



JANUARY 30, 2020

Exploring Expanded Distributed Energy Resource Participation in the IESO Administered Markets

Part 2: Options and Considerations for Enabling Distributed Energy Resource Participation

Public Webinar

The DER white paper series

- On October 17, 2019 the IESO released the first of a two-part series of white papers on exploring expanded Distributed Energy Resource (DER) participation in the IESO Administered Markets (IAMs)
- The first white paper provided a working definition of DERs, principles for integrating DERs into the IAMs, participation models that are available in the IAMs today, barriers to enhanced participation, and an overview of DER integration efforts in other jurisdictions
- The second white paper will include a more detailed examination of the relevant participation models and explore potential options and considerations to address the barriers that were identified in the first white paper that could be considered in future market design work



Purpose of this document

- Review stakeholder feedback from the first white paper
- Define the scope of the second DER white paper and how it relates to other IESO initiatives
- Present draft high-level options and considerations to enhance DER participation in the IAMs that are proposed to be explored in the second DER white paper
 - Stakeholder feedback on this document will be used to help determine which options and approaches are included and more fully explored in the second DER white paper
 - **The IESO is not committing to implement these options** at this time. **The IESO is only committing to further explore options** in more detail in the second DER white paper in order to help inform any future market design work

Overview

- Stakeholders generally agree that the correct barriers to DER participate in the IAMs had been identified in the first DER white paper
- The IESO is proposing to explore a series of options and approaches to enhancing DER participation in the IAMs and to identify key considerations for any future market design work
- The IESO is seeking feedback on the draft options and considerations presented in this document in order to further scope the second DER white paper:

Overview (Cont'd)

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. Identifying and communicating system needs and capabilities	Publish information on hosting capacity at regular intervals

Stakeholder feedback on first white paper

- The IESO requested stakeholder feedback on the barriers to DER participation in the IAMs that were identified in the first white paper
- 11 submissions were received from the following organizations:
 - [Ontario Waterpower Association](#)
 - [Ontario Power Generation](#)
 - [Environmental Defence](#)
 - [Hydro One](#)
 - [Advanced Energy Management](#)
 - [Ontario Energy Association](#)
 - [Alectra](#)
 - [Peak Power](#)
 - [QUEST Ontario CHP Consortium](#)
 - [Electricity Distribution Association](#)
 - [Energy Storage Canada](#)
- The IESO's response-to-feedback document has been posted to the [Innovation and Sector Evolution White Paper Series engagement page](#)

Key themes identified in stakeholder feedback

- Consensus that the correct barriers to DER participation in the IAMs have been identified
- Reconsider the evolution of energy efficiency from the definition of DERs being used for the white paper
- Need for increased coordination between IESO and the Ontario Energy Board (OEB)
- Consider potential cost mobility impacts to Local Distribution Companies (LDCs) and the distribution system generally

Stakeholder feedback on first white paper

Feedback

IESO Response

Consensus that the correct barriers to DER participation in the IAMs have been identified

As stakeholders have affirmed the relevance of the key barriers identified in the white paper, the IESO is comfortable moving forward to explore options to address those barriers within the second white paper

Reconsider the exclusion of energy efficiency (EE from the definition of DERs being used for the white paper

The definition of DERs presented is exclusively for the purpose of the white paper. EE is out of scope for the white paper as the ability of EE to participate in electricity markets in Ontario is being examined elsewhere (e.g. EE pilot auction). Other initiatives are considering the use of EE more broadly (e.g. regional planning, conservation framework) Since EE is out of scope for the white paper, the definition of DER used for the purpose of the white paper does not include EE. EE has a unique set of properties compared to other DERs (e.g. EE is not controllable in real-time or near real-time like many other DERs)

IESO will provide further thoughts on the challenges and opportunities of EE to participate in markets in the next white paper for further discussion with stakeholders

Stakeholder feedback on first white paper (Cont'd)

Feedback

IESO Response

Need for increased coordination between IESO and the Ontario Energy Board (OEB)

The IESO continues to engage with the OEB on issues related to DERs, including the options and considerations being explored to enhance DER participation in IAMs. While coordination with the OEB on the subject matter of the white papers is important and valuable, coordination becomes more important when and if DER intergradation initiatives progress to the point of being considered for implementation (e.g. the OEB's DER Connections Review—IESO is a member of the Working Group, and Utility Remuneration/Responding to DERs process—IESO is a participant)

Consider potential cost and reliability impacts to Local Distribution Companies (LDCs) and the distribution system generally

Several options to enhance interoperability with LDCs are being proposed within the Draft Options



Exploring Expanded DER Participation in the IAMs **Scope of the Second DER White Paper**

IESO initiatives related to DER participation in the IAMs

There are a series of IESO initiatives related to DER participation in the IAMs:

- Energy Efficiency Action Pilot:
 - Intended to inform long-term discussions about enabling EE to compete to meet system needs through an appropriate market-based mechanism
- Storage Design Project (SDP):
 - Answering key questions related to the participation of energy storage in the IAMs
 - Focusing on transmission and the distribution connected energy storage resources that participates directly (i.e. not via an aggregation)
- Demand Response Working Group (DRWG):
 - Deals with issues related to the Demand Response (DR) (i.e. access to data, measurement and verification approaches)

IESO initiatives related to DER participation in the IAMs (Cont'd)

- Market Development Advisory Group (MDAG):
 - Provide advice, guidance and support to IESO efforts to evolve the Ontario electricity market, beyond the Market Renewal Program, cost-effectively ensure reliability in the near and longer terms
- Expanding Participation in Operating Reserve – Energy (EPOR-E):
 - Focuses on market design with a goal of expanding participation in Ontario's Operating Reserve (OR) and energy markets
 - Focuses on existing Market Participants, including generation and demand response
 - The project will also explore the opportunities for hybrid resources (load and storage, generation and storage) to participate in the future
 - Will identify initiatives that will make changes to the market design, systems, tools and processes that can be delivered in the near term
 - Proceeding through the MDAG and will ensure that key considerations from the DER White Papers are included in the work

Scope of the Second DER white paper

The second DER is being scoped to:

- Focus primarily on exploring options and considerations to address key barriers identified in the first DER white paper (i.e. minimum size threshold and aggregation specific rules)
 - Identify key considerations for future market design work to be conducted through MDAG
- Focus primarily on resources that are not currently Market Participants
- Focus on options that could be considered in the post Market Renewal timeframe
- Avoid overlap with other ongoing or planned IESO initiatives and provide input to those initiatives for further consideration (i.e. EPOR-E)

Current DER participation models

- The next slide displays the range of participation models for DERs \geq 1MW in Ontario
- The second DER white paper will explore options to enhance or enable certain of these participation models
- Options are not being proposed to enhance all participation models. Certain participation models are out of scope for the second DER white paper

Current DER participation models (Cont'd)

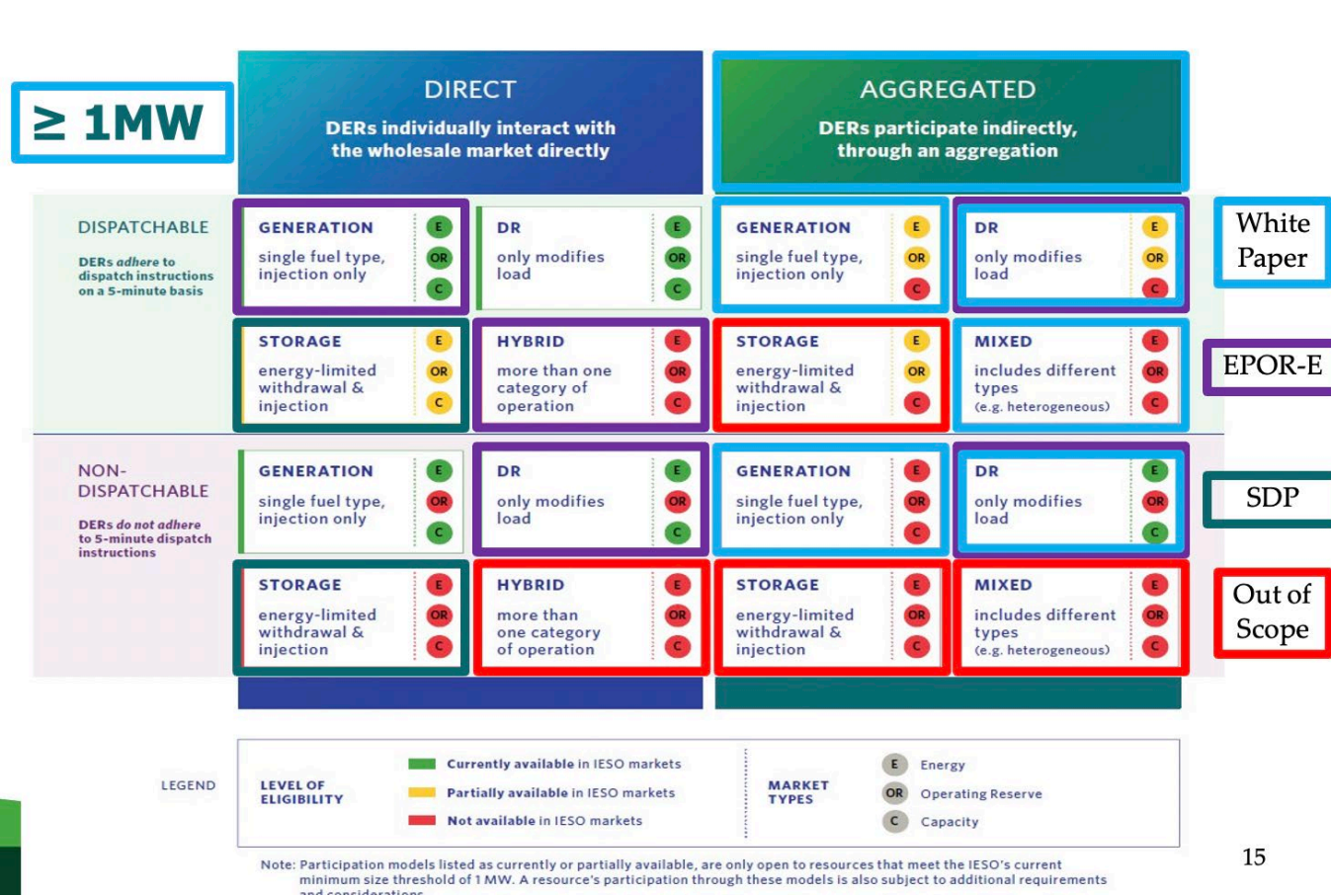
≥ 1MW	DIRECT DERs individually interact with the wholesale market directly		AGGREGATED DERs participate indirectly, through an aggregation	
DISPATCHABLE <i>DERs adhere to dispatch instructions on a 5-minute basis</i>	GENERATION single fuel type, injection only (E OR C)	DR only modifies load (E OR C)	GENERATION single fuel type, injection only (E OR C)	DR only modifies load (E OR C)
	STORAGE energy-limited withdrawal & injection (E OR C)	HYBRID more than one category of operation (E OR C)	STORAGE energy-limited withdrawal & injection (E OR C)	MIXED includes different types (e.g. heterogeneous) (E OR C)
NON-DISPATCHABLE <i>DERs do not adhere to 5-minute dispatch instructions</i>	GENERATION single fuel type, injection only (E OR C)	DR only modifies load (E OR C)	GENERATION single fuel type, injection only (E OR C)	DR only modifies load (E OR C)
	STORAGE energy-limited withdrawal & injection (E OR C)	HYBRID more than one category of operation (E OR C)	STORAGE energy-limited withdrawal & injection (E OR C)	MIXED includes different types (e.g. heterogeneous) (E OR C)

LEGEND

LEVEL OF ELIGIBILITY	<ul style="list-style-type: none"> ■ Currently available in IESO markets ■ Partially available in IESO markets ■ Not available in IESO markets 	MARKET TYPES	<ul style="list-style-type: none"> ● Energy ● Operating Reserve ● Capacity
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Note: Participation models listed as currently or partially available, are only open to resources that meet the IESO's current minimum size threshold of 1 MW. A resource's participation through these models is also subject to additional requirements and considerations.

Where participation models are being addressed



Why certain participation models are outside the scope of the second DER white paper

- Some participation models are out of scope because they are being addressed through other IESO forums (i.e. SOP, EPORE)
- Other participation models are out of scope because they require initial enhancements to move forward first
 - For example, participation barriers to directly participating dispatchable storage should be addressed before considering enhancements for aggregated storage
- In general, IESO sees value in prioritizing the enhancement of dispatchable participation models
 - This focus on dispatchable participation models is mirrored in other jurisdictions pursuing DER integration

IESO principles for integrating DERs

1. Provide an appropriate level of visibility of the resources operating within the distribution system
2. Enable increased competition by removing unnecessary barriers that limit DERs ability to compete within the IAMs
3. Expose resources operating within the distribution system to economic signals reflecting the conditions and needs of the bulk system
4. Maintain an appropriate level of system reliability
5. Consider and respect the potential impacts on the distribution system
6. Prioritize initiatives with the greatest benefits
7. Support sector evolution that enables transparency and competition at all levels of the system



Exploring Expanded DER Participation in the IAMs **Draft Options**

Draft options for further exploration in the second DER white paper

1. Adjusting the minimum size threshold
2. Clarifying aggregation rules & processes
3. Modifying aggregation boundaries
4. Modifying aggregation compositions
5. Creating a participation model for aggregated non-dispatchable generation
6. Permitting alternative telemetry sources
7. Enhancing T-D interoperability
8. Identifying and communicating system needs and capabilities

1. Adjusting the minimum size threshold

Options to Consider:

- a. Explore the ability to reduce the minimum size threshold to below 1 MW if current or planned internal systems/infrastructure upgrades are expected to perform adequately given increased volume of resources, bids/offers etc.
- b. Consider a phased approach to allow a capped number of participants below 1 MW to join the IAMs per year if uncertainty exists regarding capabilities of current/planned systems. Cap could increase annually
- c. Consider a reduced minimum size threshold for certain services (e.g. reduced for energy and capacity but maintained for operating reserve)

Participation Models Impacted:

Generally, all participation models would be impacted by lowering the minimum size threshold – this would also include transmission connected resources

1. Adjusting the minimum size threshold (Cont'd)

Potential Benefits:

- Increase competition within IAMs by expanding pool of eligible resources
- Provide IESO with more granular visibility and control of resources <1 MW
- Provide path for currently contracted resources to participate in IAMs once contracts expire

Implementation Considerations:

- Modifying (or adding) participation models and/or increasing the number of participating resources could overwhelm the ability of IESO tools, including the Dispatch Scheduling and Optimization (DSO) tool, to perform calculations and functions necessary for the efficient operation of the market
- If a phased approach was adopted (i.e. limited number of less than 1 MW resources allowed to register per year) a reasonable method of selecting those resources would need to be developed

2. Clarifying aggregation rules & processes

Options to Consider:

- a. Identify and communicate where and under what circumstances aggregations are more or less likely to be approved
 - Identify where reliability risks exist and where aggregation would be less likely to have impacts
 - Explore opportunities to automate, streamline or categorize types of aggregations by risk
 - Create request process that pre-filters aggregations based on requirements to assess risk
- b. Clarify market rules related to aggregation to ensure they are appropriate for distributed resources and not just transmission connected aggregations
 - Where aggregations are referenced in the current market rules and manuals, identify what types of aggregations are being referred to (compliance, consolidated etc.) and determine and communicate where they do and do not fit aggregations of DERs

Participation Models Impacted:

All aggregated participation models

2. Clarifying aggregation rules & processes (Cont'd)

Potential Benefits:

- Set clearer expectations for Market Participants proposing aggregated DERs
- Reduce manual approval processes for low risk aggregations
- Enable more DERs to participate through existing channels with potentially less investment by the IESO

Implementation Considerations:

- Current aggregation rules were not written for DERs but may allow certain configurations (e.g. at a single T/D node) under limited circumstances
- Approval of aggregations often requires modelling the combined resource to determine impacts and changes to requirements for performance validation

3. Modifying aggregation boundaries

Options to Consider:

- a. Establish sub-zonal aggregation boundary for DERs, determining zone size and areas that are unlikely to have adverse impacts on the transmission system
 - Sub-zones would likely be smaller than the IESO's current Transmission Zones¹ and could be based on areas with similar congestion and multiple T-D nodes with a similar Locational Marginal Price (LMP), where dispatch is likely to have a consistent predictable impact (e.g., CAISO's Sub-LAP² (Load Aggregation Point))
- b. Enable multi-nodal (i.e. more than one T-D node) aggregation for aggregated dispatchable generation and aggregated dispatchable DR
 - Where the impact of delivering to either node is low
 - Explore modelling of a resource at multiple nodes using distribution factors

Participation Models Impacted:

Aggregated dispatchable generation and aggregated dispatchable DR

¹ Sub-LAPs are areas within default load aggregation points (LAPs) that group buses with similar grid impacts:

<https://www.caiso.com/Documents/AgendaandPresentation-SubLoadAggregationPointRealignment.pdf>

3. Modifying aggregation boundaries (Cont'd)

Potential Benefits:

- Areas served by multiple nodes have larger potential resource populations and may be less susceptible to disturbances than areas served by single nodes
- Determining the delivery and impacts of an aggregation in a smaller zone may give operators more confidence that dispatching the resource will produce the desired bulk system outcome
- Balance operator confidence with ability to form aggregations and effectively leverage DERs

Implementation Considerations:

- More co-ordination with LDCs to ensure reliability and feasibility of dispatch (See Option 6 below)
- Changes to modelling process/systems to model an aggregation at more than one connection point, change connection points based on system conditions, or model a portion of capacity at different connection points

4. Modifying aggregation compositions

Options to Consider:

- a. Allowing aggregations of different types of dispatchable generation (wind, hydro, solar, gas) (i.e. mixed aggregations)
 - Start with types that have similar operating characteristics (i.e. inverter-based)
 - Demonstrate the effects of these types of aggregations on power quality and distribution operations
- b. Allowing DR aggregations consisting of contributors from LDC metered residential and C&I customers, as well as IESO revenue metered dispatchable loads (with alternative telemetry sources)
 - Require constituent resources within the aggregated resource to provide telemetry at similar intervals
 - For residential and C&I customers, permit the transference of telemetry from alternative sources (i.e. smart thermostats, Wi-Fi-enabled water heaters)
 - Alternative forms of telemetry permitted would need to encompass a significant enough portion of the customer's load or at least the most responsive component to reasonably reflect the total response to a dispatch signal

4. Modifying aggregation compositions (Cont'd)

Participation Models Impacted:

Mixed generation aggregations, DR aggregations

Potential Benefits:

- Better utilize existing resources by allowing market participants to leverage different technologies in tandem to better meet bulk system needs

Implementation Considerations:

- Study operating characteristics to assess impact of dispatching mixed aggregations
- Participation in the capacity auction would require the development of methods to qualify capacity and determine resource adequacy contribution
- Further develop measurement and verification methodologies to capture mixed types of loads participating within an aggregation

5. Create participation model for aggregated non-dispatchable generation

Options to Consider:

- a. Enabling non-dispatchable aggregations of generation to participate in the Energy and Capacity Markets
 - Non-dispatchable aggregations of generation could potentially provide schedules or forecasts like self-scheduling resources or variable generators
 - As a first step, these aggregations could continue to be limited to single T-D interfaces and to single resource types (e.g. all solar, all wind) to simplify modeling and dispatch

Participation Models Impacted:

Non-dispatchable aggregated generation

5. Create participation model for aggregated non-dispatchable generation (Cont'd)

Potential Benefits:

- Provides IESO with visibility of these resources to be accounted for in planning and operational decisions
- Enables participants to receive market revenues for system benefit they provide
- Encourages future deployment where resources have greatest value to bulk system

Implementation Considerations:

- Potentially less useful to meet system needs since they are non-dispatchable/price takers
- Work is underway to include self-scheduled resources in the Capacity Auction

6. Permitting alternative telemetry sources

Options to Consider:

- a. Explore the ability for resources to provide the IESO with alternative telemetry to secure operational data
 - Where telemetry is required for market participation, IESO currently only accepts telemetry that is combined with revenue metering, achieved through either ICCP wide-area-network (WAN) or internet (TCP/IP) using VPN
 - Telemetry could also be delivered through the LDC
 - Operational data required includes real energy (kWh), reactive energy (kVARh), volt-squared hours (V²h), amp-squared hours (I²h)
- For LDC-metered loads, consider allowing change of status (e.g., on/off from smart thermostats), electric vehicle charger data, and faster access to smart-meter data (including 15-minute data if possible)
- For non-IESO metered generation, consider allowing data from inverters, telemetry captured by distributors if available

¹ Telemetry is the communication of operational data from the resource/facility to the IESO

6. Permitting alternative telemetry sources (Cont'd)

Participation Models Impacted:

- Aggregated dispatchable and non-dispatchable DR
 - Existing LDC-metered DR participants (which can currently only participate as Hourly Demand Response) could potentially become 5-minute dispatchable with settlement performed after-the-fact
- Direct and aggregated dispatchable and non-dispatchable generation

Potential Benefits:

- The IESO could obtain visibility into DER operations and verify that DER market participants are adhering to dispatch instructions
- Smaller resources could access lower cost telemetry alternatives
- Non-dispatchable resources could increase system flexibility by becoming dispatchable

6. Permitting alternative telemetry sources (Cont'd)

Implementation Considerations:

- IESO's technical ability to receive and process alternative telemetry
 - Issues with volume of data and multiple telemetry formats (e.g., on/off status)
 - Cybersecurity risks related to alternative telemetry (e.g., risks of not using VPN)
- M&V complexity (where telemetered point and periodicity does not match revenue-metering point and periodicity)
- Availability of real-time access to LDC smart meter data
 - Currently no avenue for fast access to smart meter data outside of associated LDCs
 - Some smart meter data logs intervals of 15-minutes, while others log data hourly
 - Concerns exist around telemetry use being outside the intent of smart metering initiative (e.g., privacy), and ability to re-transmit data to third parties using existing systems
- Availability of distributor collected telemetered data
 - Currently has no mechanism to access this data (except for distributed generators >5 MW)

7. Enhancing T-D interoperability

Options to Consider:

- a. Modify connections/registration process for aggregations to collect constituent resources, communicate them to the LDC, and receive approval from LDC based on consideration of:
 - Negative impacts to distribution grid
 - Distribution system conditions which would impact ability of DERs to operate in line with IESO dispatch
 - LDC visibility and control over constituent resources within aggregations
- b. Share day-ahead schedule of DERs with LDC to determine reliability impacts and feasibility of dispatch
- c. Coordinate with LDCs on boundaries of aggregation zones in intra-day timeframe to manage changes to distribution network conditions that could affect feasibility of dispatch and delivery

7. Enhancing T-D interoperability (Cont'd)

Participation Models Impacted:

All aggregation participation models

Potential Benefits:

- Could enhance IESO confidence in DERs ability to provide grid services
- Mitigates risks of infeasible dispatch or negative distribution system reliability impacts
- Provides LDCs with visibility of resources providing bulk level services
- Enhances dispatch accuracy for aggregations based on more up to date information on distribution network configuration
- Could allow DERs to meet Ontario's grid capacity and operability needs more cost effectively

7. Enhancing T-D interoperability (Cont'd)

Implementation Considerations:

- As transmission and distribution systems have different reliability standards, system operator and distributor will have different goals for interoperability coordination
- Manual coordination processes in the short-term could be administratively complex to execute
 - Coordination needs to be automated in the future, with greater DER penetration. This requires LDCs to enhance their own visibility of the overall distribution grid, and DERs within it, as well as developing tools to forecast DER behaviour and corresponding system impacts at the T-D interface
- Inaccurate scheduling and/or coordination may impact DERs may impact reliability
 - For example, integrating DERs into dispatch scheduling algorithms may severely complicate optimization requirements. DER variability can result in scheduling risk, requiring more manual intervention during real-time
- May require code and standard modifications (i.e. Distribution System Code) to consider impacts of DER connections to the IESO-controlled grid.

8. Identifying and communicating system needs and capabilities

Options to Consider:

- a. Regularly identifying hosting capacity on the transmission and distribution system
 - Work with the LDC to identify areas where there is capacity to site DERs that considers transmission and distribution level capabilities, and preferred locations
- b. Identifying and communicating opportunities for aggregations of DR through load forecasts per node or sub-zone
 - Could be enhanced by signaling where demand growth is outpacing infrastructure to improve resource siting and behavior

Participation Models Impacted:

All participation models

8. Identifying and communicating system needs and capabilities (Cont'd)

Potential Benefits:

- Improve siting and visibility of resources by more clearly and granularly communicating the location of system needs and capabilities

Implementation Considerations:

- Equal access to information for resources would be required to ensure fair competition in any competitive process to provide system products or services (i.e. Capacity Auction)

- The granularity and regularity of information sharing, and demand for this information, would have to be balanced with availability of IESO/LDC resources
- Identifying hosting capacity and value for resources at the transmission level would only represent a portion of the potential value of a resource. Local value (e.g. as a Non-Wires Alternative) and local hosting capacity would not be included in this information

Next Steps

- [Webinar](#) to discuss Draft Options scheduled for January 30, 2020
- The IESO is requesting feedback on the following questions:
 - Would the draft options enhance DER participation in the IAMs?
 - Are there other implementation considerations the IESO should be aware of?
 - Are there other options the IESO should be exploring in the second DER white paper?
- Send feedback to engagement@ieso.ca by February 13, 2020
 - Please use the feedback form that can be found under the January 30, 2020 entry on the Innovation and Sector Evolution White Paper Series [website](#)
- White paper to be released in Q2 2020

Thank You

ieso.ca

1.888.448.7777

customer.relations@ieso.ca

engagement@ieso.ca



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