Summary and Commentary on the Energy Storage Advisory Group 2019 Work Plan

Date: May 31, 2019

For parties interested in: Energy Storage and Innovation in Ontario

Context

- The Independent Electricity System Operator (IESO) released "Removing Obstacles for Storage Sources in Ontario" report[1] on December 19, 2018 based on consultation with its Energy Storage Advisory Group (ESAG).
- On May 24, 2019, the IESO presented the 2019 work plan to the ESAG for addressing barriers to energy storage resources in the IESO-Administered Market (IAM).
- The 2019 work plan includes two committed projects and four prospective projects (see table below).

Projects		Completion Date
Committed Projects	i) Clarification of performance requirements for inverter-based technologies	End of 2019
	ii) Lack of clarity with respect to energy storage in the interconnection process	
Prospective Projects	i) Uplift cost allocation to energy storage resources (ESRs)	IESO considering projects within their 2020 business plan
	ii) Interim State of Charge (SOC) management in Dispatch Scheduling Optimization (DSO) tool	
	iii) Operating Reserve (OR) participation for ESRs	
	iv) Updates to Automatic Generation Control (AGC) tool	

BACKGROUND

As outlined in their Long-Term Energy Plan (LTEP) Implementation Plan, the IESO established the ESAG to *"Identify potential obstacles to fair competition for energy storage with other technologies in the delivery of services and, where appropriate, propose mitigation strategies"*[2]. The ESAG[3] was launched in April 2018 to advise, support and assist the IESO in evolving policy,

[1] The report can be found here http://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/esag/Removing-Obstacles-for-Storage-Resources-in-Ontario_20181219.pdf?la=en

[2] The IESO's LTEP Implementation Plan, "Putting Ontario's Long-Term Energy Plan Into Action", can be found here http://www.ieso.ca/-/media/Files/IESO/Document-Library/ltep/IESO-ltep-implementation-plan.pdf

[3] The ESAG website contains meeting materials, stakeholder feedback and the recommendation report - http://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Energy-Storage-Advisory-Group

rules, processes and tools to better enable the integration of storage resources within the current structure of the IAM. Throughout 2018, the ESAG met monthly to identify potential barriers to energy storage, develop criteria and principles for assessment of the barriers, and finally develop mitigating strategies to the barriers.

The energy storage recommendation report issued by the IESO provided a summary of the identified obstacles and mitigating strategies discussed with the ESAG. The report makes recommendations to remove barriers for energy storage resources in Ontario. The recommendations were not limited to activities solely under IESO's mandate, many of the recommendations require action by the Ontario Energy Board (OEB) and Ministry of Energy, Northern Development and Mining (MENDE). The recommendations were divided into two categories. The first addresses lack of clarity in Ontario's electricity regulatory framework (i.e., Market rules, codes, legislation and regulation) related to energy storage resources. The second category focuses on specific concerns within the regulatory framework.

2019 Work Plan

The initial framework for the 2019 work plan was presented during the November 2018 ESAG meeting. The conceptual proposal for the 2019 work plan focused on two major design streams. First, wholesale market storage integration design stream with a focus on storage integration into wholesale electricity products. Second, interface with distribution-connected storage.

On May 24, 2019, the IESO hosted an ESAG webinar to present the 2019 work plan. The work plan detailed committed projects as well as prospective projects that were under IESO review as part of the organizations business planning process.

Committed Projects

The 2019 work plan identified two committed projects: i) clarification of performance requirements for inverter-based technologies, and ii) lack of clarity with respect to energy storage in the interconnection process.

For the first committed project, the IESO expects to update *Market Manual 2.20: Performance Validation*[4] and *Market Rules Chapter 4 Grid Connection Requirements Appendices 4.2 & 4.3*[5] to clarify testing requirements applicable to energy storage (e.g., dynamic reactive power response, dynamic active response, etc). In addition, the IESO will participate as a contributor to the revisions of Canadian Standards Association (CSA) standards and the Ontario Energy Board's

[4] http://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/market-administration/ma-PerformanceValidation.pdf?la=en

[5] http://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-rules/mr-chapter4appx.pdf?la=en

(OEB's) Distribution System Code (DSC) related to clarification revisions for voltage/frequency ride-through, voltage control, islanding and momentary outage requirements for Distributed Energy Resources (DERs).

For the second committed project, the IESO will produce an interconnection roadmap to summarize the high-level steps of the interconnection process. The interconnection process involves multiple parties (i.e., transmitters and local distribution companies (LDCs)). The roadmap will provide clarity on the links to the transmitter's and LDC's interconnection process and provide typical timelines based on past experiences. Finally, the IESO will update *Market Manual 2.10: Connection Assessment and Approval*[6] to include specific provisions in the System Impact Assessment (SIA) process for energy storage resources.

Both committed projects are expected to be finalized by the end of 2019.

Prospective Projects

The IESO provided an overview of prospective projects that could be included in the 2019 work plan. The inclusion of the prospective projects will primarily be determined by timing and resources availability as determined by the IESO business planning process. The IESO identified four prospective projects: i) uplift charges allocation, ii) lack of State of Charge (SOC) management in the DSO tool, iii) interim measure for OR participation, and iv) updates to AGC tool.

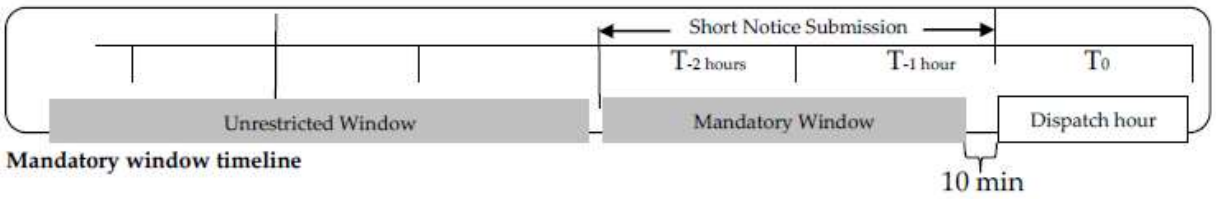
Uplift Charges Allocation

The review of allocation of uplift charges to ESRs will consider the applicability when ESRs are withdrawing from the grid depending on the service the ESR is provided (e.g., system service versus energy arbitrage).

Lack of SOC management in DSO tool

The DSO tool does not have the capability to assess an ESR's SOC, therefore can issue dispatch instructions that the ESR is not capable of carrying out due to lack of stored energy. In the IAM, energy market bids and offers are for 1-hour blocks with dispatches every 5 minutes. Bids and offers are locked 2 hours before start of the dispatch hour and can only be changed within the 2-hour window (i.e., Mandatory Window) by manual approval from the control room operator (see diagram below for an illustrated example of the IESO's mandatory window timeline). The IESO intends to explore an interim measure to provide SOC visibility for control room operators.

[6] http://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/market-administration/ma-caa.pdf?la=en

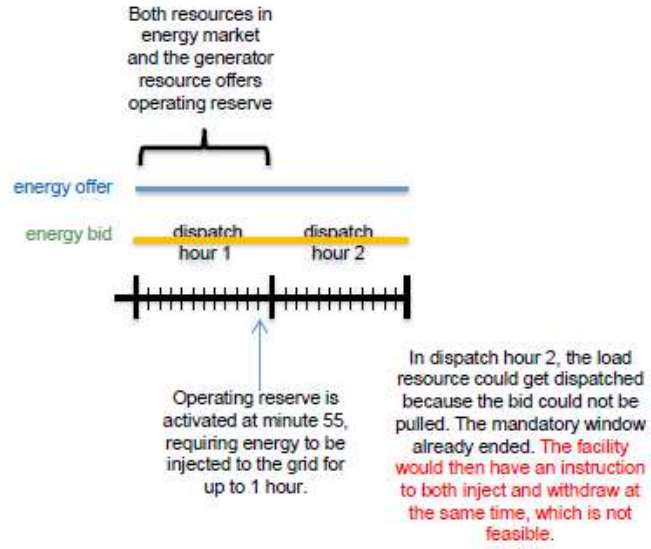


Mandatory window timeline

OR Participation for ESRs

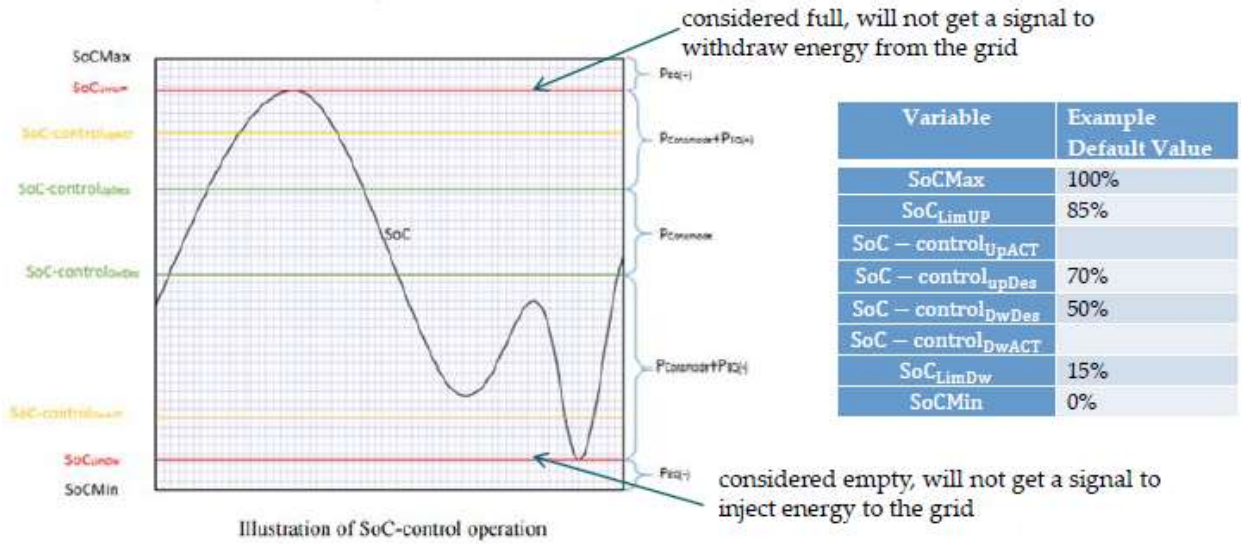
ESRs are modelled in the DSO tool as two separate resources (i.e., a load and a generator). When an ESR is schedule as a load but receives an activation for OR injection, the dispatch instruction is infeasible since the ESR is being asked to inject and withdraw at the same time (see diagram below for an example of an infeasible dispatch). Interim measures and guidance are needed for bidding and offering to ensure that all dispatch instructions are feasible.

Example of infeasible dispatch



ESR in AGC

The SOC visibility issue for real-time energy market participation is also an issue for ESRs providing regulation service to the IESO. The AGC tool does not have the capability to manage SOC for ESRs and therefore when an ESR is near its SOC limit, it cannot provide the appropriate response required. The proposed upgrade for the AGC tool would allow the system operator to manage the SOC based on energy limits provided by the ESR owner (i.e., 15% to 85% SOC). In addition, the IESO expects the AGC tool upgrade would also allow the ESR to provide both regulation service in parallel to other services (e.g., energy arbitrage, demand reduction). See diagram below for an example SOC management based on pre-determined limits.



Variable	Example Default Value
SoCMax	100%
SoC_{LimUP}	85%
$SoC - control_{UpACT}$	
$SoC - control_{upDes}$	70%
$SoC - control_{DwDes}$	50%
$SoC - control_{DwACT}$	
SoC_{LimDw}	15%
SoCMin	0%

Illustration of SoC-control operation

No DSO Tool Upgrades

Similar to other jurisdictions, the DSO tool does not have an ESR participation model and therefore does not consider many of the parameters and attributes of ESRs. Changes to the DSO would address many of the barriers for ESRs in the IAM (e.g., ability to submit bid and offers at the same time, account for ESR ramp rates, manage SOC, eliminate the possibility of infeasible dispatch instructions, and allow greater participation in all IAM markets). The IESO stated during the ESAG webinar that no upgrades to the DSO tool will occur prior to the upgrades for Market Renewal Program (MRP)[7]. The IESO is reviewing resource requirements for DSO upgrades to fully enable storage in order to determine options for timing that take into consideration potential impacts on DSO upgrades required for MRP. DSO upgrades for MRP are not expected to be in service until 2022.

The IESO expects to report back to ESAG with a revised work plan that includes timing of DSO upgrades and updates on prospective projects based on the 2020 business plan process by Q3 2019.

[7] The MRP is the most comprehensive overhaul of the IAM since market opening in the early 2000s. For more information on MRP, see here: http://www.ieso.ca/en/Market-Renewal

Power Advisory Commentary

In Power Advisory's opinion, the 2019 work plan for energy storage presented by the IESO is a disappointment. Last year, Power Advisory was encouraged by the leadership on the energy storage file demonstrated by the IESO in the establishment of the ESAG. However, the IESO actions in 2019 fall well short of expectations and are considered a failure on many different fronts. For example, the 2019 work plan has been released almost half through the year and is composed of two minor projects that do little to address the key barriers for energy storage. In addition, the IESO's engagement with stakeholders has been lacklustre[8] and has not included any meaningful engagement with the energy storage community.

Earlier this year the IESO initiated an "Innovation and Sector Evolution White Papers Series" engagement plan in support of the IESO's Innovation Roadmap 2019-2021 work plan[9]. The IESO intends to develop and release a number of white papers covering a wide variety of topics. ESRs are a significant component of the white paper series (e.g., non-wires alternatives, distribution sector evolution, framework for integrating distributed energy resources (DERs) in the IAM, etc.). Specifically, the Innovation Roadmap references investments in the DSO tool and AGC tool to integrate ESRs are contemplated as a capital project in the 2019-2021 work plan. Further, a top area of focus for innovation for the IESO is "unlocking the value of new and existing resources", which ESRs would clearly qualify as. The 2019 work plan for the ESAG fails to provide details how the IESO will accomplish the Innovation Roadmap work plan objectives. Disappointingly, the IESO did not provide any details how the ESAG work plan and the Innovation Roadmap work plan are coordinated or support each other.

In Power Advisory's opinion the subpar engagement process is a broader issue for the IESO. Too often the engagement process for the IESO is a "box checking" exercise instead of an opportunity to leverage the significant expertise of stakeholders to address the complicated challenges facing Ontario's electricity sector.

Partially in response to Federal Energy Regulatory Commission (FERC) Order 841, other jurisdictions are rapidly overhauling their regulatory framework and market design to incorporate the many benefits of energy storage. Even if the requirements of Order 841 are ignored, the growing investment and potential of energy storage are motivating decision makers in the electricity sector to act. The lack of action by the IESO on energy storage reminds Power Advisory of the stagnation related to the real-time energy market design in Ontario. Arguably, the majority of the energy workstream activities in MRP (i.e., location marginal pricing, day-ahead market, enhanced real-time unit commitment) are rooted in the fact that the IAM did not keep pace with design changes in other markets. Other major electricity markets in the US are expected to be mostly Order 841 compliant by the end of 2019 (see diagram below). By

[8] For example, the May ESAG meeting was changed from an in-person meeting to a webinar and was not included in the weekly IESO bulletin of stakeholder engagement activities

[9] The IESO's innovation roadmap can be found here (note that Power Advisory was the consulting resource for the IESO in the development of the Innovation Roadmap) http://www.ieso.ca/-/media/files/ieso/document-Library/Innovation-Roadmap/Innovation-Roadmap-20190508

delaying any meaning action until after MRP, the IESO will be far behind other markets in realizing the benefits of energy storage, costing Ontario electricity customers and reducing the attractiveness of the Ontario electricity sector.

ISO/RTO	Proposed Timeline to Implement Tariff Provisions from FERC Order 841 from the ISO/RTO's Most Recent Tariff Filing
PJM	December 3, 2019.
MISO	December 3, 2019 originally, but later asked for an extension of 18 months from the date of accepting the filing. Expected implementation by the end of 2020.
CAISO	December 3, 2019. Already implemented most of the requirements in the order.
ISO-NE	December 3, 2019 for most requirements, and January 1, 2024 for some complex changes affecting binary storage facilities (e.g., some pumped hydro) providing regulation.
SPP	December 1, 2019.
NYISO	May 1, 2020 due to some already planned market upgrades in late 2019.

In Power Advisory's opinion a major overhaul of the ESAG and IESO approach to energy storage is required. There is general confusion on responsibilities for activities to address barriers to energy storage between the multiple engagement processes underway at the IESO (e.g., ESAG, innovation white paper series, MRP, planning process updates, etc.). Further, there is a lack of clarity on how the IESO has prioritized issues and reached conclusions on recommended actions to resolve issues. Power Advisory recommends the following to address the many issues energy storage must overcome so that Ontario electricity customers can realize the benefits of energy storage.

First, an oversight committee composed of multiple government entities is required. The IESO correctly concluded in their energy storage recommendation report that many of the issues facing energy storage are the responsibility of not just the IESO, but also the OEB and the MENDE. An oversight committee should report to the various executive teams at each of the organization and be responsible for ensuring coordination on required actions and timelines are met.

Second, a definition of ESRs in the IESO's market framework is a required first step. The two committed projects the IESO is pursuing in the 2019 work plan are destined to be ineffective as long as ESRs is defined as a combination of two existing resources (i.e., a generator and load). The need for an ESR definition is the same conclusion that the Alberta Electricity System Operator (AESO) came to in their energy storage report last year[10]. Power Advisory's understanding is this is one of the first steps in their soon to be published roadmap. The IESO should follow the lead of their western counterpart and work with stakeholders to define ESRs in the IAM.

Third, the IESO should publish a report on the current IAM's compliance with Order 841 requirements and identify the key issues in any compliance requirements that cannot be met.

[10] The AESO published the Dispatchable Renewables and Energy Storage report (https://www.aeso.ca/assets/Uploads/AESO-Dispatchable-Renewables-Storage-Report-May2018.pdf) last year and announced that an energy storage roadmap would be developed in mid-2019, see https://www.aeso.ca/market/current-market-initiatives/energy-storage for more details

Despite repeated requests from stakeholders, the IESO has failed to produce a summary of the key issues with the existing IAM design and tools with respect to Order 841. Knowing the issues is the natural starting point to addressing them.

Fourth, the IESO should work with stakeholders to develop a business case for the many investments required to enable ESRs in the IAM. A business case should clearly estimate the cost and timelines of updating tools (e.g., DSO, AGC) or business processes and compare those costs to potential benefits from ESR (e.g., low costs to customers, reduced operating costs for the IESO, more competition of resources in constrained areas, etc.). The IESO's experience with ESRs and quantifying their benefits to electricity markets is extremely limited, therefore the IESO should be seeking stakeholder expertise and input to develop the business case. Development of business cases in an open and transparent manner meets the core objectives of the IESO as part of their overall market development plans.

Finally, the IESO needs to change their approach to engagement with respect to energy storage. Too often the IESO has approached stakeholder engagement as an activity where they are expected to speak to stakeholders on a variety of subjects. Instead, the IESO should approach the ESAG as an opportunity to work as a team to address the various challenges Ontario is facing with respect to energy storage. For example, sub-committees can be formed to investigate and draft potential market rule changes that would use less of the IESO's resources and allow experience from other jurisdictions to be directly applied to Ontario. The IESO cannot and should not expect to shoulder the burden of all the work required to Ontario's regulatory framework for energy storage.