Non Emitting Resource Subcommittee (NERSC)
February 16th, 2018

Minutes of Meeting

Date held: February 16th, 2018	**Time held:** 09:00 – 16:00	**Location held:** Four Points By Sheraton, Toronto Pearson
Invited/Attended	**Company Name**	**Attendance Status** (A)ttended; (R)egrets; (S)ubstitute
Alectra Utilities	Carr, Daniel	A
Ameresco	Costa, Steven	A
APPrO	Butters, David	A
Bruce Power	Dalzell, Pat	A
CanSIA	Johnston, Wesley	A
Capstone Infrastructure Corp	Kausel, Andrea	A
Customized Energy Solutions	Tinkler, Mark	A
EDA	Farmer, Kathryn	A
Enbridge	MacRobbie, Ian	A
Hydrostor Inc.	Fuentes, Alex	A
NextEra Energy Canada	Tuck, Jennifer	A
Ontario Power Generation	Wizniak, Lynn	A
Ontario Waterpower Association	Norris, Paul	A
Peak Power	Sachs, Matthew	A
Power Advisory LLC	Cumming, Alison	A
Power Advisory LLC	Chee-Aloy, Jason	A
Power Advisory LLC	Simmons, Sarah	A
Rankin Renewable Power	Bekhuis, Jordan	A
Temporal Power	Chen, Katherine	A
TransCanada Energy Ltd.	Kuntz, Margaret	A
TransCanada Energy Ltd.	Ford, Nathan	A
TransCanada Energy Ltd.	Didomenico, Nick	A
University of Windsor	Carriveau, Rupp	A
University of Windsor	Miller, Lindsay	A
Virtual Power Plants Inc.	Rasmussen, Terry	A
IESO	Butterfield, Adam	A
IESO	Chapman, Tom	A
IESO	Cirovic, Marko	A
IESO	Ellard, Barbara	A
IESO	Fox, Conrad	A

IESO	Grbavac, Jason	A
IESO	Hartland, Mark	A
IESO	Nollert, Beverly	A
IESO	Pyrka, Agatha	A
The Brattle Group	Chang, Judy	A
The Brattle Group	Spees, Kathleen	A
The Brattle Group	Van Horn, Kai	A
IESO	Butterfield, Adam	A
IESO	Chapman, Tom	A
IESO	Cirovic, Marko	A
IESO	Ellard, Barbara	A
IESO	Fox, Conrad	A
IESO	Grbavac, Jason	A
IESO	Hartland, Mark	A
IESO	Nollert, Beverly	A
IESO	Pyrka, Agatha	A
The Brattle Group	Chang, Judy	A
The Brattle Group	Spees, Kathleen	A
The Brattle Group	Van Horn, Kai	A
Scribe: Mark Hartland Please report any corrections, additions or deletions e-mail to scribe.		

All meeting material is available on the IESO web site at: http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee

Introduction

Tom Chapman, of the IESO welcomed stakeholders to the NERSC meeting which he explained would be focused on identifying barriers to participation for NERs in the IESO administered markets. To support this discussion, Tom introduced the Brattle Group who were present at the meeting to facilitate resource specific break out groups.

Technical Conference

Mark Hartland provided stakeholders with an overview of the expectations for the April 5th Technical Conference and invited stakeholder feedback on the format of the day. Among other things, Mark informed that the conference will be interactive and consist of a range of panel discussions as well as short presentations from external speakers. Ultimately, the objectives of the conference are to have a focused discussion on the barriers to participation for NERs, and enable more fulsome stakeholder responses to the NER RFI.

Break out Session

Kathleen Spees, Judy Chang, and Kai Van Horn of the Brattle Group facilitated resource specific break out groups tasked with identifying; (i) the values that various NERs can provide, (ii) key barriers limiting them from providing these values, and (iii) ideas for breaking down barriers. A summary of these findings will be shared with the Market Renewal Working Group later in Q2, which will also feed into the end of year NERSC report. Notes from these breakout sessions can be found on page 4 onwards of these minutes. The notes capture, at a high-level, the perspectives shared by the stakeholders who participated in each break out group. This information will be used as an input into topics of discussion at the technical conference and findings in the final NERSC report.

Modelling Exercise

In brief, Tom Chapman introduced the modelling exercise which will be conducted by a consultant to support the second phase of the NERSC work plan; market efficiencies. The modelling will consist of a higher level indicative approach for a range of scenarios agreed upon within the NERSC. Tom highlighted that a number of future market scenarios have already been identified within the 2016 OPO and 2017 LTEP, however, stakeholder feedback on potential scenarios will be welcomed.

The following comments are stakeholders' perspectives on the values the NERs represented at the NERSC can provide to the grid, the barriers limiting or preventing them from providing these values, and ideas for breaking down these barriers and facilitating the participation of NERs in the wholesale markets.

Distributed NERs

Session 1: **Resource values and services**	**Resource types represented in Break Out Group** • Energy storage, solar, energy efficiency, direct load participation, renewable natural gas (RNG), electric vehicles (EVs), demand response (smart thermostats, aggregations), renewable CHP, microgrids **Potential** • By 2030 could displace 80% of residential load, 50% of commercial load, and 25% of industrial load • Can help to reduce Ontario's carbon footprint *The risk associated with significant adoption of these resources is an increase in stranded assets* **Value streams** • **Bulk system:** Capable of providing energy, capacity, flexibility, increased resilience through diversified supply, and operating reserve • **Distribution system:** Act as a substitute for ancillary services from the central grid, extend infrastructure life of assets, and provide other benefits such as: the capacity freed up from power factors correction and reactive power • **Customer:** Power factor correction, increased customer choice, reliability, environmental benefits
Session 2: **Key barriers to realizing value** **Tech. = technological** **Reg. = regulatory** **WMS = wholesale market structure** **Cont. = contractual**	**Challenges** • **Current**: - LDC's appear to be resistant to technological changes needed to better integrate distributed energy resources (DERs) - There are imperfections in the price signal resulting from different rates/charges for different types of customers - The minimum capacity requirement of 1MW is a barrier for smaller distributed resources - Aggregation of dispatchable loads is not enabled - High costs that come with participating in the energy market (prudential requirements that mitigate the risk of default, metering requirements etc.) - There are values that DERs can provide but are currently not compensated for - Current DR parameters (e.g. the 4-hour block requirement for HDR resources) hinder resources from being activated Further evolution of the DR product is needed to increase the

	utilization and demonstrate the value of DR - Market rules limit participation of distributed resources in providing ancillary services • **Future**: - Uncertainty on government policy direction - An increase in distribution system costs if a large number of DERs are providing electricity to consumers **Barriers** • **Tech**: Cost of infrastructure (DER cost to investor/customer, and cost to participate in markets), access to meter data, lack of uniform system across LDC territories • **Reg**: Rate structures, no rate basing of assets permitted, energy price does not reflect locational factors associated with providing services, short commitments through the ICA may make financing challenging • **WMS**: Bundled products/lack of market for some products, non-transparent information through the bundling of costs in Global Adjustment • **Cont**: Uncertainty about transition from current contracts to future markets/contracts, locked in supply/stranded assets, contracting with site host (land rights, insurance) • **Other**: Level of education of shareholders and stakeholders
Session 3: **Big ideas for breaking down barriers**	**Current** • Unbundling of rates and market products Incentives for LDCs and others to take more risks in investing in new technology to facilitate DER integration • Better consumer education **Future** • Organized markets for existing and new ancillary service products that enable DER participation • Match commitment period to cost of resource

Hydro and Nuclear

Session 1: **Resource values and services**	**Resource types represented in Break Out Group** • Existing and new hydro and nuclear resources **Potential** • **Hydro:** Potential for thousands of additional MWs of incremental capacity and thousands of MWs of pumped storage to serve mining demand or remote First Nations demand (supplanting diesel) • **Nuclear:** Additional value will come from refurbishments, improved optimization of current reactors, and pursuing smaller-scale modular reactors (SMRs) **Value streams** • **Bulk system:** Capable of providing energy, capacity, flexibility, and ancillary services (less so for nuclear); longer life spans than most other resources • **Distribution system:** Benefits include supporting remote communities and remote First Nations communities, emergency preparedness and response which is similar to islanding • **Provincial/social value:** Benefits include byproducts such as public safety/ flood mitigation/ recreational activities in waterways from hydro, and the production of medical isotopes from nuclear • **Customer:** Can support remote First Nations' efforts to replace diesel generation; small modular reactors (SMRs) are mobile and can be placed in remote communities
Session 2: **Key barriers to realizing value** **Tech. = technological** **Reg. = regulatory** **WMS = wholesale market structure** **Cont. = contractual**	**Challenges** • **Current**: Lack of ability to optimize resources, transmission constraints, regulatory restrictions, the uncertainties associated with life after contract for small hydro resources, and market design • **Future**: Long lead times for projects due to the regulation process and a lack of revenue certainty **Barriers** • **Tech**: Allocation of capacity on lines irrespective of capacity factor, inadequate information on hydro resource capabilities and attributes (lack of knowledge) • **Reg**: The regulatory requirements are the same for small hydro and large hydro resources; additionally the approval process is both lengthy and costly. No clear policy vision for hydro resources • **WMS**: ○ Incremental Capacity Auction is not compatible with the long lead time/lifespans of nuclear and hydro plants

	○ Once their contracts expire some resources may be worse off with locational pricing than with uniform pricing ○ The dispatch tool is not able to effectively model and schedule feasible cascade hydro offers • **Cont**: Investment risk increases without long-term contracts; without contracts there is no mechanism to be paid for non-electricity value streams • **Other**: Transmission constraints are a concern as hydro and nuclear are typically far from load centres, clean energy attributes not recognised.
Session 3: **Big ideas for breaking down barriers**	**Current** • Provide a baseline (inventory) of hydro resources • In the short term increase capacity for self-scheduling of resources, which would decrease the risk of receiving infeasible schedules for cascade hydro resources • Option to extend current contracts • Reduce development timelines; hold multi-sector roundtables to identify opportunities for development time reduction; use a "one-window" approach for hydro (timeline limits to hold reg. bodies accountable for delays); allocate resources based on high their capacity factor is **Future** • Develop technical framework and tools for representing cascading hydro in dispatch/markets. This could be achieved by developing a model in the system or evolving how offers are submitted • Augment proposed market to recognize development timelines of different asset types (e.g., solar vs large-scale hydro or nuclear) • Build out transmission to unlock resource potential • Create framework for recognizing social value of hydro (particularly in NW Ontario) • Provide a one window approval for hydro • Provide clean energy payments and value for environmental attributes

Solar

Session 1: **Resource values and services**	**Types of resources** • Large and small scale solar resources **Potential** • There is virtually unlimited fuel from the sun as well as numerous options to improve performance and expand applications as a result of technological innovations. Solar is flexible in where it can be placed, however there are limitations in terms of land availability **Value streams** • **Bulk system:** Solar has the ability to provide quick ramp and peaking power to the bulk system. Without storage, solar can still provide energy and environmental benefits. With storage, solar has the potential to provide flexibility and capacity. Depending on the rules put in place, large scale solar can provide capacity through capacity auction and ancillary services, especially when combined with other resources and smart inverters • **Distribution system:** Similar to the bulk system, solar can provide quick ramp, customer choice, load displacement behind the meter and peaking power. Additionally, when aggregated, small scale solar can also provide capacity and ancillary services • **Customer:** Behind-the-meter energy and load displacement, environmental benefits, solar can be integrated with other technologies in energy efficient smart buildings for customers looking to decrease their costs • **Other:** Reduces reliance on the grid by providing offgrid/microgrid opportunities, as well as providing other services that are unlocked by integrating with other technologies
Session 2: **Key barriers to realizing value** **Tech. = technological** **Reg. = regulatory** **WMS = wholesale market structure** **Cont. = contractual**	**Challenges** • **Current**: Seasonality/variability aspect of the resource type, rate design (Time of Use (TOU), commercial and industrial) impacts the economics of distributed connected solar projects and possibly filters through to the wholesale market , the design of the market and subsequent rules (e.g., for ancillary services) don't always advance as quickly as the resource technology, the costs of technology, and the availability of raw materials to manufacture solar panels • **Future**: Market rules (price signals), rate design, in an unbundled market there will be a challenge in managing the relationship

	between dx and tx connected resources
	Barriers
	• **Tech**: Forecast challenges may cause issues in day-ahead participation, variability/seasonality, raw material bottlenecks along the solar supply chain, and technological advancements driving the obsolescence of existing PV resources
	• **Reg**:
	  ○ Regulations do not keep up with the pace of technological advancements
	  ○ The rate designs (TOU, Commercial and Industrial) do not provide granular price signals at the distribution level
	  ○ Distribution code with respect to PV penetration rates at the distribution level
	• **WMS**:
	  ○ Low revenues associated with consistently low marginal prices
	  ○ Risk of forecast errors in Day-Ahead Market
	  ○ Challenges aligning the services that resources provide at the Dx and Tx level in an unbundled market
	  ○ Lack of market products that reflect the value of solar
	• **Cont**: Current solar contracts are for energy and there is uncertainty if these contracts will be amended to enable these resources to provide additional grid services before their contracts expire (also applies to WMS)

Session 3: **Big ideas for breaking down barriers**	**Current** • Have in place a market that can adapt effectively to advancements in technology and have the flexibility to facilitate the participation of newer technological capabilities in providing a range of grid services • Improve how the interplay between resources on the Tx and Dx system are managed • Utilize smart grid and big data to improve grid visibility **Future** • New rate designs that reflect value of distribution level resources • Improved forecasting software will be key to ensure that solar is forecasted as accurate as possible

Storage 1

Session 1: **Resource values and services**	**Types of resources** • Bulk-scale long duration Pumped Hydro System (PHS), Compressed Air Energy Storage(CAES) **Potential** • Significant potential to increase the role of storage in providing energy, capacity, and other services **Value streams** • **Bulk system:** Storage can recapture the lost opportunity of surplus baseload generation that results in wind curtailments, and spilled hydro. Other bulk system values include: capacity, system flexibility, optimization of other bulk resources by moving energy to periods where it is needed, operating reserve (10s, 10N, 30 min), ramping, regulation, voltage reduction, black start, line loss reduction, transmission deferral, emission reduction, and inertia • **Distribution system:** Distribution infrastructure investment deferral, LDC empowerment (e.g., local management of supply and demand balance), and improved resilience by providing local ancillary services • **Customer:** Customer energy management, enabling microgrids and prosumers, reliability, resilience, and cost management e.g. ICI or GA management

Session 2: **Key barriers to realizing value** **Tech. = technological** **Reg. = regulatory** **WMS = wholesale market structure** **Cont. = contractual**	**Challenges** • **Current**: - Lack of monetary incentive to capture surplus generation - Uncertainty in the market (e.g., what markets will be in place and when, will they be enduring) and insufficient revenues - Current rate design does not offer granular price signals at the distribution level - Inability to stack values and a missing link between values to the system and revenues to the resource • **Future**: Market uncertainty; future market design needs to be better suited for certain resources (speed to market vs forward period); government policy uncertainty (e.g., are we moving towards a 100% clean grid or a different future) **Barriers** • **Tech**: Perception around the maturity of storage as a viable resource in the sector, the existing dispatch algorithm does not allow for storage to be properly integrated into the market, and uncertainty regarding system needs for storage • **Reg**: ○ Rate design, policy uncertainty (e.g., around decarbonization), uplift charged to storage when charging. ○ No framework for non-wires alternatives in Tx and Dx proceedings ○ There is an uneven playing field as storage resources are unable to approach the OEB to receive rate based treatment even if they are solving a Tx issue for potentially lower costs • **WMS**: Market uncertainty, lack of value stacking, value streams without products (e.g., inertial response), no value for deferring infrastructure build, no tri-optimization of energy/operating reserve/regulation which exist in other markets • **Cont**: No contracting process available to allow for financing of capital-intensive resources, current contracts do not provide any incentives to help address SBG

Session 3: **Big ideas for breaking down barriers**	**Current** • Creation of new revenue streams including for services that are currently provided at no cost (e.g., inertia) • Update dispatch tools to better represent storage and its full range of capabilities • Create incentives to contract for storage • Current contracts do not allow for resources to make modifications to their facilities; if modifications were allowed then this may enable resources to provide additional services to the system • Storage is able to capture variable non emitting SBG; an environmental attributes market would provide storage with an added incentive to do this **Future** • Crediting storage for capturing curtailed renewables (such as through RECs) • ICA commitment periods long enough to improve investment financing • ICA requirements consistent with storage capabilities • Provide level playing field between transmission and storage (e.g. rate base hearings) • Treat storage as a service, not a load - remove uplift charges/Global Adjustment on storage charging • Create products that compensate storage for value to the system • Improve the near term price signals that indicate the need for storage on the system but frequently flatten once storage has come online

Storage 2

Session 1:
 	
Resource values and services
	Types of resources
	• Bulk-scale long duration Pumped Hydro Storage (PHS), Compressed Air Energy Storage (CAES), distributed & shorter duration batteries
	
	Potential
	• PHS—thousands of MWs in Southern and Northern Ontario
	• CAES—thousands of MWs close to the GTA load centre
	• High potential from batteries
	• Can help to cover the planned 2023 Pickering shut down shortfall, enables customers to sell back to the grid, supports electrification, and reduces grid instability
	
	Value streams
	• **Bulk system:**
	  ○ Storage has the ability to support other non-emitting resources at the bulk level
	  ○ Can provide system flexibility
	  ○ Defer the need for new transmission
	  ○ Solve "too much energy and not enough capacity" issue (time shifting)
	  ○ Other bulk system values include: demand management, operating reserve, and ancillary services
	• **Distribution system:** Fast frequency response, flexibility, ancillary services, demand management, distribution infrastructure deferral
	• **Customer:** The prosumer can sell storage services back to the grid

Session 2:
 	
Key Barriers to Realizing Value
 	
Tech. = technological Reg. = regulatory WMS = wholesale market structure Cont. = contractual
	Challenges
	• **Current**:
	  - Market governance
	  - Revenue uncertainty with regards to capacity market requirements and financing of new projects
	  - The full value of storage is not captured. There should be mechanisms in place that value storage's multiple attributes
	• **Future**:
	  - Policy uncertainty and potential government interference in electricity markets
	  - Market cannibalization where storage smooths out peak demand periods that are typically high revenue periods
	
	Barriers

	• **Tech**: Visibility and management of storage resources (who should manage these resources to get greatest value out of them) • **Reg**: Interconnection process is outdated in that there is nothing specific to storage (Form B, not even a check box for storage), no mechanism in place to value non-wires alternatives, risk of regulatory change • **WMS**: Lack of long-term revenue certainty, products do not capture the full range of value created (particularly at distribution/customer level), insufficient revenue stacking opportunities (OR, black start, other ancillary services), no mechanism for capturing locational value • **Cont**: Lack of long-term price certainty for financing of new projects
Session 3: **Big ideas for breaking down barriers**	**Current** • Modernize the interconnection process to include storage and to not only treat is as a load • Multiple-year commitment period through ICA/certainty for revenues • Align product requirements with technological capability and system needs (e.g., lower time requirements for ancillary services or differentiation of products) • More granular capacity auctions e.g. at a zonal level to value what DER adds to the system **Future** • Increase level of granularity in market signal • Excess baseload usage payment • Allow battery aggregation e.g. with regards to virtual power plants • Allow behind-the-meter batteries to be metered independently of customer facility

Wind

Session 1: **Resource values and services**	**Types of resources** • Existing and potential wind resources **Potential** • There is potential to increase output of current capacity through asset optimization. Wind can provide baseload supply during the period of nuclear generation refurbishments and following the retirement of the Pickering nuclear generation station. New sites have been identified particularly in northern Ontario where wind could serve remote communities, and there is additional offshore wind potential of approximately 14GW **Value streams** • **Bulk system:** A range of services including: capacity, energy, environmental attributes, voltage control support, fast ramp reactive power, ancillary services, 15 minute reserves, frequency response, black start (with storage) • **Distribution system:** All of the above, as well as islanding capability in a black start situation, off-grid and serving remote communities • **Customer:** Wind provides clean power, there is also small wind that can be deployed at the customer level offsetting customer costs
Session 2: **Key barriers to realizing value** **Tech. = technological** **Reg. = regulatory** **WMS = wholesale market structure** **Cont. = contractual**	**Challenges** • **Current:** Locational (siting, connection capability), quantifying market requirements (MW), lack of awareness of non-energy services, revenue adequacy related investment risk • **Future:** Concern around the term of the Incremental Capacity Auction (ICA) in getting projects financed, risks associated with forecasting in the day-ahead market (DAM), and the impact of locational marginal pricing on where to build future projects **Barriers** • **Tech:** Ice on lakes (for offshore wind), St. Lawrence seaway restrictions, the variable nature of wind resources • **Reg:** Permitting approvals for upgrading wind resource capabilities, • **WMS** Minimum MW threshold, ability to achieve revenue adequacy in the future market • **Cont:** Lack of incentives in contract to provide a more diverse range of services (technological capability is there but disabled) • **Other:** Siting and connection capability, offshore wind moratorium, NIMBYism (and public relations associated with that), financing (lack

	of assurances increases borrowing costs), government intervention
Session 3: Big ideas for breaking down barriers	**Current** • Provide contracts • Transmission buildout • Remove moratorium on offshore wind • Create market for environmental attributes **Future** • Creation of electricity products that recognize the attributes of non-emitting resources • Support for revenue adequacy, whether through market or non-market means, to enable investments