
Removing Obstacles for Storage Resources in Ontario

December 19, 2018

EXECUTIVE SUMMARY

Background

Given the proliferation of distributed energy resources (DERs), including energy storage, and the growing role they are poised to play in maintaining system reliability and enabling customer resiliency, system operators are exploring ways to integrate these resources into their systems.

According to Bloomberg New Energy Finance, the global energy storage market will double six times between 2016 and 2030, rising to a total of 125 gigawatts. This is similar to the solar industry's expansion between 2000 and 2015, when solar share, as a percentage of total generation, doubled seven times.

When Ontario's current electricity markets, supporting tools and processes, and regulatory frameworks were created, the widespread adoption of storage technologies (aside from large-scale pumped hydro) was not contemplated and many of the storage technologies available today were unknown.

The emergence of new energy storage technologies has changed the paradigm in a sector that has traditionally been operated with conventional resources that act as a load or a generator but not both. As a result, storage facilities are facing obstacles that limit both their ability to compete to provide services that they are otherwise capable of delivering, and to integrate into wholesale electricity markets and systems.

As Ontario moves to a more competitive and technology-neutral approach to acquiring products and services, energy storage resources need to be able to compete in the delivery of market services and be effectively integrated into the system to ensure their potential value is realized to achieve the best cost and reliability outcomes for ratepayers.

IESO Committed to Supporting New Technologies

Enabling innovation and competition of newer technologies is central to the Independent Electricity System Operator's (IESO's) innovation and efficiency agenda. Because energy storage can deliver multiple capabilities – both as a load and as a generator – supporting further

integration of these resources into the electricity system is essential to sector evolution and modernization.

Moving with the U.S.

As the IESO focuses on eliminating barriers to the participation of energy storage in the electricity markets in Ontario, the U.S. Federal Energy Regulatory Commission (FERC) is making similar moves. In February 2018, FERC issued order no. 841, requiring independent system operators (ISOs) and regional transmission organizations (RTOs) to level the playing field. The order requires each ISO and RTO to revise its tariff to establish a participation model for storage resources, and implement a compliance plan by the end of 2019.

Evolving Role of Energy Storage

Despite current obstacles, energy storage is not new to Ontario's electricity system. For more than six decades, the Sir Adam Beck Pump Generating Station has been helping the IESO maintain reliability in the province through its storage of water from the Niagara River.

In 2012, the IESO launched the Alternate Technologies for Regulation pilot program and procured six megawatts of capacity from two storage facilities to provide regulation service that maintains second-by-second balance on the grid. Both of those facilities came online in 2014.

Two years later, the IESO expanded its portfolio with two procurements (Phase 1 and Phase 2 Energy Storage Programs) for an additional 50 MW of energy storage from approximately 20 different projects. These projects are providing the IESO with more information on both the reliability services that energy storage solutions can provide and the value of these solutions in Ontario.

Creation of the Energy Storage Advisory Group

In April 2018, the IESO established the Energy Storage Advisory Group (ESAG) to advise, support and assist the IESO in evolving policy, rules, processes and tools to better enable the integration of storage resources within the current structure of the IESO-administered markets.

The objectives of the ESAG are to:

- Support the IESO's work to identify obstacles to fair competition for energy storage resources, in Market Rules, industry codes, and regulations, and propose mitigating strategies, where appropriate;
- Provide input to the IESO's work plan and/or list of priorities to address storage-related issues and opportunities within the current IESO-administered markets, including tools and operational arrangements; and
- Advise, consult and coordinate discussions on issues which may affect storage participation in the existing IESO-administered markets.

This report focuses on the identified obstacles and mitigating strategies to address these barriers and help ensure fair competition of energy storage resources in the market.

Developing Mitigating Strategies

The IESO has developed, with consideration of feedback from ESAG,¹ mitigating strategies to deal with obstacles that warranted further action and relate to the IESO Market Rules, OEB Codes, or legislation and regulations. Criteria were developed, reviewed by the ESAG, and applied to an inventory of obstacles to determine which of them met these conditions.

Recommendations

- [Review and amend Market Rules](#)
- [Review the Ontario Energy Board Codes](#)
- [Consider energy storage in Ontario legislation and regulations](#)
- [Consider the market-efficiency impact of applying wholesale uplift charges](#)
- [Review the application of transmission and distribution charges](#)
- [Clarify the use of forecast revenues from distribution and transmission rates as an offset to connection costs](#)
- [Provide a clearer framework for including storage assets in rate base](#)
- [Address the incentive for distributors to favour capital investments](#)
- [Develop guidance for storage resources providing multiple services to different entities](#)
- [Review the application of the gross revenue charge](#)

¹ All public comments and feedback provided by ESAG members are published on the [ESAG webpage](#) on the IESO's website. In addition, the IESO reviewed all public feedback at ESAG meetings and described how it was considered. The presentations reviewing the feedback are also available on the ESAG webpage.

- [Review the RRRP program surcharge](#)
- [Clarify the resources that transmitters and distributors can own and operate](#)

The organizations responsible for these recommendations include the IESO, the OEB and the Ministry of Energy, Northern Development and Mines.

The IESO is committed to leveraging the ESAG as a forum to pursue solutions to the identified barriers that fall under its jurisdiction.

To encourage implementation of recommendations across the responsible organizations, the OEB and the Ministry of Energy, Northern Development and Mines are welcome to leverage the ESAG forum to continue discussions on items related to their respective mandates.

INTRODUCTION

Background

At any given point in time on the electricity grid, power supply and demand must be equal. Adjustments are made constantly to accommodate for predictable changes like human behaviour and unpredictable changes like equipment failure. Energy storage technologies are allowing electricity to be stored and re-injected back into the grid when it is needed, helping maintain that important balance of supply and demand and ensuring a reliable grid.

However, when the electricity markets opened in 2002, widespread adoption of distributed energy resources (DERs), including energy storage, was not contemplated (except for large-scale pumped hydro). The market's system tools and processes created at that time supported the participation of conventional resources. As a result, storage facilities are facing obstacles that limit both their ability to provide services that they are otherwise capable of delivering and to integrate into wholesale electricity markets and systems.

As Ontario moves to a more competitive and technology-neutral approach to acquiring products and services, and as the role of storage in Ontario continues to grow, these resources need to be able to compete in the delivery of market services and be effectively integrated into the system to ensure that the potential value is realized.

IESO Committed to Supporting New Technologies

Enabling innovation and competition of newer technologies is central to the Independent Electricity System Operator's (IESO's) innovation and efficiency agenda. Identifying, understanding and removing barriers to new technologies will help enable the innovation of these participants.

Because energy storage can deliver multiple capabilities – both as a load and as a generator – supporting further integration of these resources into the electricity system is essential to sector evolution and modernization.

Creation of the Energy Storage Advisory Group

In April 2018, the IESO established the Energy Storage Advisory Group (ESAG) to advise, support and assist the IESO in evolving policy, rules, processes and tools to better enable the integration of storage resources within the current structure of the IESO-administered market.

The objectives of the ESAG are to:

- Support the IESO's work to identify obstacles to fair competition for energy storage resources;
- Provide input to the IESO's work plan and/or list of priorities to address storage related issues and opportunities; and
- Advise, consult and coordinate discussions on issues which may affect storage participation in the existing IESO-administered markets.

Moving Forward

The recommendations in this report are an important step in removing the barriers facing energy storage resources in Ontario. However, there is still more work to be done by the sector, including the Ontario Energy Board (OEB) and the Ministry of Energy, Northern Development and Mines.

As an IESO advisory body, the ESAG will continue to play a key role in helping to implement report recommendations that are within the IESO's mandate through ongoing discussions in 2019.

The recommendations in this report are expected to be used as one input to the OEB's initiatives to: identify regulatory reforms for distributed energy resources (DERs), such as storage; and, encourage utilities to strengthen their focus on long-term value and least-cost solutions.² Through this OEB-led work, dialogue related to a number of the recommendations included in this report is expected to continue.

² As described in the OEB's [2018-2021 Business Plan](#)

Recommendations

The ESAG examined many different barriers to fair competition of storage resources within the current market structure. The complete inventory can be found on the [ESAG page](#) on the IESO website.³

The IESO has developed, with feedback from the ESAG, strategies for mitigating obstacles in the inventory that relate to Market Rules, OEB Codes, legislation and regulations, based on the criteria described in Appendix 1.

The recommendations fall into two categories. The first addresses [lack of clarity in Market Rules, OEB Codes, and legislation and regulations](#) related to energy storage resources, while the second deals with [specific concerns within the Market Rules, OEB Codes, Policy and Guidance, and legislation and regulations](#), or any combination thereof.

LACK OF CLARITY IN MARKET RULES, OEB CODES, AND LEGISLATION AND REGULATIONS

With often no reference to energy storage in the Market Rules, OEB Codes, and legislation and regulation, all parties are left to interpret how the existing rules apply. Because storage resources act as both a load and a generator, the intended application and interpretation of existing rules for loads and generators is often unclear. This can create confusion and inefficient outcomes.

To remedy these concerns, this report recommends

- [The IESO review and amend its Market Rules;](#)
- [The OEB review its relevant Codes;](#) and
- [The Government of Ontario consider energy storage in Ontario legislation and regulations.](#)

³ <http://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Energy-Storage-Advisory-Group>

Review and Amend the IESO Market Rules

Energy storage is not specifically identified in the IESO's Market Rules. For example, rules regarding prudential requirements, facility registration, metering, operational rules, settlement, ancillary services and reliability requirements do not address storage. Further, software tools used for market administration and resource dispatch better support market participants that are loads or generators; these tools do not always effectively represent resources that can serve as both. Most notably, this includes the dispatch scheduling optimization (DSO) engine, which is used to determine optimal dispatch instructions through consideration of a number of future dispatch intervals. The DSO helps to avoid excessive cycling of resources, as well as unpredictable dispatch, assisting in the maintenance of reliability and efficiency of the grid.

Recommendation

The IESO should review and amend its Market Rules, where possible, to clarify the participation of storage resources in IESO-administered markets.

This lack of clarity in the Market Rules is a systemic issue related to other obstacles facing energy storage resources explored by ESAG, including the:

- Inability of energy storage to participate in the IESO operating reserve (OR) market;
- Inability to optimize regulation service in the IESO-administered market from energy storage facilities;
- Inability of the IESO dispatch scheduling optimization (DSO) engine to model energy storage functionality;
- Absence of mechanisms to enable energy storage facilities to accrue revenues by offering multiple, non-overlapping services; and
- Lack of clarity with respect to storage in the interconnection process.

A Note on the Implementation of this Recommendation

A key part of implementing this recommendation is a plan to ensure fair treatment of energy storage facilities with respect to other types of market participants. This plan will be influenced by the continued work of the IESO's ESAG, as well as learnings from the IESO's energy storage competitive procurements.

Any proposed amendments to the IESO Market Rules need to be directionally consistent with the changes considered as part of the market renewal initiatives.

As Market Rules are reviewed, in the short-term consideration should be given to providing:

- Clarification of performance requirements for inverter-based technologies (per the standards that are being or have been developed by the Canadian Standards Association), as well as the party responsible for initiating the connection assessment process; and
- Guidance on how to operate under the existing Market Rules, including the process for submitting dispatch data and responding to dispatch instructions, where applicable.

Review the Ontario Energy Board Codes

Energy storage resources are not specifically referenced in OEB Codes, such as the Transmission and Distribution System Codes and the Retail Settlement Code. These Codes set out the obligations of distributors and transmitters and, among other things, provide the rules regarding connection of customers, as well as the economic evaluation of connections and expansions.

Because storage is not specifically identified in these Codes, sector participants, including transmitters and distributors, apply the existing regulatory framework to storage-related proposals, creating the risk of inconsistency.

Recommendations

- The OEB should review its Codes to consider energy storage participation and its regulatory framework, including processes and requirements for connections. This work may be undertaken in the context of broader initiatives outlined in the OEB's Business Plan, such as the initiative to enable DERs.
- Pending a comprehensive review of its Codes, the OEB could provide information on how to interpret the existing requirements in the Codes with respect to energy storage resources.

Consider Energy Storage in Ontario Legislation and Regulations

In many cases, there is no clear role and/or definition of energy storage in Ontario legislation and regulation. While the government recently amended Ontario Regulation 429/04 *Adjustments Under Section 25.33 of the Act* to address energy storage, other regulations – such as Ontario

Regulation 124/02 *Taxes and Charges on Hydro-Electric Generating Stations*, as well as Ontario Regulation 442/01 *Rural or Remote Electricity Rate Protection* – are left open to interpretation.

Recommendation

The Government of Ontario should consider the role of energy storage both as part of any new legislation and regulations or amendments to existing legislation and regulation and within Ontario Regulations 124/02 and 442/01, which refer to the [gross revenue charge](#) and [rural and remote rate protection plan surcharge](#).

SPECIFIC CONCERNS WITH MARKET RULES, OEB CODES, POLICY AND GUIDANCE, AND LEGISLATION AND REGULATION

Concerns identified by ESAG with respect to specific content covered by the IESO Market Rules, OEB Codes, Policy and Guidance, and legislation and regulation (and combinations thereof) are addressed in the following mitigating strategies:

1. [IESO Market Rules](#)
 - [Consider the market-efficiency impact of applying wholesale uplift charges](#)

2. [OEB Codes, Policy and Guidance](#)
 - [Review the application of transmission and distribution charges](#)
 - [Clarify the use of forecast revenues from distribution and transmission rates as an offset to connection costs](#)
 - [Provide a clearer framework for including storage assets in rate base](#)
 - [Address the incentive for distributors to favour capital investments](#)

3. [IESO Market Rules and OEB Codes, Policy and Guidance](#)
 - [Develop guidance for storage resources providing multiple services to different entities](#)

4. [Legislation and Regulations](#)
 - [Review the application of the gross revenue charge](#)
 - [Review the application of the RRRP program surcharge](#)

- [Clarify the resources that transmitters and distributors can own and operate](#)

Section 1 - IESO Market Rules

Consider the Market-Efficiency Impact of Applying Wholesale Uplift Charges

Currently, uplift charges are used to recover the costs associated with such items as cost guarantees, ancillary services and reliability expenses. As part of operating the market, the IESO calculates uplift charges and allocates them to market participants on their withdrawals of electricity.

Storage resources withdrawing electricity to charge their facilities are required to pay wholesale uplifts according to their consumption, much like a traditional load. The storage community has indicated that this may result in inefficient market outcomes if the storage facilities recover these costs through the market when providing a wholesale market service. For example, stakeholders noted that market inefficiencies could result if the application of the uplifts prevented a storage facility from being economic to dispatch and this resulted in higher total costs to the system.

The IESO believes that it is appropriate for storage resources to pay wholesale uplifts from the perspective of consistency with how other market participants are charged, as well as fairness in terms of paying for the services from which they benefit. However, more discussion is required to understand the impact on market efficiency.

Recommendation

The IESO should lead further discussions to consider the potential impacts to market efficiency resulting from the application of uplift charges. These discussions should be coordinated with design changes as part of the IESO's market renewal initiatives.

Section 2 – OEB Codes, Policy and Guidance

Review Application of Transmission and Distribution Charges

Without a specific rate class for energy storage resources, transmitters and distributors must interpret the existing framework to determine the applicability of transmission and distribution

charges to energy storage resources. This issue means that energy storage resources are generally treated as loads for the purposes of the application of these charges.

The storage community also expressed concern with respect to gross load billing for the line and transformation connection components of the transmission charges. Specifically, the concern is that storage resources experience a lower threshold for triggering gross load billing than embedded renewable resources. This issue has been raised as part of a live proceeding before the OEB EB-2017-0049 and continues to be monitored by the sector.

Transmission and distribution charges are the jurisdiction of the OEB. Given the complexity of this issue, and its linkages to the regulatory framework, the IESO recommends that further dialogue on these challenges take place.

Recommendation

As the application of transmission and distribution charges is a complex and multi-faceted problem that involves cost allocation and rate design, the OEB should lead further discussions on this issue.

A Note on the Implementation of this Recommendation

The OEB will be considering the application of charges, as well as rate design, as part of the initiatives outlined in its [2018-2021 Business Plan](#) to identify regulatory reforms needed to facilitate the integration of distributed energy resources, including storage.

Clarify the Use of Forecast Revenues from Distribution and Transmission Rates as an Offset to Connection Costs

Because energy storage resources are often treated as loads, they are subject to transmission and distribution charges based on their withdrawals of electricity. In some cases, these revenues are not considered when determining capital cost contributions related to new or expanded connections, as per section 3.2.1 of the Distribution System Code (DSC) and section 6.3 of the Transmission System Code (TSC). This issue has resulted in inconsistent treatment of energy storage as it relates to the provisions of the DSC and TSC.

Recommendations

- To the extent that there is an inconsistent application of the DSC and TSC for energy storage facilities when it comes to connection costs, the OEB should provide clarification on the intention and expected application of these provisions.
- The OEB should also ensure stakeholders are aware of the process for filing complaints regarding incorrect application of rules.

Provide a Clearer Framework for Including Storage Assets in Rate Base

Regulated utilities now have more potential cost-effective options for meeting their distribution or transmission needs, including storage. Distributors and transmitters are more practiced in the process for cost recovery of “poles and wires” solutions through the rate base, while there is less experience in the inclusion of other types of cost-effective assets in the rate base. While some distributors have already included storage in rate base, more clarity is required on how a distributor or transmitter can include a cost-effective storage asset in its rate base.

Recommendation

With new potential cost-effective options to meet needs, the OEB should provide the sector with greater clarity on how to include options such as cost-effective energy storage in the rate base.

A Note on the Implementation of this Recommendation

The OEB’s [Guidelines for Electricity Distributor Conservation and Demand Management](#) discuss how distributors can apply to recover the costs of storage in rates if the need for capital investment is deferred or displaced. In addition, discussions on facilitating the use of DERs, such as storage, as alternatives to “poles and wires” are expected to continue as part of the OEB initiative to move to a regulatory framework that would allow utilities to strengthen their focus on long-term value and least- cost solutions.

Address the Incentive for Distributors to Favour Capital Investments

Under the current regulatory framework, distributors may be incented to pursue their own capital investments over third-party solutions to provide a distribution service. This is not only because distributors earn a return on capital but not on operating expenses, through which third-party solutions would be financed, but also because distributors have a legal

responsibility to maintain the safety and reliability of their systems and relying on a third-party solution to meet those obligations may be perceived as riskier.

Recommendation

The OEB should consider emerging alternatives for service provision, such as energy storage, in its planned review of utility remuneration.

Section 3 – IESO Market Rules and OEB Codes, Guidance and Policy

Develop Guidance for Storage Resources Providing Multiple Services to Different Entities

Currently, there are limited means to enable energy storage facilities to accrue revenues from offering multiple, non-overlapping services. While they have the potential to provide services behind-the-meter, at the distribution and transmission levels, and to the wholesale markets, existing frameworks are not conducive to optimizing the services they can provide.

Recommendations

- Recognizing that storage can provide services behind-the-meter and at the distribution and transmission levels, the OEB should develop guidance on providing multiple services to different entities.
- The IESO should lead discussions with the storage community to better understand the breadth of wholesale market services that energy storage could provide and how to integrate this into the current IESO-administered markets.
- Given the interconnected nature of these recommendations, the IESO suggests that further discussions should include engagement with the ESAG.

A Note on the Implementation of this Recommendation

The OEB has identified the need to appropriately compensate the multiple value streams that DERs, such as storage, can provide as part of its broader initiative to enable DERs.

Section 4 – Legislation and Regulation

Review the Application of the Gross Revenue Charge

Hydro-electric generating facilities pay taxes and charges calculated on their gross revenue, as required through Ontario Regulation 124/02.

There are three parts to this gross revenue charge (GRC):

- Property tax portion payable to the Minister of Finance
- Property tax portion payable to the Ontario Electricity Financial Corporation, and
- Water rental charge portion payable to the Minister of Finance.

These charges are applied to pumped hydro facilities when they withdraw electricity from the grid to operate the facility's pumps, much like a load. The storage community has indicated that the application of the gross revenue charge may not be appropriate as the stored electricity is returned to the grid.

Recommendation

Since GRC has tax policy and other considerations, the Ministry of Energy, Northern Development and Mines and the Ministry of Finance should lead further dialogue and review of the application of the GRC to pumped hydro storage.

Review the Application of the RRRP Program Surcharge

The Rural and Remote Rate Protection (RRRP) program, required by *Ontario Regulation 442/01*, is a surcharge applied to all electricity consumers. Funds collected are provided to some LDCs to help offset the cost of providing service to consumers in rural and remote areas.

Storage facilities are subject to this surcharge on their withdrawals, similar to a load. The storage community has indicated that the application of the RRRP charge may not be appropriate as the stored electricity is returned to the grid.

Recommendation

Given that this charge deals with government programs and policy, the Ministry of Energy, Northern Development and Mines should lead further dialogue and review of the appropriateness of applying the Rural and Remote Rate Protection surcharge to storage.

Clarify the Resources that Transmitters and Distributors can Own and Operate

Section 71 (3) of the OEB Act identifies the types of resources that distributors can own and operate, including energy storage. Stakeholders have observed that a similar provision is not included in the act for transmitters.

It was also noted that there is clarity required around how Section 71(3) of the act relates to Section 80 of the act, which refers to the requirement to notify the OEB of generation ownership by transmitters and distributors. The IESO notes that a licensed entity could approach the OEB to request clarity on the relationship between these two provisions of the act, if it so required.

Recommendation

The Ministry of Energy, Northern Development and Mines should give consideration to creating a similar provision for transmitters as that in Section 71(3) of the OEB Act provides in respect of distributors.

NEXT STEPS

The IESO, with the input of ESAG members, has completed an important step in addressing barriers facing energy storage by categorizing and evaluating obstacles and, where appropriate, identifying mitigating solutions.

The ESAG has an enduring role and its focus will now shift to implementing the mitigating strategies within the IESO's mandate.

Specifically, in 2019, the ESAG will focus on creating and implementing a plan to ensure consistent treatment of energy storage facilities and inform IESO Market Rule amendment proposals through discussions of⁴ the:

- Integration of storage into wholesale market products and regulation service; and
- Interface between the wholesale market and distribution-connected storage.

The IESO welcomes the OEB and others to use the ESAG as a forum to continue discussions on barriers related to their mandates, where feasible and appropriate. The IESO recognizes that further work regarding many of the recommendations related to items within the OEB's

⁴ As discussed in the "Future ESAG Issues Scope" materials at the November 6, 2018 meeting, available at: <http://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Energy-Storage-Advisory-Group>

mandate will be conducted as part of its initiatives to facilitate DERs and address the remuneration of utilities. The scope of these initiatives is broader than issues pertaining solely to energy storage and a broader set of stakeholders must be engaged. The IESO encourages members of the ESAG to participate in the OEB's consultations on these initiatives as well. To the extent that this work addresses a barrier identified through ESAG or is related to IESO initiatives, ESAG members have expressed an interest to have a common forum for these discussions.

While the focus of this work is on the current structure of the market, the IESO also encourages ESAG members to participate directly in the future market vision as part of the market renewal initiatives.

CONCLUSION

With the growth of energy storage resources that can play a significant role in supporting system reliability, the sector must work together to enable fair competition when these resources are technically able to deliver these services.

The IESO, with the input of ESAG members, has taken an important step in unlocking opportunities for storage resources. Obstacles have been identified and mitigating strategies, where appropriate, have been developed to ensure that storage resources can be integrated into the market and can compete in the delivery of services, where technically feasible.

Because the current electricity market, supporting tools and processes, and regulatory frameworks were created before widespread adoption of distributed energy resources, including storage, many of the barriers identified in this report stem from a lack of clarity with respect to how storage should participate in the Market Rules, OEB Codes, and legislation and regulation.

Addressing obstacles to fair competition of energy storage resources requires further collaboration and ongoing dialogue among stakeholders in the electricity sector, including new and existing market participants, regulators and those that establish public policy.

The IESO is committed to its role enabling competition of energy storage in the delivery of services. To that end, it will continue to leverage the ESAG to support the implementation of the IESO-centred recommendations outlined in this report.

Appendix 1 – Criterion for Determining Obstacles

Is storage prevented from, or burdened in, competing with other technologies in the delivery of services that they are otherwise capable of providing?

The following test questions can be used to help assess issues for which the answer to the main criterion is not clear:

- Are Ontario's electricity Market Rules, Codes, and regulations able to accommodate the evolution and competition of new technologies, such as storage resources?
- Is the treatment of storage resources with respect to regulatory and market charges consistent with the intent of those charges?