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White Paper Series: Exploring Expanded DER Participation in the IAMs

Part II – Options to Enhance DER Participation

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Agenda

- Purpose
- Overview of the DER white paper series
- Conclusions from first white paper
- High-level options explored in the second white paper
- Evaluation of options and summary of conclusions
- Options to enhance DER participation
- Next steps
- Stakeholder engagement

Purpose of this Document

- This document presents the draft conclusions of part II of a two-part series of white papers exploring expanded participation of Distributed Energy Resources (DER) in the IESO Administered Markets (IAMs)
- Stakeholder feedback on the draft white paper will be used to finalize the conclusions and help determine which of the options merit further consideration in future market design work, which should be considered for pilot opportunities, and which do not merit further consideration at this time

Why the IESO is Exploring DERs

- Addressing barriers to market participation for DERs has the potential to improve competition and market efficiency, contribute to reductions in wholesale electricity prices, and enhance reliability and resiliency
- The importance of advancing work on the integration of DERs in the IAMs is underscored by the large number of DERs that have been installed in the province (e.g. for FIT, ICI programs) the potential for many more (e.g. driven by electricity rates, electric vehicle and clean energy policy) and a recent decision by the US Federal Energy Regulatory Commission (FERC – Order 2222) requiring wholesale market operators to create participation models for DER aggregations

The DER White Paper Series

In June 2019, IESO committed to developing a two-part white paper exploring expanded DER participation in the IAMs

- The first white paper, *Part I – Conceptual Models for DER Participation*, provided a working definition of DERs, established a framework for understanding potential DER participation models, assessed the extent to which DERs are enabled to participate in the IAMs today, and identified barriers to enhanced DER participation
- The second white paper, *Part II – Options to Enhance DER Participation*, explores options to address the barriers identified in the first white paper, evaluates the potential impacts of those options, and provides key insights and considerations to inform future market design work related to DERs

Conclusions from *Part I – Conceptual Models for DER Participation*

- There are currently limited options for DER participation in the IAMs:
  - Direct participation for DERs ≥ 1 MW, zonal aggregations of non-dispatchable demand response, and nodal aggregations of dispatchable generation and demand response
- The key barriers to enhanced participation of DERs are the minimum size threshold of ≥ 1 MW and the rules for aggregations
- Secondary barriers include telemetry requirements, limitations on coordination between the transmission and distribution systems, and the availability of system data (e.g. hosting capacity)

High-Level Options Explored in Second White Paper

Option*	Description
1. Adjusting the minimum size threshold	Enabling resources < 1MW to participate in the IAMs
2. Clarifying aggregation rules & processes	Clarify how aggregations of dispatchable DERs can participate in the IAMs today
3. Modifying aggregation boundaries	Modifying parameters for where aggregations could form
4. Modifying aggregation compositions	Modifying the parameters for what types of resources could be permitted within an aggregation
5. Creating a participation model for aggregated non-dispatchable generation	Permitting aggregated non-dispatchable generation to participate in the IAMs
6. Permitting alternative telemetry sources	Allow for the collection of operational data from new sources
7. Enhancing transmission-distribution (T-D) interoperability	Address potential distribution system impacts from DER participation in the IAMs
8. Identify and communicate system needs and capabilities	Publish information on hosting capacity and system needs at regular intervals

*High-level options were stakeholdered on Jan 30th, 2020

Evaluation of Potential Impacts and Key Considerations

For each of the options explored, potential impacts and key considerations were examined, including:

- Increasing the visibility of distribution-connected resources
- Enhancing competition in the IAMs
- Maintaining bulk system reliability
- Impacts to the distribution system and distributors
- IESO resources and costs required to implement
- Implementation time frame
- Ongoing administrative burden
- Interdependencies with other IESO initiatives
- Existence of alternative viable pathways for resources

Conclusion Categories

- Based on the outcome of the evaluation of potential impacts, the white paper identifies whether an option merits further consideration by the IESO and stakeholders, should be tested through a pilot, or should be paused until a later time

Merits Further Consideration	Pilot	Does Not Merit Further Consideration at this Time
Explore the implementation of the option in greater detail in future market design work in consultation with stakeholders	Test the feasibility of the option via a pilot project prior to making a decision on whether the option merits further consideration	The option does not merit further consideration at this time based on high-level net benefits or need

Options and Conclusions

Option	Merits further consideration	Pilot	Does not merit further consideration
Reducing the Minimum Size Threshold			X
Reducing the Minimum Size Threshold - Phased Approach	X		
Clarifying Existing Aggregation Rules and Processes	X		
Modifying Aggregation Boundaries: Sub-Zonal Aggregation Boundaries			X
Modifying Aggregation Boundaries: Multi-Nodal Aggregations	X		
Modifying Aggregation Compositions: Mixed Aggregations of Dispatchable Generation		X	
Modifying Aggregation Compositions: Mixed DR Contributors		X	
Creating a Participation Model for Aggregated Non-Dispatchable Generation	X		
Permitting Alternative Telemetry Sources: Device Level Data		X	
Permitting Alternative Telemetry Sources: Inverters		X	
Permitting Alternative Telemetry Sources: LDC Collected Operational Data	X		
Enhancing T-D Interoperability: Modifying Connection Process for Aggregations	X		
Enhancing T-D Interoperability: Sharing Day Ahead Schedule with LDCs			X
Enhancing T-D Interoperability: Coordinate on Boundaries of Aggregation Zones			X
Identifying and Communicating System Needs and Capabilities: Hosting Capacity	X		
Identifying and Communicating System Needs and Capabilities: System Needs	X		

Options that Merit Further Consideration or Require Pilots

Reduce the Minimum Size Threshold – Phased Approach

- Reducing the minimum size threshold for participation in the IAMs from ≥ 1 MW to a lower value *in a phased manner (e.g. allowing a limited number of resources <1 MW to participate and increasing that number over time)*
  - Mitigates the risk of overwhelming the IESO's market registration and dispatch processes and allows the IESO to slowly increase the volume of resources being managed
  - Also allows the IESO to gauge the level of interest of resources less than 1 MW to participate in the IAMs

Clarify Existing Aggregation Rules and Processes

- Provide clarity with respect to identifying the connection point to the IESO-Controlled Grid for DERs that are downstream of Transmission-Distribution (T-D) nodes (e.g. circuit vs bus vs feeder)
- Review and revise the connection assessment process to take into account dynamics at the T-D interface or below for DERs (e.g. load transfers or connection points served by multiple T-D nodes)
- By clarifying market rules/developing guidance documents, the IESO can more clearly define requirements for DER aggregators, as well as set expectations on how applications for aggregation will be vetted

Modify Aggregation Boundaries: Multi-Nodal Aggregations

- Allow aggregations with contributors connecting to more than one point on the IESO-Controlled Grid
- Would increase the ability of DER aggregations to meet local needs, and could allow the IESO to increase or remove caps on aggregated DERs secured through demand response or capacity auctions
- Potential to pilot this option through a targeted Grid-Innovation Fund (GIF) call

Modify Aggregation Compositions: Mixed Aggregations of Dispatchable Generation or Mixed DR Contributors

- Allow aggregations of different types of generation resources (starting with resources with similar output characteristics) or different customers
  - Would make it easier for aggregators to find contributors and provide greater flexibility to respond to dispatch signals
  - For DR, customers can have different metering, measurement intervals, and M&V - details of this option require further investigation
  - Potential to pilot this option through a targeted GIF call
  - Potential to include storage in dispatchable mixed aggregations once enduring participation model is implemented

Create a Participation Model for Aggregated Non-Dispatchable Generation

- Enable aggregations of non-dispatchable resources to participate in the Energy Market and Capacity Auction
- Absent a participation model for this category of resources, the IESO risks losing the capacity contributions from a large portion of existing contracted DERs at the conclusion of their contracted terms
- If such resources were permitted to aggregate in the energy market, a major barrier to future participation in capacity auctions would be removed

Permit Alternative Telemetry Sources

- **Device Level Data:** Secure telemetry data (i.e. operational data required for dispatch and monitoring of the resource) direct from devices other than IESO revenue grade meters data
  - Further analysis is needed to test the actual performance, determine M&V requirements, and assess cybersecurity concerns of this option
  - Potential to pilot this option through a targeted GIF call
- **LDC Collected Data:** Leverage telemetry data collected by LDCs
  - IESO would have to coordinate with distributors to obtain access to the data stream as well as ensure that IESO systems have capacity to accommodate the number of additional connections

Enhance T-D Interoperability: Modifying Connection Process for Aggregations

- Modify the IESO's resource registration and connection assessment processes to include LDC assessments of impacts to the distribution system and, ultimately, LDC approval for registration of DER aggregations
- Prudent first step towards further coordination that may be required in the future given the current limitations on the real-time modelling of the distribution system, and the absence of real-time communication protocols for DER aggregation dispatch

Communicate System Capabilities and Needs

- **Hosting Capacity:** Provide guidance to participants on where the bulk system can accommodate DERs, identifying areas of bulk system congestion, and working with transmitters to determine hosting capacity that reflects transmission asset constraints in order to better target deployments
- **Local Needs:** The IESO could further identify more geographically specific needs through the regional planning process, including where DERs could potentially act as cost-effective non-wires alternatives to defer/offset traditional infrastructure

Next Steps

- For those options identified as meriting further consideration, the IESO will incorporate learnings into future market design work
- For those options identified as requiring pilots, the IESO will consider piloting opportunities, including through the Grid Innovation Fund (GIF)
- Develop roadmap/vision to set out approaches/timing for fully enabling DERs to compete in IESO-administered markets for all products/services they are technically capable of providing
- Initiate DER Potential Study to determine existing and potential future speed and scope of DER development in Ontario in order to inform business case for potential market integration activities

Stakeholder Feedback

- Which of the options would be most effective to encourage DER participation in the IAMs? Why?
- Are there additional potential impacts to stakeholders that have not been explored in the white paper?
- Are there additional implementation considerations that have not been explored in the white paper?
- Which wholesale products/services would DER owners/aggregators seek to provide in the IAMs if these options were implemented in the future? Using what technologies? Are there specific options that would allow these products/services to be offered?

Stakeholder Feedback

Please use the feedback form found under the November 19th entry on the Innovation and Sector Evolution White Paper Series webpage to provide feedback on the draft white paper.

Please send to engagement@ieso.ca by December 10, 2020.

Questions?

Appendix:
All Options to Enhance DER Participation Explored

Option 1(a) Reducing the Minimum Size Threshold

Description

- Reduce the minimum size threshold for participation in the IAMs from ≥ 1 MW to a lower value (e.g. 500 kW or 100 kW)

Option 1(a) Reducing the Minimum Size Threshold

Conclusion→ Does not merit further consideration at this time

- Reducing the minimum size threshold is the fastest approach to removing barriers for smaller DERs to participate in the IAMs
- An abrupt reduction applicable to all resource types may result in an unmanageable administrative burden on the IESO due to the increased volume of market participants (e.g. registrations, connections, modelling, slowing dispatch software)
- NYISO currently experiencing similar issues related to a reduction in the minimum-size threshold to 100 kW

Option 1(b) Reducing the Minimum Size Threshold – Phased Approach

Description

- Reduce the minimum size threshold for participation in the IAMs from ≥ 1 MW to a lower value (e.g. 500 kW or 100 kW) *in a phased manner*
- Permit a limited number of resources below 1 MW to participate in the IAMs and increase that limit annually

Option 1(b) Reducing the Minimum Size Threshold – Phased Approach

Conclusion → Merits further consideration

- A phased approach has several benefits over a complete reduction:
  - Mitigates the risk of overwhelming the IESO's market registration and dispatch processes
  - Allows the IESO to slowly increase the volume of resources being managed by the DSO in order to mitigate potential risks
  - Allows the IESO to gauge the level of interest of resources less than 1 MW to participate in the wholesale markets

Option 2 Clarifying Existing Aggregation Rules and Processes

Description

- Provide clarity with respect to identifying the connection point to the ICG for DERs that are downstream of T-D nodes (e.g., circuit vs bus vs feeder)
- Review and revise the connection assessment process to take into account dynamics at the T-D interface or below (i.e., dual element spot networks (DESNs) switching, load transfers by distributers) for DERs

Option 2 Clarifying Existing Aggregation Rules and Processes

Conclusion → Merits further consideration

- Existing rules were tailored to transmission-connected resources and do not adequately describe approaches for aggregation for DERs located at different connection points
- By clarifying language within the market rules/developing guidance documents, the IESO can more clearly define requirements for DER aggregators, as well as set expectations on how applications for aggregation will be vetted by the IESO

Option 3(a) Modifying Aggregation Boundaries: Sub-Zonal Aggregation Boundaries

Description

- Sub-zonal aggregation boundaries are essentially smaller transmission zones established for the purposes of DER aggregations.
- These zones can be defined by groups of T-D nodes with similar system conditions or the same or similar Local Marginal Prices (LMP)

Option 3(a) Modifying Aggregation Boundaries: Sub-Zonal Aggregation Boundaries

Conclusion→ Does not merit further consideration at this time

- Sub-zonal aggregation boundaries could allow the IESO to have greater confidence in the modeled impacts of resource operation relative to the zonal aggregation approach used for HDR today
- Boundaries may still be too large to provide the IESO with high confidence in the dynamics of power flows of aggregated resources
- The use of sub-zonal aggregation boundaries would likely encounter issues similar to those found in the zonal aggregation of HDR

Option 3(b) Modifying Aggregation Boundaries: Multi-Nodal Aggregations

Description

- Multi-nodal aggregations could allow aggregations with contributors connecting to more than one point on the IESO-Controlled Grid:
  - Multiple contributor resources connected to more than one T-D node
  - A contributor resource that is within a distribution system served by more than one T-D node
  - A connection point that has multiple electrical connections like a Dual Element Spot Network (DESN)

Option 3(b) Modifying Aggregation Boundaries: Multi-Nodal Aggregations

Conclusion→ Merits further consideration

- Could give the IESO greater confidence regarding a DER aggregation's impact on local and bulk system conditions. Increases the usability of DER aggregations to meet more local needs, and could allow the IESO to increase or remove caps on aggregated DERs secured through demand response or capacity auctions
- IESO could incorporate analysis to determine allowable combinations of nodes within the regional planning process, and refine these boundaries incrementally in coordination with transmitters and LDCs

Option 4(a) Modifying Aggregation Compositions: Mixed Aggregations of Dispatchable Generation

Description

- Enable mixed aggregations of generation resources, starting with resources with similar output characteristics (e.g., inverter-based technologies)

Option 4(a) Modifying Aggregation Compositions: Mixed Aggregations of Dispatchable Generation

Conclusion→ Pilot

- Allowing multiple types of generation to participate in a single aggregated resource has a number of advantages relative to permitting only one type of generation, including:
  - Reducing the difficulty of finding enough contributor resources to form an aggregation
  - Enabling aggregators flexibility to respond to system operator dispatch signals

Option 4(b) Modifying Aggregation Compositions: Mixed DR Contributors

Description

- Enable mixed aggregations of different load types
- Develop the measurement and verification methodologies to facilitate mixed DR aggregations

Option 4(b) Modifying Aggregation Compositions: Mixed DR Contributors

Conclusion → Pilot

- Existing and prospective DR participants have referenced challenges in building portfolios of DR with sufficient capacity to achieve the IESO's minimum size threshold
- Permitting a diverse mix of contributor loads within a DR aggregation could ease the formation of aggregations and enhance the ability of an aggregated resource to meet dispatch instructions
- Different customers have different metering, measurement intervals, and M&V, many details of this option require further investigation

Option 5 Creating a Participation Model for Aggregated Non-Dispatchable Generation

Description

- Enable aggregations of non-dispatchable resources to participate in the Energy Market and Capacity Auction

Option 5 Creating a Participation Model for Aggregated Non-Dispatchable Generation

Conclusion → Merits further consideration

- At present, there is no market participation model for aggregated non-dispatchable generation resources in the IAMs
- Absent a participation model for this category of resources, the IESO risks losing the capacity contributions from a large portion of existing contracted DERs at the conclusion of their contracted terms
- If such resources were permitted to aggregate, they could then be made eligible for participation in the capacity auction in the future

Option 6(a) Permitting Alternative Telemetry Sources: Device-Level Data

Description

- Securing telemetry data direct from certain types of devices, rather than IESO revenue grade meters

Option 6(a) Permitting Alternative Telemetry Sources: Device-Level Data

Conclusion → Pilot

- Permitting device-level telemetry could allow market participation for a diverse assortment of smaller scale DERs for which the current methods of providing telemetry may be too expensive or complex
- It is expected that the technical level of performance of such an arrangement could be compatible with the IESO's standards for dispatchable resources as defined in the Market Rules – however, analysis is needed to test the real-world performance, determine M&V requirements, and assess cybersecurity concerns of this option

Option 6(b) Permitting Alternative Telemetry Sources: Inverters

Description

- Securing telemetry data direct from smart inverters, rather than IESO revenue grade meters

Option 6(b) Permitting Alternative Telemetry Sources: Inverters

Conclusion → Pilot

- Modern inverters are being more broadly deployed as new projects are built or inverters are replaced on existing projects
- The IESO and market participants could begin to leverage the advanced features of these inverters (e.g. ability to supply telemetry)
- As is the case with device level telemetry, the ability to leverage inverter telemetry, in aggregated form, will need to be studied in more detail to assess their ability to comply with IESO data transfer, accuracy, and security requirements

Option 6(c) Permitting Alternative Telemetry Sources: LDC Collected Operational Data

Description

- Securing telemetry data for distributed generators that is already collected by LDCs, rather than using IESO revenue grade meters

Option 6(c) Permitting Alternative Telemetry Sources: LDC Collected Operational Data

Conclusion → Merits further consideration

- LDC collected operational data represents an existing source of telemetry that is compatible with the IESO's minimum standards for accuracy, scan rate, latency, and security for market participation
- To be able to leverage this data, the IESO would have to coordinate with distributors to obtain access to the data stream as well as ensure that IESO systems (e.g. SCADA/EMS) have capacity to accommodate the number of additional connections

Option 7(a) Enhancing T-D Interoperability: Modifying Connection Process for Aggregations

Description

- Modify the resource registration and connection assessment processes to include LDC assessments of impacts to the distribution system and, ultimately, LDC approval for registration and connection of DER resources

Option 7(a) Enhancing T-D Interoperability: Modifying Connection Process for Aggregations

Conclusion → Merits further consideration

- Can help avoid expected areas of conflict between the operational needs of the bulk system and distribution system
- Give LDCs a measured ability to approve or reject DER aggregations that may compromise the reliability of their systems
- Prudent first step towards further coordination that may be required in the future given the current limitations on the real-time modelling of the distribution system, and the absence of real-time communication protocols for DER aggregation dispatch

Option 7(b) Enhancing T-D Interoperability: Sharing Day Ahead Schedule with LDCs

Description

- Share day-ahead DER schedules with affected LDCs to help determine the feasibility of the IESO's dispatch schedule and identify any reliability impacts due to distribution system constraints

Option 7(b) Enhancing T-D Interoperability: Sharing Day Ahead Schedule with LDCs

Conclusion → Does not merit further consideration at this time

- Could allow LDCs to prepare for potential adverse circumstances and inform the IESO of reliability issues
- Could create an ongoing administrative burden for the IESO and LDCs
- Market participant confidentiality risks also exist, particularly if LDCs' roles are expanded to include resource ownership in the future
- The IESO's day ahead market is still under development and should be complete before this options is explored further

Option 7(c) Enhancing T-D Interoperability: Coordination of Aggregation Boundaries

Description

- Work with LDCs to identify existing T-D interfaces (i.e., nodes) that can serve as allowable points for aggregation, followed by the creation of "new" or additional nodes based on distribution-level constraints

Option 7(c) Enhancing T-D Interoperability: Coordination of Aggregation Boundaries

Conclusion → Does not merit further consideration at this time

- To further mitigate potential conflicts between the needs of the bulk system and the conditions expected within the distribution system, LDCs could participate in the development and regular reevaluation of aggregation boundaries affecting their service territory
- The near-term necessity of LDC input into this process may not be warranted given the lack of DER aggregations participating in the IAMs (other than HDR)

Option 8(a) Identifying System Capabilities and Needs: Hosting Capacity

Description

- Provide guidance on where the bulk system can accommodate DERs, identifying areas of bulk system congestion, and working with transmitters to determine hosting capacity that reflects transmission asset constraints

Option 8(a) Identifying System Capabilities and Needs: Hosting Capacity

Conclusion → Merits further consideration

- Providing public information on available hosting capacity can help guide DER development in areas of the system with the ability to accommodate new resources
- The IESO could consider regularly determining and communicating higher tier constraints relating to zonal and transmission circuit congestion for the entire province
- These activities could be undertaken periodically as needed

Option 8(b) Identifying System Capabilities and Needs: System Needs

Description

- Communicate transmission-level system needs identified through the provincial planning process and regional planning process
- The IESO can further identify more geographically specific needs through the regional planning process, including where DERs could potentially act as non-wires alternatives

Option 8(b) Identifying System Capabilities and Needs: System Needs

Conclusion → Merits further consideration

- The determination and communication of system needs could expediently direct DER development towards areas of high and overlapping bulk and local system benefits
- The IESO's Regional Planning process provides an avenue for coordination between the needs of transmitters, LDCs, and communities

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