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**MAY 16, 2022**

# Transmission-Distribution Coordination Working Group (TDWG) – Meeting #2

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# Today's Agenda

- Feedback summary (IESO)
- T-D Interface, DSO models, distribution override (IESO)
- Sub-transmission System (Hydro One)
- T-D Coordination Considerations (Entegrus)
- DER Scenarios and Modelling Study (EPRI)

# TDWG Member Feedback

## Feedback

## IESO Response

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Sub-transmission component of the system should be included in analysis.

A Hydro One presentation will be provided on this subject today. We will continue to consider how to capture this issue in the conceptual coordination protocols.

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Include consideration for ancillary services i.e. black start, frequency regulation, reactive power management/control, ride-through for voltage and frequency, ramp rate control, micro grid.

While non-wires alternatives (NWA) will be the distribution service(s) that will be focused on in developing the conceptual coordination protocols (in addition to wholesale services), we continue to be interested in understanding what other distribution services are expected in the near- to medium-term.

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T-D coordination frameworks should consider the coordination arbitration process among parties; hierarchy of operational control

Thank you – we except that the conceptual coordination processes will address the issue of prioritization and hierarchy of control.

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Include consideration for remuneration mechanisms for distributed energy resources (DERs).

Beyond investigating the distribution non-wires alternative service(s) (without regard for their remuneration) and contemplating wholesale market services, other remuneration issues are out of the TDWG's scope.

# TDWG Member Feedback

## Feedback

Role of connection impact assessments to ensure that transmission-distribution (T-D) coordination extracts the best value from DERs.

- Total Distribution System Operator (DSO) coordination model should be included; one model may not suit all distribution systems/service areas
- The local distribution company (LDC) as an Aggregator would be the only entity capable of deciding the optimal benefit in maximizing utilization from the distribution grid to uphold the wholesale market and the grid's integrity. The LDC System Operators would be cognizant of the impact on customer bills and service reliability when deciding to exceed asset capacity limits, reorient the distribution grid connectivity, or re-schedule planned outages.

## IESO Response

Thank you – in developing the conceptual coordination protocols, consideration will be given to potential impacts/opportunities in connection assessments.

In response to working group members' feedback, the IESO will also investigate conceptual coordination protocols for the Total DSO model. This issue will be expanded upon in upcoming slides.

# TDWG Member Feedback

## Feedback

Request for IESO and distributors jointly review the existing override procedures for their ongoing suitability and relevance as DERs become more prevalent.

A common condition requiring distribution override is system switching. Reasons for system switching (or reconfiguration) could be for isolating specific assets, such as for replacement or renewal, which results in the transfer of load between station buses or transmission circuits, impacting the T-D interface.

Override of dispatch of DER or DER aggregators will be a critical tool for LDCs to maintain reliability conditions and safe operation of the distribution grid.

## IESO Response

The IESO invites LDCs to share existing procedures for de-rating DERs or instructing DERs to go/remain offline with the TDWG.

Thank you for this feedback. We would also like to note that establishing “override” procedures will be critical for transmission level reliability as well.

The IESO market rules and manuals (e.g. 7.1 and 7.3) have existing emergency procedures that include distributor actions as well as existing outage management requirements for resource facilities. The IESO will explore whether additional requirements will be needed as part of the TDWG.

# TDWG Member Feedback

## Feedback

If DERs are unavailable to meet distribution needs, the operational practices, in order of preference, are:

- Load transfer: move loads to other sources of supply to relieve local conditions
- Use any contingency capacity present on the system, reducing system resiliency to maintain service
- Implement Conservation Voltage Reduction until the DER has been restored
- Construction of traditional poles are wires solutions
- As an emergency measure, rotational load shedding

When a NWA is not available when needed by the LDC, then would request to consider third party owned, operated and controlled DER vs. an LDC owned, operated and controlled DER

## IESO Response

Thank you for this feedback. These practices have been noted.

There is continued interest in understanding the conditions under which LDCs would “override” IESO schedules and dispatches. This issue will be expanded upon in upcoming slides.

# TDWG Member Feedback

## Feedback

The presence of distribution automation (DA) in the system makes the condition of “normal state” more dynamic, and could make the transmission interface where DER resources appear variable.

With increased DER penetration, LDC service territories with dense DA are expected to experience more frequent switching events and override over automated system controls (e.g. distribution switch overrides) in order to preserve distribution system safety and reliability.

DA could automatically reconfigure the distribution system rendering DERs unable to meet their supply obligations.

## IESO Response

Thank you for this feedback. We will continue to consider how to capture impacts of DA in the development of conceptual T-D coordination protocols.

# TDWG Member Feedback

## Feedback

Clarity sought around the core deliverable for the TDWG, and the TDWG members' roles. Suggested deliverables include:

- Establish a common understanding of existing coordination protocols for embedded generation participating in the IESO-administered markets (IAMs) under normal and abnormal operating conditions
- IESO presentation on existing protocols for distribution connected generation participating in the IAMs
- A request for LDC members to comment on the above existing protocols and for LDC evaluation of coordination requirements and impact of DER participation in IAMs from their perspectives

## IESO Response

Explicit IESO-DER-LDC protocols do not exist today. In particular, the DER participants may be 3<sup>rd</sup> party aggregators, who may not be regularly communicating with the distributors. The IESO is interested in understanding current interactions between LDCs and aggregators.

From an IESO perspective, DER participants must adhere to market rules and manuals, which include the processes to submit dispatch data in the real-time energy and operating reserve markets as well as the process to submit outage requests in accordance with the IESO outage management processes.

The IESO is preparing presentation materials on the Market Renewal Project dispatch data submission processes as well as outage coordination processes for a future TDWG meeting.

# TDWG Member Feedback

## Feedback

Identify fundamental principles for conceptual coordination protocols that would be reflective of post-Market Renewal Program IAMs, with data points and timelines for communication among all parties

Outline operating terms that would be included in future reliability agreements between LDCs and DERs that would support multiple service offerings by DERs.

## IESO Response

The process, including timelines, for communication among parties will be captured as part of the conceptual coordination protocols.

While we are not developing principles for the conceptual coordination protocols, the DER Market Vision Project will develop criteria for evaluating “foundational” and “enhanced” DER participation models for the wholesale market, leveraging the criteria established by other projects such as the Hybrid Integration Project and Market Renewal Program. This issue will be briefly discussed in upcoming slides.

Noted – the IESO will consider investigating the key rules, codes, agreements, regulations, etc. to enable the conceptual coordination protocols as part of potential follow-on work after meeting the established objective of developing conceptual coordination protocols by Q1 2023.

# TDWG Member Feedback

## Feedback

Clarification sought on the coordination protocols that must be addressed, in particular:

- the day-ahead communication requirements between IESO-LDC-DER with respect to system deliverability capability and resource availability
- Real-time communication requirements to schedule, dispatch and operate DERs in coordination with LDCs and IESO
- Real-time outage management processes to manage and coordinate abnormal system conditions during a system contingency event

## IESO Response

Thank you for this feedback, which is consistent with our intent. The conceptual coordination protocols will address the day-ahead and real-time timeframes in the post-Market Renewal Program wholesale market as well as the timeframes for outage management.

The IESO is preparing background presentation materials on topics that are relevant to these processes for the next TDWG meeting.

# Finalized Terms of Reference (TOR)

Changes to deliverables to include Total DSO model:

- Coordination protocol(s) will be developed for *both the Dual Participation and Total DSO models*, and will be shared with the IESO's broader stakeholder community through the DER MVP engagement process throughout 2022, prior to finalizing foundational DER participation models by Q1 2023
- Some timeframes noted in the TOR have been adjusted:
  - Draft meeting notes available within *two* weeks following a meeting
  - Members have *three* weeks to provide feedback following a meeting

# Working Definition for T-D Interface

- T-D Interface (working definition): the physical locations (e.g. structures, equipment, etc.) at which the IESO-controlled grid and the distribution systems interconnect
  - E.g. typically at a major substation that reduces the voltage level as the electric topology transitions from networked to radial
- *IESO-controlled grid* means the transmission systems with respect to which, pursuant to operating agreements, the IESO has authority to direct operations (IESO Market Rules - Chapter 11 Definitions)

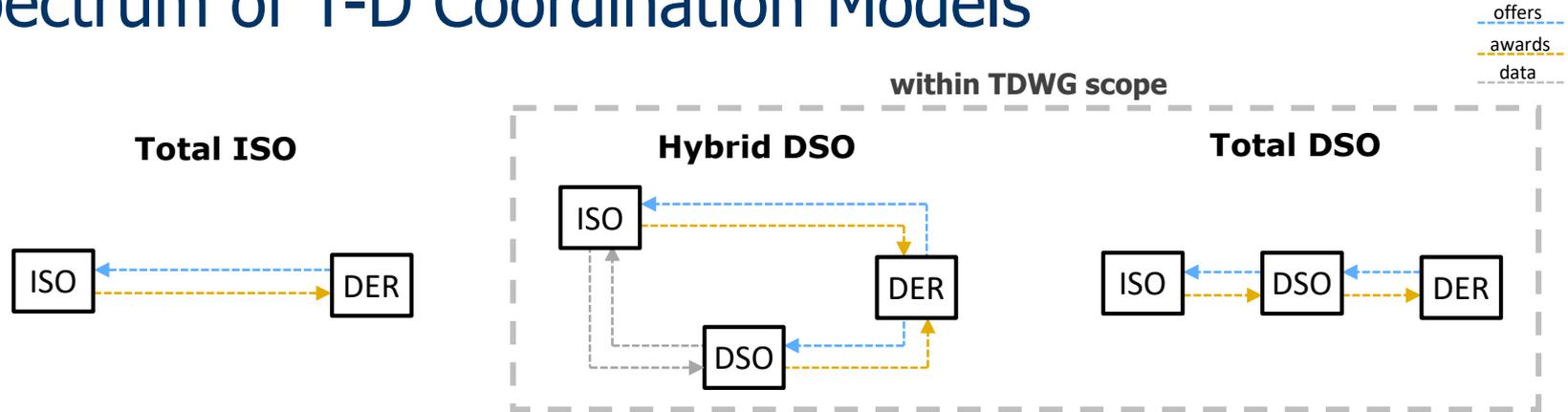
# Models to Explore in TDWG

- TDWG scope includes examination of reliable participation of DERs in both distribution services and IESO wholesale market services, enabling DER participants to “stack” service opportunities as appropriate
- Coordination will also be required for distribution “override” of IESO schedules or dispatch of DERs to manage distribution outages, abnormal conditions, and limits/reliability violations
- Working group members requested to explore other models, in addition to the “dual participation” model proposed at the January TDWG meeting
- In response to feedback, conceptual coordination protocols will also be developed for the Total DSO model

# Foundational and Enhanced Models

- IESO's DER Market Vision Project (MVP) seeks to develop a "foundational" model for integrating DER in the wholesale market with implementation in 2026
  - Involves manageable IESO implementation cost and complexity
  - Requires regulatory changes to be incremental/feasible in near-term
  - Seeks to minimize the need for incremental LDC capabilities
- The DER MVP will also explore "enhanced" participation models to be implemented at a future date, including criteria for when to implement
- IESO intends to focus on Hybrid DSO models for the DER MVP's foundational effort and is open to other options longer-term

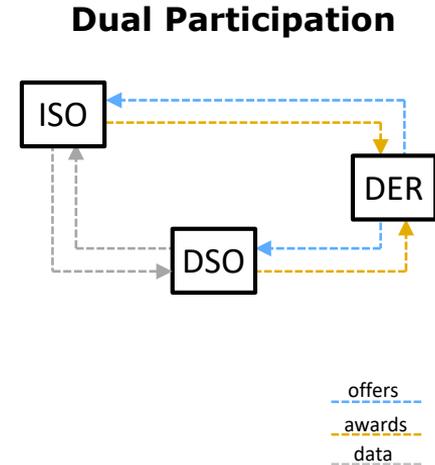
# Spectrum of T-D Coordination Models



- There is a range of models, with Total ISO and Total DSO being bookends
- The Total Independent System Operator (ISO) model is not being explored within the TDWG given limitations (scalability, tool availability, etc.)
- There are many ways to structure hybrid models – a common model being the dual participation model

# Dual Participation Model (A Hybrid DSO Model)

- When providing services in the Dual Participation model, the DER participant interfaces with:
  - ISO for wholesale market services
  - DSO for distribution services
- DER participants that provide both types of services manage two interfaces and would relay information between the ISO and DSO
- ISO and DSO can also share data, e.g. as redundancy
- In line with several other jurisdictions, e.g. some U.S. jurisdictions responding to FERC\* order 2222



# Total DSO Model

- In the Total DSO model, the DER participant interfaces with DSO for distribution services and wholesale services
- DSO in turn interfaces with the ISO, relaying information about the availability, deliverability and price of DERs
  - DSO calls on DERs for distribution services
  - DSO dispatched by ISO for wholesale service and the DSO relays that dispatch to DER participants
- Total DSO model represents a major change that would likely require an appropriate regulatory environment to be put in place and necessary DSO capabilities to be developed

## Total DSO



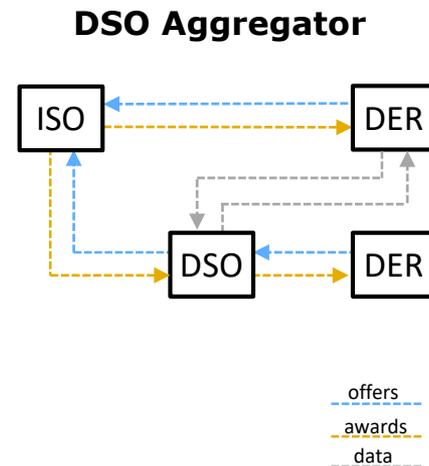
offers  
awards  
data

## Other Potential Hybrid DSO Models

- Conceptual coordination protocols will be developed for the Total DSO and Dual Participation models
- In addition to the Dual Participation model, there are a number of other potential Hybrid DSO models – these are out of scope for the DER Scenarios & Modelling Study
- However, it is expected that the protocols developed for the Total DSO and Dual Participation models could be adapted for other models
- For instance, another potential approach is the DSO Aggregator model, as expanded upon in the next slide

# DSO Aggregator Model (A Hybrid DSO Model)

- When providing services in the DSO Aggregator model, the DER participant interfaces with:
  - ISO if only providing wholesale market services, but also coordinates with DSO for “override” conditions
  - DSO if providing distribution services, including if providing distribution and wholesale services
- DER participant continues to have direct path to wholesale market
- DSO acts as an “aggregator of aggregators” that are providing distribution services



# Distribution Override

- Distribution “override” is a fundamental component of T-D coordination
- Relates to ISO schedules/dispatch of DERs being infeasible due to distribution system planned and forced outages as well as violations of distribution reliability when operating under abnormal conditions
- In U.S., FERC Order 2222 requires that the override is in accordance with transparent and non-discriminatory distribution system procedures
- Distributors would identify override conditions and communicate instructions to DER participants, who would provide notification to the ISO
- Override procedures should provide all parties sufficient time to minimize impacts to distribution and ISO markets/services and system operations

# ESIG's Illustration of DER De-Rate Notification (1/4)

The below is an illustration for how aggregator notification to the ISO about reduced capability could work for distributors in the future based on CAISO market timelines from the ESIG report [DER Integration into Wholesale Markets and Operations](#).

- Note: the ESIG illustration is not consistent with IESO terminology, timelines, processes, etc. but is being presented to inform how outage/de-rate coordination could be approached in Ontario

The scenario is as follows: The aggregator has a DER aggregation (DERA) with 5 MW capacity (maximum power injection) composed of individual DERs distributed over two distribution circuits within a single transmission-distribution interface (PNode). Circuit A hosts 3 MW and circuit B hosts 2 MW of the DERA capacity.

## ESIG's Illustration of DER De-Rate Notification (2/4)

At 9 am Monday, the DSO informs the aggregator of an immediate transformer problem that has taken out distribution circuit B, preventing 2 MW of the DERA capacity on that circuit from operating. The DSO expects the problem to continue for the next 24 hours until circuit B can be restored.

We will assume the time line of the CAISO spot market:

- Day-ahead offers for Tuesday must be submitted for all 24 hours by 10 am on Monday.
- Real-time offers must be submitted by 75 minutes prior to each operating hour (T-75).
- Outage/derate cards must be submitted immediately whenever the event occurs.

The following steps describe how the aggregator would use the DSO constraint information to modify its market offers and inform the ISO of its reduced capacity.

## ESIG's Illustration of DER De-Rate Notification (3/4)

1. The aggregator immediately submits an outage/derate card to the ISO indicating DERA capacity reduction from 5 MW to 3 MW for HE10 (hour ending at 10 am) Monday through HE09 Tuesday.
2. The aggregator structures its day-ahead market offers for the DERA for Tuesday to reflect maximum 3 MW for HE01-09 and maximum 5 MW for HE10-24 (based on the expected 24-hour duration of the circuit B outage).
3. The aggregator structures its real-time market offers for Monday HE12-24 based on maximum 3 MW capacity. This may involve the aggregator buying back portions of the DERA's day-ahead schedules (which cleared in Sunday's day-ahead market) for hours where they exceed 3 megawatt-hours (MWh).

## ESIG's Illustration of DER De-Rate Notification (4/4)

4. The ISO does not receive new real-time offers for 5-minute intervals from 9:10 am until 11:00 am, but the market optimization knows from the outage/derate card that the DERA's maximum output is 3 MW, so it will not dispatch the DERA for more than 3 MW capacity in any interval.
5. For the interval from 9:00 am to 9:10 am the ISO does not perform any new market optimization, so its previously issued dispatches to the DERA would reflect 5 MW capacity. Thus, the DERA may fall short of its day-ahead schedule or real-time dispatch. The imbalance on the ISO system is managed by regulation (automatic generation control) and may subject the DERA to uninstructed deviation charges.

## Feedback Questions (1/2)

- Are there any suggestions to improve the working definition of T-D interface?
- What communications take place between LDCs and third party aggregators in real-time/near real-time today, if any?
- Any comments on the coordination models proposed to be explored in the TDWG?
- What are existing procedures for de-rating DERs or instructing DERs to go/remain offline? I.e. What conditions would warrant distributor “override” of DERs’ schedules/dispatch from the IESO? (repeat from last TDWG session)
- Any feedback on the Entegrus T-D Coordination Considerations presentation?

## Feedback Questions (2/2)

- Any feedback on the Hydro One Sub-Transmission System presentation?
- Do EPRI's scenarios and methodology for the DER Scenarios & Modelling Study make sense? Any suggestions?

## Next Steps

- Please use the feedback form found under the May 16 entry on the [TDWG webpage](#) to provide feedback and send to [engagement@ieso.ca](mailto:engagement@ieso.ca) by June 6
- The next TDWG meeting is expected in late June/early July and will focus on IESO market dispatch data submission and outage request submission processes as background for the TDWG members to support the development of the conceptual coordination protocols

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# Thank You

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