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Distributed Energy Resources (DER) - Market Vision and Design Project

Recommendations for Foundational Models

Angeli Jaipargas
Lead, System & Sector Development, Innovation, Research & Development

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Agenda

1. DER Market Vision and Design Project Recap and Updated Items
2. Stakeholder Feedback from the June 2022 Session
3. Recommendations for the Foundational Models & Associated Rationale
4. Next Steps and Stakeholder Questions

DER Market Vision and Design Project and Foundational Models Recap

Recap: Enabling Resources and the DER Roadmap

- The IESO's DER Market Vision and Design Project is a key initiative within the IESO's broader Enabling Resources Program (ERP), a five year-capital program through which the IESO will undertake the work to more fully enable hybrid, DER and storage resources to contribute to meeting Ontario's growing electricity needs
- The DER Market Vision and Design Project also advances the Wholesale Market Integration and Transmission-Distribution Coordination streams of the IESO's DER Roadmap
    - Enabling Non-Wires Alternatives is the Roadmap's third area of focus

Recap: DER Market Vision and Design Project Structure

- The DER Market Vision and Design Project will be separated into two phases:
- **Phase I:** 2021-(Q1)2023 *DER Market Vision Project* (MVP)
  - Identify "foundational" wholesale participation models for design and implementation in Phase II and "enhanced" participation models to be implemented at a future date
- **Phase II:** 2023-2026 *DER Market Design Project* (MDP)
  - Design in detail and implement "foundational" wholesale participation models (includes market rule/manual amendments and process/tool updates based on recommendations identified in Phase I)

Recap: Foundational Vs. Enhanced Models

Foundational Models

Focus on establishing pragmatic participation models that enable resources to provide required grid services with manageable implementation cost and complexity

- Solutions that will not require upgrades to core IESO dispatch tools
- Outcomes of this work will progress to design & implementation (i.e., Phase II or MDP)

Enhanced Models

Explore more sophisticated, participation models and the criteria for implementing those models

- Explore remaining options not selected in the foundational stage for applicability to the enhanced models
- Outcomes of this work will progress to detailed design and implementation once the criteria have been met

DER Definition (Updated)

To date, the IESO has defined DERs as:

> "A resource that is directly connected to the distribution system, or indirectly connected to the distribution system behind a customer's meter; and generates energy, stores energy, or controls load"

- DERs can be modelled as a single contributor or "single resource" (i.e., a single facility such as a generation facility or dispatchable load facility) or an aggregation of contributors (i.e., multiple facilities/resources aggregated into a DER Aggregation, "DERA")
- The IESO will continue to work with stakeholders and others in the sector (e.g., the Ontario Energy Board) to develop consistent definitions of DERs in Ontario

Recap: DER MVP—Phase I Questions

Key Focus Area	Phase I Question
Participation & Aggregation	1. What participation and aggregation models will be established for DERs? And why? 2. Which entity/entities represents the IESO market participant in the IESO-administered markets? 3. Are maximum and minimum size thresholds needed for individual DERs or DER Aggregations (DERAs)?
Eligible Services	4. What products and services can DER(A)s provide? 5. In what timeframes will DER(A)s be eligible to participate? 6. What are appropriate visibility requirements for DER(A)s (i.e., telemetry)?
IESO-Distributor Coordination	7. What coordination protocol(s) will be used amongst the IESO-Distributors-Aggregators to enable reliable wholesale market participation?
Metering and Settlement	8. What revenue metering arrangements are appropriate for DER(A)s? 9. Will additional settlement arrangements need to be established for DER(A)s?

See October 2021 Session for additional considerations associated with the Phase I Questions

What is Enabled in the IESO Markets Today? (Updated)

Through existing market rules, DER(A)s can participate in either "Single Resource" model or the "Demand Response" aggregation model

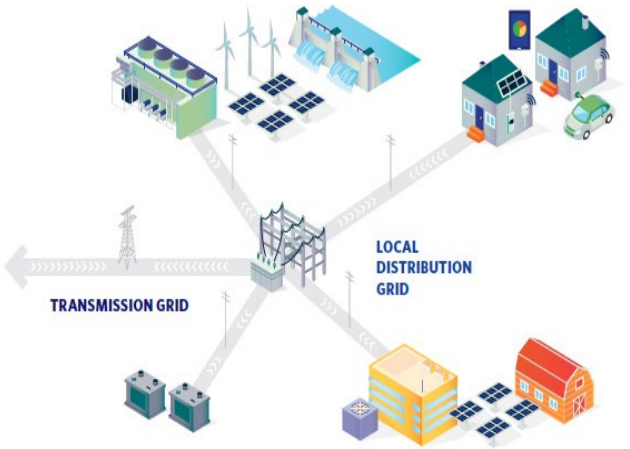
Requirements	**Single Resource Model** *DER Foundational Models will build from here*	**Demand Response (DR) Aggregation Model – Capacity Auction Rules** *Out of Scope for Foundation Models*
A) Aggregation	Single resource only (e.g., generation, storage or dispatchable load) – aggregations are not permitted	Part of a physical hourly demand response (HDR); virtual HDR – residential; virtual HDR – commercial and industrial (C&I); and dispatchable loads (DLs)
B) Aggregation connection	Single connection point*; resources at the same facility are permitted to aggregate	Multiple connection points; aggregated by zone
C) Size	Resources required to be 1MW of greater	Contributors can be less than 1MW; aggregation must be 1 MW or greater
Eligible Services if A+B+C are met	Capacity, Energy, Ancillary Services	Capacity (majority are not 5-minute dispatchable)

*point of interconnection to the IESO-Controlled Grid

Recap: What We Are Seeking to Enable Via New Foundational Models

The DER MVP is seeking to establish new foundational participation models for DER(A) integration into wholesale markets by:

- creating opportunities for aggregations to provide additional wholesale services by becoming 5-minute dispatchable
- enabling aggregations to be comprised of different fuel/technology types (where possible) and modelling aggregations as single resource (where possible)
- enabling wholesale market participation in order to expand opportunities for resources to participate in future procurements
- seeking to expand opportunities for resources less than 1 MW to participate
- seeking to reduce participation barriers by re-examining telemetry and metering requirements



Recap: Out-of-Scope For Foundational Models

The MVP/D Project is not seeking to:

- Propose changes to existing Demand Response models or Capacity Auction rules and requirements
- Enable dispatchable aggregations of residential or small consumer loads
  - This item will be explored as a part of enhanced participation models given the need for additional tool changes to accommodate numerous smaller-scaled resources from an operational, metering and settlement perspective
- Design and implement the enhanced model recommendations from other IESO initiatives (e.g., the Storage Design Project long-term vision or the Hybrid Integration Project's enhanced models)

Stakeholder Feedback Themes from the June Session

Stakeholder Feedback Themes and IESO Response

Feedback	IESO Response
In the June 2022 session, the IESO asked stakeholders if the appropriate options were identified. Stakeholder feedback indicated that they were amenable to the options and provided direct commentary on which of the technical recommendations should be selected for each of the Phase 1 Questions.	Today's session will outline recommendations for each Phase 1 Question and Sub-Question/Sub-Area. The IESO appreciates the detailed feedback received and will consider each item, alongside feedback following today's session, during the finalization of the foundational models.

Stakeholder Feedback Themes and IESO Response (cont'd)

Feedback	IESO Response
Request for clarity on how the IESO used the criteria presented in the June session to determine recommendation selection. Stakeholders sought clarity on if the IESO performed a quantitative or a qualitative analysis.	The IESO has developed recommendations based on a largely qualitative assessment of which options can extract the most benefit while effectively limiting costs and risk. The IESO utilized subject-matter experts, lessons learned from past projects, jurisdictional scans, research and work with external partners to develop recommendations. Certain recommendations for the foundational models (i.e., minimum size threshold) and enhanced models will be made/refined based on quantitative inputs.

Stakeholder Feedback Themes and IESO Response (cont'd)

Feedback	IESO Response
Stakeholders expressed the desire for a "speed to market" criteria be included given upcoming resource adequacy needs.	Timelines for DER integration have been developed through the Enabling Resources Program (ERP). The ERP work plan reflects a number of key considerations including aligning DER integration with when system needs are expected to emerge as identified in the IESO's Annual Acquisition Report. Hybrid resources have been identified as the number one priority for enabling resources and the timing of the initiatives reflects this decision
Stakeholders expressed concerns at the pace of the MVP implementation and sought clarity around timelines given Market Renewal Project's (MRP) revised schedule.	Presently, there is no indication the revised MRP schedule will have an impact on the Enabling Resources Program timelines and they are continuing progress as planned. In addition, since foundational models are limiting tool changes, the IESO does not expect the recommendations to adversely impact established timelines.

Recommendations for Phase I Questions for Foundational Participation Models

Foundational Recommendations - Methodology

- Today's session will present the IESO's recommendations for foundational participation models
- The IESO has leveraged a number of the sources below to identify the foundational model recommendations which include*:

1. Learnings from past studies, whitepapers, and previous Grid Innovation Fund projects
2. Jurisdictional scans from system operators implementing FERC Order 2222 and findings from industry leaders such EPRI
3. Outcomes of the DER potential study
4. Outcomes and suggestions from T-D Coordination Working Group
5. Stakeholder feedback

Options not selected for the foundational models may be selected for the enhanced models (e.g., where material tool changes are required)

**Note: each of these items were considered in development of options but not all directly impacted recommendations*

Participation & Aggregation – Question 1

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
What participation and aggregation models will be established for DER(A)s, and why?	Do all resources have to share the same dispatch characteristics?	1. Yes (all contributors to an aggregation must share the same characteristics) 2. No (some contributors to the DERA do not have to be dispatchable as long as the aggregation is dispatchable)	• **RECOMMENDATION:** Permit contributors to an aggregation to be either dispatchable or non-dispatchable however the aggregation itself will have to be dispatchable if providing capacity, energy or operating reserve. The DER(A) will be expected to meet IESO dispatch instructions; not the individual contributors. • **RATIONALE**: Allows for wider range of contributors to an aggregation while enabling efficient scheduling post-MRP
	Locational Requirements	1. Modelled behind a single node 2. Modelled behind multiple nodes 3. Single and Multi-nodal	• **RECOMMENDATION:** Require DER(A) to be modelled behind a single node • **RATIONALE:** Introducing multi-nodal aggregation would require updates to the Dispatch Scheduling and Optimization (DSO) and associated tools and therefore introduces substantial added costs and complexities

Participation & Aggregation – Question 1 (cont'd)

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
What participation and aggregation models will be established for DER(A)s, and why?	Aggregation Composition	1. Homogenous (utilizing existing single resource models e.g., hydro, thermal, variable generation etc.) 2. Heterogeneous (combination of resource types and capabilities) 3. Homogenous and some permutations of heterogeneous	• **RECOMMENDATION:** (A) Proceed with homogenous aggregations and already existing combinations of non-homogenous (e.g. wind + solar, storage + wind) • (B) Enable aggregations of dispatchable loads with behind-the-meter resources • (C) Model DER(A) as either a generator or a load; not both • **RATIONALE:** (A) Additional combinations (with different underlying technologies, e.g., inverted-based + synchronous resource) will need to be reviewed on a case-by-case basis subject to a reliability assessment as they have not been previously studied • (C) Current IESO market and systems tools can only model resources as either a generator or a load (similar to the way storage is modelled today); not both

Participation & Aggregation – Question 2

Phase 1 Question	Options	Recommendation For Foundational Models

Which entity/entities represents the IESO market participant?	1. Stand-Alone DER
	2. Aggregators
	3. Distributors
		• **RECOMMENDATION:** Permit stand-alone DER (i.e., single contributor) and Aggregators to take on all of the roles and responsibilities of a Registered Market Participant (RMP)
		  ○ For stand-alone DER, the RMP is associated with the single contributor
		  ○ For DERA, the aggregator will be the RMP
		  ○ Additional direction from the OEB required for Distributors
		• **RATIONALE:** Distributor participation in IESO markets is subject to legislation (the OEB Act) and regulatory interpretation of that legislation.

Participation & Aggregation – Question 3

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
Are maximum and minimum size thresholds needed for individual DERs or DERAs?	Minimum Size	1. Existing 1MW minimum IESO Administered Market (IAM) participation requirement for DER(A)s 2. FERC requirement of minimum aggregation size of 100kW 3. Value Between 100kW and 1MW	• **RECOMMENDATION:** Use existing 1 MW min size or lower if feasible • **RATIONALE:** The IESO is in the process of reviewing cost estimates for tool changes and resourcing requirements to implement a lower threshold; to be confirmed in the MDP phase
	Maximum Size	1. No maximum size thresholds required for DER or DERA 2. Maximum Size Thresholds expected for both DER and DERA 3. Maximum Size Threshold Required for single resource (i.e., DER) only 4. Maximum Size Threshold Required for DERA only	• **RECOMMENDATION:** Require a maximum size threshold for both the DER and the DERA • **RATIONALE:** The IESO anticipates that sizing thresholds will be necessary for reliability reasons (e.g., reliability impacts in local areas); MDP phase to confirm sizing values

Eligible Services – Question 4

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
What products and services can DER(A)s provide?	1. Capacity	1. Yes 2. No	• **RECOMMENDATION:** Enable DER(A) participation in Capacity • **RATIONALE:** Capacity needs emerge starting from mid-2020s including locational capacity needs due to limitations on transmission system
	2. Energy	1. Yes 2. No	• **RECOMMENDATION:** Enable DER(A) participation in Energy • **RATIONALE:** Energy needs expected to emerge starting from mid-2025
	3. Operating Reserve	1. Yes 2. No	• **RECOMMENDATION:** Enable DER(A) participation in Operating Reserve • **RATIONALE:** DER(A) will be required to be dispatchable, as such they will have the capability to participate in Operating Reserve

Eligible Services – Question 4 (cont'd)

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
What products and services can DER(A)s provide?	4. Regulation Service	1. Yes 2. No	• **RECOMMENDATION:** Participation in Regulation Service to be examined for enhanced models • **RATIONALE:** IESO will continue to forecast and evaluate Regulation needs post-2026 to determine if there is an additional need that can be met through DER(A) participation
	5. Other Ancillary Services	1. Yes 2. No	• **RECOMMENDATION:** Participation in other ancillary services to be examined for enhanced models • **RATIONALE:** IESO assessment required to determine if additional ancillary services will be needed post 2026 and the feasibility of delivery from DER(A)s

Eligible Services – Question 5

Phase 1 Question	Sub-Feature/Sub Question	Options	Recommendation For Foundational Models and Additional Considerations
In what timeframes will DER(A)s be eligible to participate?	Day-Ahead Market (DAM) participation	1. Yes 2. No	• **RECOMMENDATION:** DER(A) will be expected to participate in the DAM and DER(A) will be required to be Quick-start resources* • **RATIONALE:** Consistent with participation requirement for other resources types
	Pre-dispatch Unit Commitment Eligibility	1. Yes 2. No	• **RECOMMENDATION:** DER(A) will be required to be Quick-start resources and will therefore not be eligible for pre-dispatch unit commitments • **RATIONALE:** Operational modelling of DER(A) will be complex for foundational models and it is unclear whether commitments would be appropriate
	Real-Time Market (RT) participation	1. Yes 2. No	• **RECOMMENDATION:** DER(A) will be enabled to participate in real-time • **RATIONALE:** Consistent participation requirement with all other Quick start resource types • The need for additional real-time requirements to be determined via the Transmission-Distribution Coordination Working Group

*A DAM Generator Offer Guarantee will be available for eligible non-quick start (NQS) generation that are committed by the DAM. A Real-Time Generator Offer Guarantee will be available for eligible NQS generation committed during the pre-dispatch.

Eligible Services – Question 6

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
What are appropriate visibility requirements for DER(A) (i.e., telemetry)?	Level of Telemetry & Associated Modelling	1. Need for individual contributor telemetry points and statuses 2. Aggregate Telemetry points and statuses	• **RECOMMENDATION:** Allow aggregate telemetry points and status where possible. Individual contributor telemetry may be required if aggregate telemetry is not available or does not meet reliability standards. • **RATIONALE:** Enabling aggregated telemetry provides DER(A) will more choice and flexibility as long as the appropriate aggregated points and statuses are provided to ensure visibility and there are no adverse impacts to reliability • Further work needed during the MDP phase between the IESO/Distributor and the DER(A) to outline specific requirements

Eligible Services – Question 6 (cont'd)

Phase 1 Question	Sub-Feature/ Sub Question	Options	Recommendation For Foundational Models
What are appropriate visibility requirements for DER(A) (i.e., telemetry)?	Maximum and Minimum Requirements (based on size of the resource)	1. Existing market Rule (MR) "high" requirements (2-second latency) ≥ 20 MVA 2. MR "medium" requirements (10-second latency) between 1 – 20 MVA 3. MR "low" requirements (1-min latency) between 1 – 20 MVA	• **RECOMMENDATION:** Require the DER(A) to meet market rule requirements depending on the size DER(A) and be subject to a reliability assessment • **RATIONALE:** Market rules have existing requirements for resources that are at least 1MW • Market rules indicate that requirements may change despite size on a case by case reliability basis; this rule is expected to be maintained for DER(A) • Re-assessment of this recommendation may be required during the MDP phase if the minimum size threshold is reduced beyond 1MW

Eligible Services – Question 6 (cont'd 2)

Phase 1 Question	Sub-Feature/Sub Question	Options	Recommendation For Foundational Models and Additional Considerations
What are appropriate visibility requirements for DER(A) (i.e., telemetry)?	Treatment of Variable Generation (VG)	1. Standalone or aggregated VG provides telemetry based on size and follows existing (dispatchable) participation model requirements 2. Allow DER(A) VG to be self-scheduling and provide telemetry with more relaxed requirements	• **RECOMMENDATION:** Maintain current requirements for variable generation resources • **RATIONALE:** Visibility and dispatchability support the reliable operation of the IESO-Controlled Grids especially when resources are intermittent

IESO-Distributor Coordination – Question 7

Phase 1 Question	Sub-Feature/Sub Question	Options	Recommendation For Foundational Models
What coordination protocol(s) will be used amongst the IESO-Distributors-Aggregators to enable reliable wholesale market participation?*	In addition to the existing emergency, forced outage, safety, equipment, & applicable law "dispatch deviation" Market Rules today, are there additional distribution conditions that should qualify for "override"?**	1. Yes 2. No	• **RECOMMENDATION:** Outline the additional conditions that would qualify for distributor override • Development of the detailed protocols will be established via the Transmission-Distribution Working Group and will be finalized via the MDP phase • **RATIONALE:** Existing requirements do not outline/contemplate distribution activities impacting capability

**These items are being actively examined as a part of the Transmission-Distribution Working Group*
*** Distributor "override" of IESO schedules/dispatch*

IESO-Distributor Coordination – Question 7 (cont'd)

Phase 1 Question	Sub-Feature/Sub Question	Options	Recommendation For Foundational Models
What coordination protocol(s) will be used amongst the IESO-Distributors-Aggregators to enable reliable wholesale market participation? *	For Distributor "override," does IESO require new communication processes between the DER(A) and the IESO outside of existing Market Rule/Market Manual requirements (for outage management and real-time dispatch data submission)?	1. Yes 2. No	• **RECOMMENDATION:** Outline new communication processes • **RATIONALE:** Existing requirements do not outline/contemplate distribution activities impacting capability. Development of the detailed protocols will be established via the Transmission-Distribution Working Group and will be finalized via the MDP phase • No changes anticipated to IESO tools (e.g., outage management tool) & associated system and market timing requirements
	Are there assurances that the IESO needs regarding communications between DER(A) and Distributor	1. Yes 2. No	• **RECOMMENDATION:** Outline what constitutes assurances between between the DER(A) and the Distributor. Development of the detailed protocols will be established via the Transmission-Distribution Working Group and will be finalized via the MDP phase • **RATIONALE:** Helps to ensure processes are in place and followed, for audit/dispute purposes, etc.)

**These items are being actively examined as a part of the Transmission-Distribution Working Group*

Metering and Settlement – Question 8

Phase 1 Question	Sub-Feature/ Sub Question	Options	Recommendation For Foundational Models
What revenue metering arrangements are appropriate for DER(A)s?	Level of Metering Installations	1. Individual metering of each contributor as per today's MRs 2. An "aggregate metering" construct	• **RECOMMENDATION:** Require individual metering of each contributor • **RATIONALE:** Needed for accurate settlement of IAMs • New constructs would require significant process redesigns and potential tool updates
	Hardware requirements (See Market Rules Ch. 6)	1. Existing hardware metering requirements (e.g., wholesale revenue requirements for a main/alternate meter, accuracy, latency etc.) 2. Relaxation of hardware requirements	• **RECOMMENDATION:** Require existing hardware requirements which include relaxed requirements for smaller resources • **RATIONALE:** Precedence established by today's market rules that relax requirements for smaller resources

Metering and Settlement – Question 8 (cont'd)

Phase 1 Question	Sub-Feature Sub Question	Options	Recommendation For Foundational Models
What revenue metering arrangements are appropriate for DER(A)s?	Size Thresholds	1. No change to existing metering requirements (for hardware and verification) given the size of the DER(A) 2. Changes to existing metering requirements (for hardware and verification) given certain sizing thresholds	• **RECOMMENDATION:** No change to existing • **RATIONALE:** Needed for accurate settlement of IAMs • New constructs would require significant process redesigns and potential tool updates
	Delivery point (DP) methodology for aggregation models	1. New delivery point methodology to model DER(A)s – dependency with locational requirements and aggregation composition from Question #1 2. Leverage existing delivery point methodology from the MRs	• **RECOMMENDATION:** Enable a new DP methodology • **RATIONALE:** A new DP methodology enables aggregations to be represented as a single resource which simplifies the settlement process for DER(A) while maintaining accurate settlement

Metering and Settlement – Question 9

Phase 1 Question	Sub-Feature/Sub Question	Options	Recommendation For Foundational Models
Will additional settlement arrangements need to be established for DER(A)s?	Are non-performance charges due to Distributor override appropriate?	1. Yes 2. No – all times 3. Subject to additional design via the MDP phase	• **RECOMMENDATION:** Subject to allowable overriding instances as determined by the TDWG and further developed via the MDP • **RATIONALE:** Further design required to outline possible override scenarios
	Should consideration be given to settlement implications at the aggregation level vs. the contributor level?	1. Yes 2. No	• **RECOMMENDATION:** Enable DER(A) settlement at aggregation level and investigate where contributor level settlement is required via the MDP • **RATIONALE:** Regulatory charges may be required to be disaggregated to the contributor level

Next Steps and Stakeholder Questions

Next Steps: Timeline and Deliverables

Date	Deliverables
October 2021	• Introduce the DER Market Vision and Design Project • Phase I Questions
January 2022	• Electric Power Research Institute (EPRI) Presentation on FERC Order 2222 • MVP timelines and deliverables for the remainder of 2022
June 2022	• Criteria used to determine foundational vs. enhanced models • Initial set of options of Phase I questions for foundational models
September 2022	• Recommendations for Phase I questions for foundational models with associated rationale
Q4 2022	• Options and draft recommendations for enhanced models with associated rationale and criteria to trigger implementation
Q1 2023	• Contingency and finalization of participation models

Feedback

Questions for stakeholder feedback:

1. Are the IESO's recommendations appropriate for foundational models? Do any recommendations risk inhibiting DER(A) participation in wholesale markets?
2. Based on the recommendations, are there key options that should be prioritized for the enhanced models?

Please use the feedback form found under the September 20 entry on the DER Market Vision and Design engagement page to provide feedback and send to engagement@ieso.ca by October 11, 2022.

Thank You

ieso.ca

1.888.448.7777

customer.relations@ieso.ca

engagement@ieso.ca

@IESO_Tweets

linkedin.com/company/IESO

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