUTRIC is not suggesting that Toronto Hydro manage the operation of EV batteries of all battery powered EVs in Toronto. The CUTRIC evidence indicates that Toronto Hydro may develop programs that allow it to manage the charging of some battery EVs and fleets where efficient and effective for customers and grid management.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-9

Reference: Exhibit M2 / p. 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."

Question(s):

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"*?

Response(s):

a) Please refer to our responses to interrogatories M2-Staff-5 and M2-EP- 9(b).

b) The CUTRIC evidence does not include specific cross-subsidized rate structures. Rather, CUTRIC identifies a number of synergies, efficiencies, and potentially avoided costs that may result from distribution system planning and rate design that recognizes and optimizes the current and growing role of EVs and EV-related DER charging infrastructure in the electricity sector and the Toronto Hydro electricity distribution system.

c) Electric propulsion includes streetcars, subways, and other catenary forms of electric transit, as well as battery electric buses and/or hydrogen fuel cell electric buses. All of these modalities play a role in the electrification of the public transit fleet.

d) CUTRIC does not agree with the proposition to the question, which goes beyond the subject matter of the CUTRIC evidence. According to the CAA and Statistics Canada, crude oil extracted in Canada's Western and Atlantic provinces is largely exported to global jurisdictions and not used in Canada, while approximately half of the crude oil used by Canadian refiners to meet consumer needs in Canada is imported from OPEC countries, the North Sea and North America. According to the CAA and Natural Resources Canada (NRCan), the refining industry in Atlantic Canada, Quebec and part of Ontario relies upon "imported crude oil" because it is cost prohibitive to ship crude oil from Western

Canada to refineries in Eastern Canada, which have "relatively easy access to offshore crudes". Surplus Canadian crude oil produced in Western Canada is typically exported to U.S. refineries, which are geographically positioned closer to the source of production. Substantial portions of Ontario's crude supplies are therefore, in fact, imported from global jurisdictions. Nuclear and other forms of electricity in Ontario are predominantly generated in Ontario and are not imported. Uranium ore, and the steel for wind mills and materials for solar panels are not uniformly mined or manufactured in Ontario. However, the electrons that Ontario electricity generation facilities produce are produced locally. https://www.caa.ca/gas-prices/faqs-gas-facts/

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-10

Reference: Exhibit M2 / p. 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,…"

Question(s):

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.

Response(s):

a) Please refer to our responses to interrogatories M2-Staff-1 and M2-Staff-3

b) Please refer to our responses to interrogatories M2-Staff-1, M2-Staff-3, and M2-EP-9(b)

c) Please refer to our responses to interrogatories M2-Staff-1, M2-Staff-3, and M2-EP-7(a). Please see the comment above about varying subscription program options that could be developed.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-11

Reference: Exhibit M2 / p. 3

Question(s):

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?

Response(s):

a) CUTRIC has developed and used the TRiPSIM© modelling tool over a period of two years and it is undergoing ongoing enhancement as one of the tools available in the electrification of transportation domain. It has been used to model the entire TTC bus fleet, as well as 12 other systems across Canada. TRiPSIM© modelling outputs have been examined and tested by utilities and other entities over a period of two years.

b) The information requested is proprietary and/or information protected by CUTRIC under the terms of agreement with vehicle manufacturers and other entities providing data. TRiPSIM© embeds within it precise manufacturer data vis-a-vis vehicle powertrain technologies. The TRiPSIM© model is not openly shared nor are its integrated assumptions. Access

to TRiPSIM© modelling outputs of interest to the OEB can be provided if the full confidentiality protections available to the Board are afforded to CUTRIC and the TRiPSIM© model and modelling.

c) Please refer to our response to interrogatory M2-EP-11(b)

d) Any potential investment required by Toronto Hydro in order to achieve these illustrative revenues from new rate structures and services is largely contingent on the substance and nature of the ownership, governance, and investment model that Toronto Hydro may choose to pursue and the configuration of EV-related DER charging infrastructure.

e) Please see response to M2-EP-7(b). The treatment of any un-materialized revenue is largely contingent on the substance and nature of the ownership, governance, and investment model that Toronto Hydro may choose to pursue and the configuration of EV related DER charging infrastructure.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-12

Reference: 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."

Question(s):

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.

Response(s):

a) Please refer to our responses to M2-Staff-2 and M2-Staff-5.

b) Please refer to our responses to M2-Staff-2 and M2-Staff-5.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-13

Reference: Exhibit 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."

Question(s):

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?

Response(s):

a) The authors are supportive of the integration of DERs including energy storage into the distribution system, where efficient and effective. The case scenario contemplates its added benefits and efficiencies.

b) Reliable figures for the number of battery-powered EVs in the Toronto Hydro service area are not available. We are therefore unable to estimate current Toronto Hydro revenues

from charging batteries of battery-powered EVs.

c) No.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-14

Reference: Exhibit M2 / p. 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.

Question(s):

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

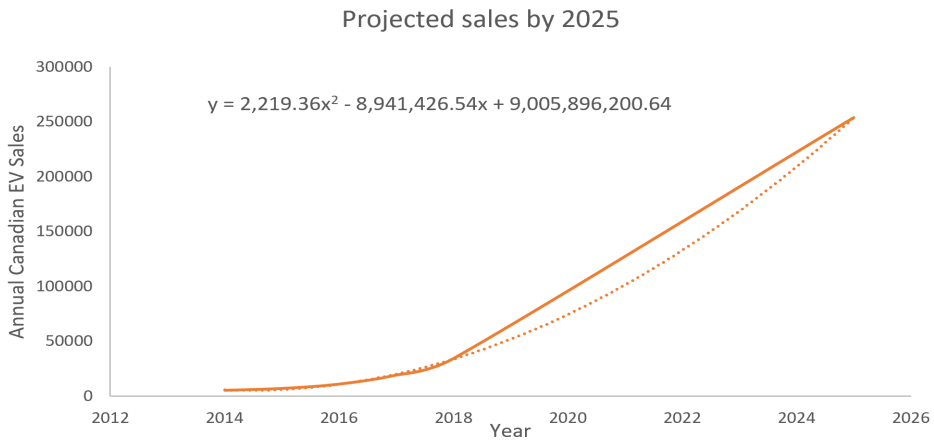
Response(s):

a) The vehicle numbers and other parameters are not conducive to inclusion in the table as they are measured in numbers and not GWh and $ set out in column 1. The vehicle number assumptions as set out in the evidence at p. 4:

- To generate reasonable potential estimations of EV penetration rates in Toronto by 2025, CUTRIC expanded the curve describing national sales of EVs from 2013 to 2018 (including plug-in hybrids and fully battery EVs), as cited by IHS (formerly R.L. Polk & Company) registration data (Fleetcarma, 2018). This extrapolation curve utilized a second order polynomial (as opposed to third order trend line) to suggest a total EV sales outlook of approximately 254,000 EVs across Canada by 2025, which constitutes approximately 12.7% of all car sales in Canada assuming a constant sales figure of approximately 2 million cars sold in Canada per annum (Autonews, 2018).
- 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.

Image 1.0 Extended growth curve predicting EV sales in Canada based on past sales data



The high-level analysis included in the model run assumes the ability to charge. It was undertaken to facilitate the consideration of EVs and related DERs as valid investments to assist in distribution efficiency and reliability, whether or not such charging infrastructure is directly owned by the utility, a competitive affiliate, or an arm's length entity.

b) Please refer to our response to interrogatory M2-Staff-2(a). It does not assume a particular ownership model.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-15

Reference: Exhibit M2 / p. 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."

Question(s):

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.

Response(s):

a) "Hubs" or "clusters" refer to the fact that a charging station is unlikely to stand alone; it is likely to be clustered with other charging stations so that rather than one EV charger, there may be five or ten clustered together, for the purposes of generating a "hub" that is a recognized point for charging of EVs. In the transit world, on-route chargers are likely to be placed at the point of terminals where several buses operating several routes enter and exit on a daily basis so that multiple routes are served by a small number of chargers co-located.

b) This depends on the usage of the "hub", which depends on variables such as geographic placement, types of vehicles that can be accommodated (i.e., whether accessible by both buses and trucks, or buses only; or whether accessible by a combination of trucks and EVs as cars if on highway routes,

for example). Storage may be efficient when multiple chargers at a hub are operating at the same time and create a significant demand at high power levels on the grid.

c) It may be possible for network hubs to developed without new wires investment, but the assessment will be contingent on the specific circumstances, which would require feasibility analysis.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-16

Reference: Exhibit M2 / p. 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."

Question(s):

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.

Response(s):

a) We note that the proceeding includes assessment of the Distribution System Plan, load/demand estimates, and potential capital expenditures, all of which should reflect the current realities of EV penetration and EV related DERs. CUTRIC was engaged by counsel to DRC to use the TRiPSIM© model to undertake the high level analysis and consider: customer efficiencies that may be effected through progressive integration of EVs into electricity distribution systems; potential of EV, BEB, and EV related DER charging infrastructure as a reliability resource, and related Operations and maintenance implications. CUTRIC does recommend further research and feasibility analysis on the potential customer efficiencies and savings that may result from EVs and EV related DERs both within and outside of the regulated business.

b) Please refer to our response to interrogatory EP-M2-16(a).

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-17

Reference: Exhibit M2 / p. 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."

Question(s):

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?

Response(s):

a) Please refer to our responses to interrogatory M2-VECC-3.

b) Answering this question would require a full feasibility analysis assessing the rates under which subways and streetcars currently fall and comparing those rates to potential new rates for e-bus buses or electrification of EVs. This assessment is outside the scope of evidence requested of CUTRIC and appropriately done by Toronto Hydro when considering such potential rates.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-18

Reference: Exhibit M2 / p. 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."

Question(s):

a) What "related services" are the authors proposing that Toronto Hydro provide to surrounding communities?

Response(s):

a) The "related services" may include but are not limited to, the utility or an affiliate (contingent on the type of service) providing: EV, EV-related DER data, feasibility data, analysis, infratsrture planning, DSP and load implications. EV and EV-related DER consulting services related to implementation, deployment, operations and maintenance may also be provided through data and or consulting arrangements (again through the utility or affiliate depending on the nature of the service). CUTRIC currently takes no position on the business model that Toronto Hydro may choose.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-19

Reference: Exhibit M2 / p. 8

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

Question(s):

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.

Response(s):

a) Canadian Finance Minister, Bill Morneau, announced the federal government will be introducing a purchasing incentive of up to $5,000 for electric battery or hydrogen fuel cell vehicles if the vehicle has a manufacturer's suggested retail price of less than $45,000 CAD. The incentive starts in fiscal year 2019-20, and the government will provide Transport Canada with $300 million to administer the program. The rebates can be stacked on top of of provincial incentives; for example, Quebec offers up to $8000 for all-electric vehicles as long as they have a starting price tag of $75,000 CAD or less. These incentives are meant to support Canada's federal target for 2040 that all vehicles sold will be zero-emissions, and by 2025 at least 10 per cent of vehicles will be zero-emissions in Canada.

b) CUTRIC takes no position on the adequacy of the incentives. We do anticipate them to further increase the penetration of EVs anticipated in the CUTRIC analysis.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: 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."

Question(s):

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.

Response(s):

a) "Optimizing EV and charging assets in a manner that responds to customer demand and flexibility requirements" means including EV and related EV DERs in the distribution network, where efficient and effective in light of customer needs, and doing so either directly or through providing access to the system. It may also include demand management and state of charge subscription programs when they are connected. See also response to M2-EP-5.

b) Please refer to our response to interrogatory M2-EP-20(a).

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-21

Reference: Exhibit M2 / p. 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."

Question(s):

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.

Response(s):

a) Please refer to our response to interrogatory M2-EP-7.

b) Please refer to our response to interrogatory M2-EP-7.

c) Please refer to our response to interrogatory M2-EP-7.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: 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."

Question(s): 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.

Response(s): Please refer to our responses to interrogatories M2-Staff-1, M2-Staff-2, and M2-Staff-5.

DRC RESPONSES TO EP INTERROGATORIES

Interrogatory: M2-EP-23

Reference: Exhibit M2, Page 13

Question(s):

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.

Response(s):

a) Please refer to our responses to interrogatories M2-Staff-1, M2-Staff-2, and M2-Staff-5.

b) Please refer to our responses to interrogatories M2-Staff-1, M2-Staff-2, and M2-Staff-5.