JUNE 23, 2025

Transmission-Distribution Coordination Working Group (TDWG) Overview

Ali Golriz, Supervisor, Market and Sector Evolution, IESO

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Presentation Outline

- TDWG overview (IESO) [5 min]
- A: Final T-D Coordination Protocols (IESO) [8 min]
- B1: Functional Assessment (Alectra & Toronto Hydro) [8 min]
- B2: Communication Assessment (Hydro One) [8 min]
- B3: Shared Platform Concept (Alectra) [8 min]
- Q&A

TDWG Overview

- Transmission-distribution coordination better integrates distributed energy resources and aggregators (DER/A) in IESO market/system operations as well as in distribution networks

- Distribution System Operators (DSOs), DER/A participants, and IESO will need to share information in a timely manner and ensure there is sufficient awareness among the parties
    - E.g., visibility into outages, limits on DER/A, and instructions to DER/A, etc.

- In this context, the IESO launched the Transmission-Distribution Coordination Working Group (TDWG) in 2022 to work closely with distributors and other stakeholders

- TDWG's objective is to support the development of operational T-D coordination protocols for DER/A participating in the wholesale market

T-D Protocol Cases

- The protocols will detail the actions to be taken and data to be shared by parties, ensuring the effective and reliable operation as DER/A:
    - participate in IESO's day-ahead and real-time markets
    - may provide services to the distribution system

- The TDWG aims to outline operational coordination for the following cases:

1. DERs that are **not participating** in any services	2. DER/A providing **distribution services**	3. DER/A providing **wholesale services**	4. DER/A providing **both** wholesale and distribution **services**

TDWG Deliverables

- TDWG produced four deliverables, led and supported by different working group members

A. Coordination Protocols	B1. Functional Assessment	B2 Communication Assessment	B3. Shared Platform Concept
Develop protocols for DER/A providing both distribution level and wholesale energy services	Analyze distributors' operational functions, capabilities, and costs across multiple dimensions	Map coordination interfaces and data exchanges for each coordination model	Develop concept for a "one-stop" shop data sharing platform for coordination
Lead: IESO	Leads: Alectra & Toronto Hydro	Lead: Hydro One	Lead: Alectra
Subgroup: Hydro One, Essex, Alectra	Subgroup: Elexicon, NSWG*, Rodan, IESO, Powerconsumer	Subgroup: Alectra, Essex, IESO, NSWG	Subgroup: Hydro One, IESO, Rodan, Powerconsumer

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Past TDWG Meetings

Mtg #	Date	Major Topic(s)
1	Jan 2022	Introductory and background materials
2	May 2022	T-D definition and coordination models
3	Jun 2022	Override, outage, and IESO market processes
4	Sep 2022	New York's coordination manual
5	Nov 2022	Draft protocol for a Dual Participation model
6	Feb 2023	Draft protocol for a Total DSO model
7	Jun 2023	DSO operational functions workshop
8	Oct 2023	Draft Deliverables statements of work
9	Dec 2023	B2. Current state of communication B4. Definitions Workshop
10	Dec 2023	B1. Functional Assessment A. T-D Reliability for Bulk Power System

Mtg #	Date	Major Topic(s)
11	Feb 2024	B1. User/Process Journey Mapping
12	Mar 2024	A. Distribution Reliability Overview B2. Telemetry Requirements for DERs
13	Apr 2024	B2. IAM Communication Interfaces B3. Shared Platform Concept - Market Intel
14	May 2024	A. Draft Service Stacking Protocols B1. User/Process Journey Mapping B4. Working Terms & Definitions
15	Jul 2024	A. Draft Service Stacking Protocols A. Swim Lane Diagrams Walkthrough B2. Future State of Communication
16	Dec 2024	B1. Work Packages Updates B3. Focus Group Workshop Debrief EPRI J-Scan on DER-Provided Grid Services
17	May 2025	Final Deliverable Presentations

Next Steps

- Insights from TDWG Deliverables are expected to inform and support sector innovation in the near term and the long term
- TDWG's work is input into and supports other initiatives

OEB's DSO Capabilities Consultation	Define a policy framework and set expectations for electricity distributors regarding the development of DSO capabilities.
IESO's Enabling Resources Program (ERP)	Integrate storage, hybrid resources, and dispatchable DER/A into the IESO-administered markets, tools, and processes.
IESO Market and Sector Evolution	Beyond the Enabling Resource Program, the IESO will continue to consider opportunities to advance the integration of DERs and DSOs.

Thank You

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JUNE 23, 2025

Deliverable A
Transmission-Distribution Coordination Protocols

OEB DSO Symposium

Ali Golriz, Supervisor, Market and Sector Evolution, IESO
Nima Omran, Senior Advisor, Market and Sector Evolution, IESO

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Purpose & Outline

Purpose: provide an overview of the final Deliverable A report on Transmission-Distribution (T-D) Coordination Protocols

Presentation outline:

- Objectives
- Coordination Challenge
- Coordination Models
- Key Feature of Protocols
- Service Timeframes
- Swim Lane Diagrams

Objectives

- Facilitate DER/A* participation in distribution and wholesale services through coordination among DER/A participants, DSOs*, and the IESO
- Consider the potential for DER/A to 'stack' services at both levels
- Examine the T-DSO*, DP-DSO*, and the MF-DSO* models
- Detail operational actions and information exchanges among parties
- Focus on the coordination of participating, dispatchable DER/A

NOTE: elements of the protocols can be implemented in the near, medium, and long term

DER/A = Distributed Energy Resource (DER) or DER aggregation; DSO = Distribution System Operator;

T-DSO = Total DSO; DP-DSO = Dual Participation DSO; MF-DSO = Market Facilitator DSO

Coordination Challenge

- Ensure DSOs and IESO visibility into real-time and expected DER/A status
- DER/A status is informed by
  - Advance limits on DER/A to maintain distribution system reliability
  - Schedules and activations for DER/A providing distribution services
  - Schedules and dispatch instructions from the wholesale market
  - Outage reporting to communicate unavailability of DER/A
- Enable DER/A to deliver ‘stacked’ services to both DSOs and IESO
- Telemetry is essential but not addressed in the T-D Coordination Protocols document

DER Service Cases

- To comprehensively address coordination among parties, four cases were considered

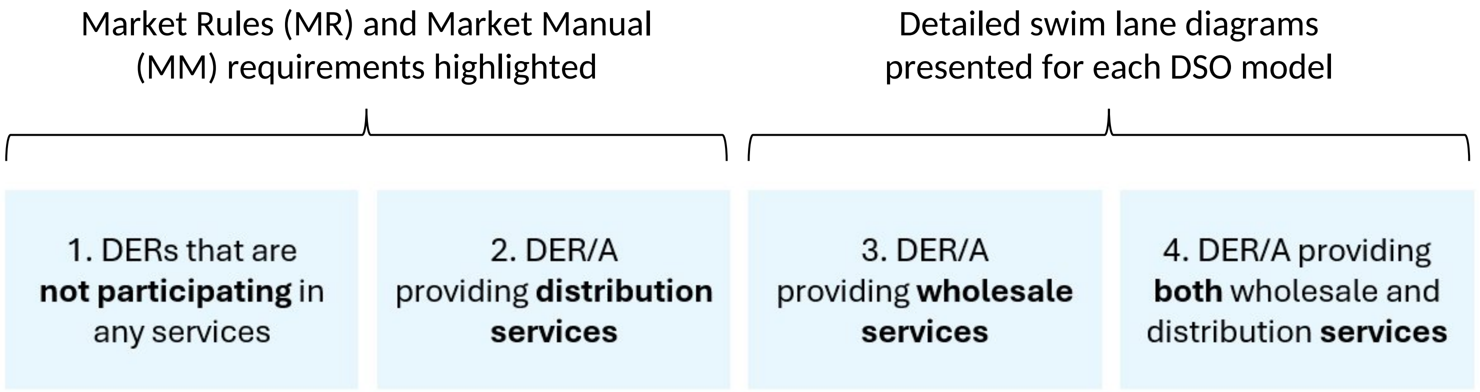


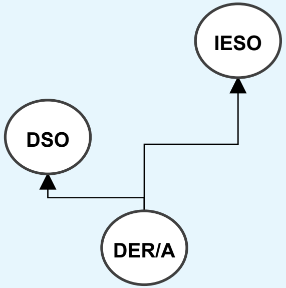
Figure 5: Four DER service cases

Increasing coordination requirements

Coordination Models

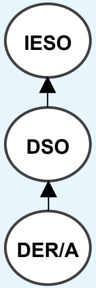
- TDWG took a neutral approach and explored three coordination models without identifying which model is preferred for the near or long term

Dual Participation DSO (DP-DSO)



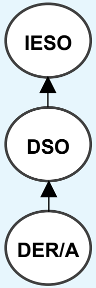
DER/A directly participate in both wholesale markets and distribution services, managing two distinct interfaces.

Market Facilitator DSO (MF-DSO)



DER/A participates directly in wholesale markets but coordinates operationally through a single DSO interface.

Total DSO (T-DSO)



DSO is the sole wholesale market participant. All DER/A interact with the market indirectly through the DSO.

Key Features of Operational Coordination

- Four key features form the foundation of the protocols.

Sequential Coordination

DER/A first considered for distribution, then wholesale services.

Ongoing DSO Limits

DSOs set advance operational limits on DER/A to maintain distribution reliability.

Floor Price Offers

DER/As capture distribution service commitments via floor-price wholesale market offers.

DSO Overrides

DSOs can curtail DER/A output to ensure safe, reliable operation of the distribution system.

General T-D Coordination Activities

- Primary action steps, applicable to both day-ahead and real-time processes:

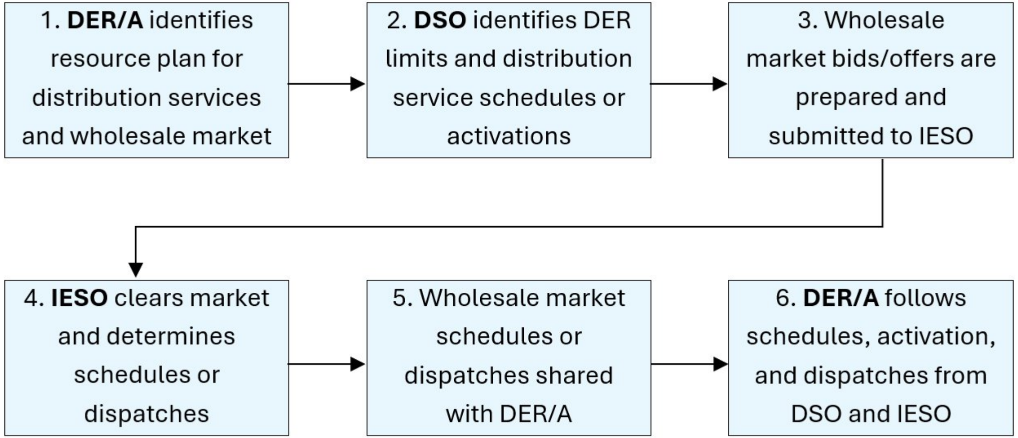


Figure 7: General activities in the protocols for all three DSO models

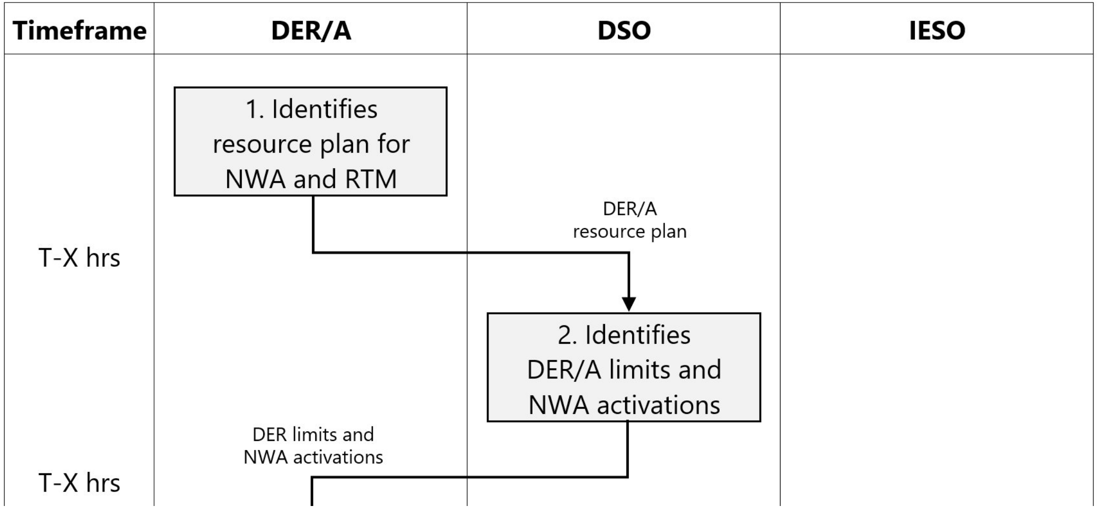
* Does not include actions related to abnormal conditions due to DER/A outages, DSO overrides, or changes to DER/A resource plans

Service Stacking Coordination Protocols

- For each of DP-DSO, T-DSO, and MF-DSO models, the report outlines coordination protocols for five processes:
  - Day-Ahead Process
  - Real-Time Process
  - DER/A Outage Process
  - Distribution Override Process
  - DER/A Resource Plan Change Process

Swim Lane Diagrams

- Swim lane diagrams are used in the report to illustrate coordination among DER/A, DSOs, and the IESO



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Key Takeaways

- Effective T-D coordination ensures all parties have the information they need to maintain safe, reliable and efficient operation of the grid
- TDWG defined three different models for T-D coordination - each model can support effective T-D coordination
- In each model the information exchanged between the parties is the same, though the way it flows from one party to another differs
- The coordination protocols developed by TDWG will inform IESO's Enabling Resources Program and ongoing market evolution efforts
- Deliverable reports expected to be published in Q3
- The IESO greatly appreciates the collaboration and contributions from TDWG members

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Service Timeframe – Wholesale Energy Market [2/2]

- RTM process determines dispatch instructions and prices for each 5-minute interval
- The rapid pace of this process presents a challenge, as communication latency or execution delays may impact reliability

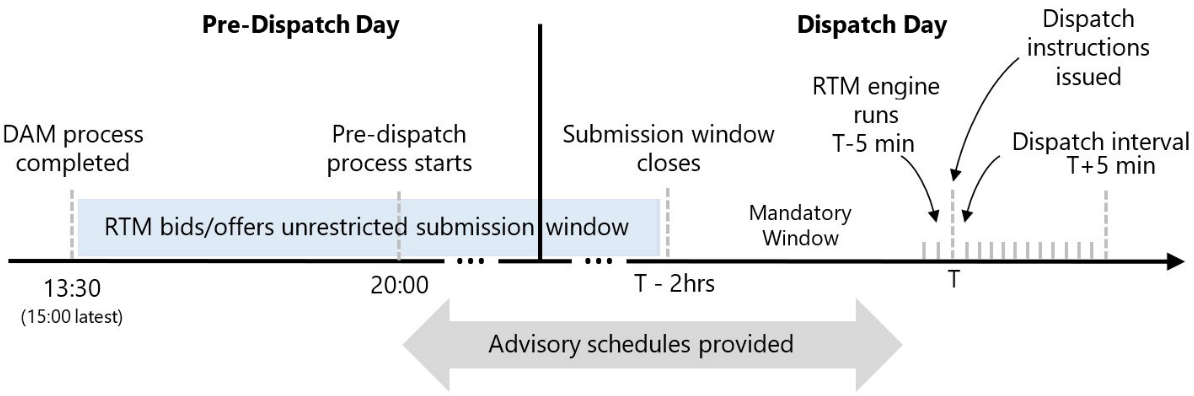


Figure 2: Relevant IESO Real-Time Market Timelines

Service Timeframe – Distribution Service [2/2]

- A sequential process requires the DSO to strategically perform key DER/A-related tasks before the IESO's DAM and RTM processes
- DSO assessments establish DER/A operating limits and distribution service instructions
- Some timeframes related to distribution services have purposely been left undefined

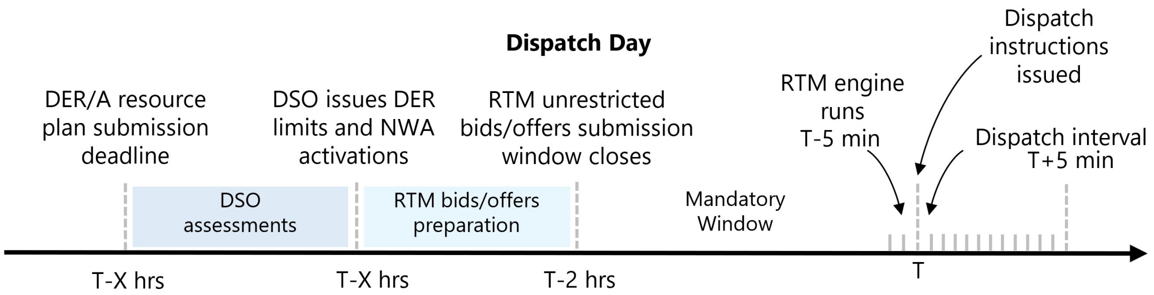


Figure 4: Relevant Real-Time DSO and IESO Timelines

OEB DSO Symposium

TDWG – B1 Functional Assessment Overview

Monday June 23rd, 2025

Alectra
Ken Chadha, Grid Analytics & Data Modernization
Vivek Somasundaram, Grid Modernization Technologies

Toronto Hydro
Hani Taki, Director, Distribution Operations & Grid Modernization

B1 Functional Assessment Overview – Work Packages

01

Conceptual Architecture

Overall DSO structure; overview of processes/systems that will enable the LDC to act as a DSO

02

Process & User Journey Mapping

All the critical processes, functional capabilities and user journeys within the DSO

03

Gap Analysis

Assess gaps between existing LDC capabilities, and the capabilities highlighted in Work Packages 1 and 2

04

Business & Functional Requirements

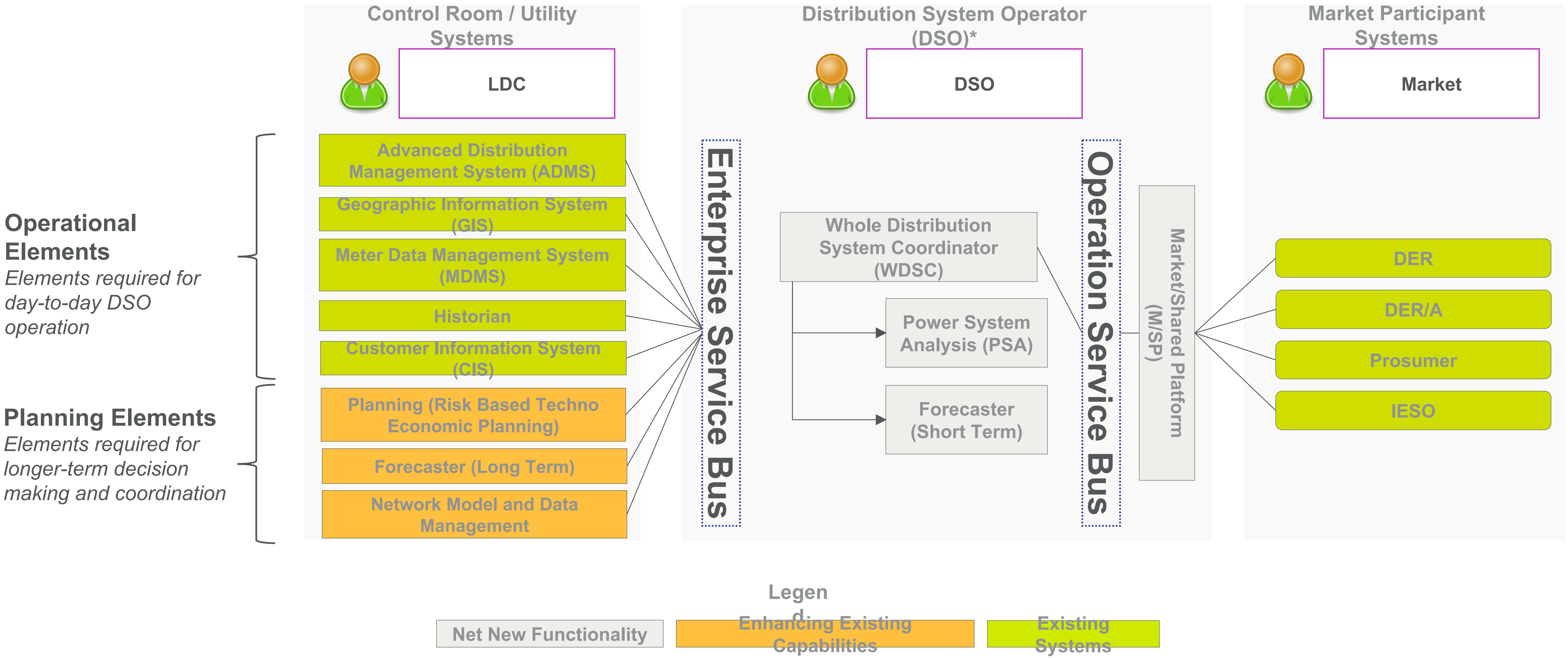
Identify tangible assets and technology requirements at various maturities

05

Investment Costs

Timeline and cost estimates for enabling the business & functional requirements

Work Package #1 – DSO Architecture Elements



*DSO functionalities are LDC functionalities, and this Architecture does not provide commentary on ownership

Work Package #2 –Process & User Journey Mapping

3

DSO Models

The 3 models considered include the Dual Participation DSO, Total DSO, and Market Facilitator DSO

4

User Journeys

4 total User Journeys were developed, which were centered around the “LDC & IESO Journey” and “Host LDC, Embedded LDC, and IESO Journey”, with and without a Shared Platform

12

DSO Model Permutations

Incorporating the 10 DSO process along with the 3 different DSO models to create B1 Work Package #1

10

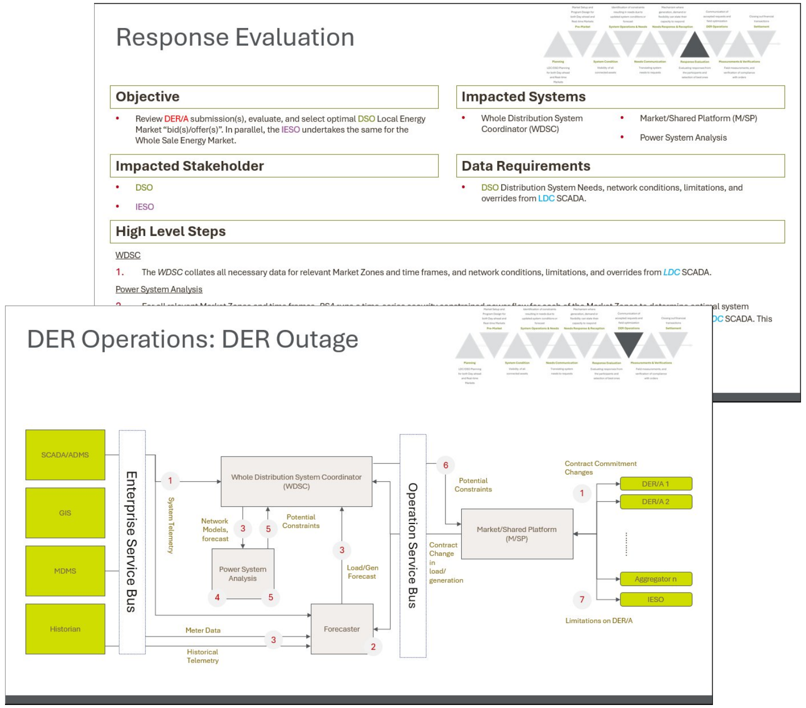
DSO Processes

Identified 10 DSO process, consistent across the 3 different models for all 4 User Journeys, covering the end-to-end operations of a DSO

400+

Baseline Operating Guide for DSO Models

400+ slide PowerPoint guide that outlines the overall objectives, stakeholders, systems, data requirements and steps for the 10 DSO Process across the 3 different models for all 4 User Journeys emphasizing end-to-end co-ordination



Major Difference Between DSO Models (Dual Participation, Total, Market Facilitator)

1. Generally, the differences between models are related to the exchange and coordination of information between different actors/systems
2. For User Journeys without the Shared Platform, the main difference is that communication between the IESO, LDC, DSO and DER/A would be managed through point-to-point integration between the parties
3. In the case of an Embedded and Host LDC, the major additional difference is an extra communication/co-ordination step that includes the Host LDC

Work Package #3 – Gap Analysis

Survey conducted through the EDA to collect feedback from LDC members to achieve a clear insight into the preparedness of LDCs across Ontario for the potential implementation of DSO capabilities. The survey inquired about the current state of capabilities, irrespective of the DSO model used.

74%
Response Rate
35/47 EDA member LDC responded, with 4 non-members also providing responses. Highest response rate for a survey from EDA.

5.2M
M
Customers
Responses received from LDC cover ~5.2MM customers or 96% of all EDA member LDC customers.

11
Sections
Questions were divvied into 11 sections that covered the DSO Processes.

82
Questions
Structured questions to understand the general readiness for DSO operations across the province.

- Strong Operational Foundations – 70% operate centralized control rooms
- Technology & System Adoption
  - 97% utilize GIS tools extensively for planning
  - 89% rely on SCADA for real-time monitoring of systems
- Active DER Integration – 54% manage over 100 DER connections; 23% have more than 500 DERs connected
- Reliable & Accurate Processes – 66% report highly accurate and reliable settlement processes.
- Proactive Steps Toward DSO Readiness
  - 71% prioritize expanding SCADA coverage
  - 69% plan significant workforce upskilling to manage DER integration and advanced grid functionalities

- Visibility & Automation Challenges
  - 34% report <25% SCADA asset visibility; 50% have real-time telemetry capabilities >75% visibility
  - All but one LDC have partial and not full DER visibility.
- Preparedness & Capability Gaps – 91% believe they require upskilling and training to effectively manage DERs and run DSO operations
- DER Management & Control Gaps – 89% do not actively engage DERs for operational needs
- Resource Constraints – 57% face budget limitations impacting planning and technology upgrades.

Work Package #4 – Business & Functional Requirements

	Maturity Level							
	IESO - LDC Coordination					DSO MVP	Full DSO Rollout	
	1 Laying the Foundation (Smaller LDC)	2 Laying the foundation (Larger LDC)	3 Emerging Capabilities	4 Advanced Capabilities	5 Full Maturity	6 DSO MVP	7 Advanced Capabilities	8 Full Maturity
Forecast	Forecasting - Weather Forecast, External	Forecasting - DER Assets	Forecasting - Weather Forecast			Forecasting - Market Commitments		Forecasting - Weather Forecast, Internal
	Forecasting - Load	Forecasting - LDC TD Coordination Support (Limited and Manual)		Forecasting - LDC TD Coordination Support (semi-automated)	Forecasting - LDC TD Coordination Support (Mature and Automated)			
	Forecasting Engine (Limited and Manual)	Forecasting Engine (Semi-Automatic)	Forecasting Engine (Mature and Automated)					
				Forecasting Engine - Short Term (Limited and Manual)	Forecasting Engine - Short Term (Mature and Automated)		Forecasting Engine - Long Term	
				Forecasting Engine - Generation Forecast (Limited and Manual)	Forecasting Engine - Generation Forecast (Mature and Automated)			
				Forecasting Engine - Load Forecast (Limited and Manual)	Forecasting Engine - Load Forecast (Mature and Automated)			Network Model Update - Operations
		Network Model Update - Asset Nameplate	Network Model Update (Limited and Manual)	Network Model Update (Semi-automatic)	Network Model Update (Mature and Automated)			Network Model Update - Emergency
Powerflow/System Analysis	Power System Analysis	Optimal Power Flow (LDC TD Coordination Support) - Analysis (Limited)	Optimal Power Flow (LDC TD Coordination Support) - Analysis (Maure)			Optimal Power Flow - Analysis (Limited)	Optimal Power Flow - Analysis (Mature)	
						Optimal Power Flow - DSO Request Creation		
						Optimal Power Flow - Reporting		
						Optimal Power Flow (Limited and Manual)	Optimal Power Flow (Mature and Automated)	
Communication	Communication Platform	Communication Platform - Request			Communication Platform - DSO Request		Communication Platform - DSO Offer Revocation	Communication Platform - Emergency
		Communication Platform - Service Offer	Communication Platform - Service Order		Communication Platform - DSO Offer	Communication Platform - DSO Order	Communication Platform - DSO Offer Rejection	
				Communication Platform - Settlement Report		Communication Platform - Settlement Report (DSO services)	Communication Platform - DSO Order Revocation	
		Communication Platform (Limited and Manual)	Communication Platform (Mature and Automated)					
Measurement and Verification	Measuring & Validating - LDC	Measuring & Validating			Settlement - Report		Settlement - Penalty	Settlement - Emergency
	Measuring & Validating - Market Participant					Settlement - Payment	Settlement - Dispute	Settlement - BAU Integration
Valuation						Valuation - Long Term Contracts	Valuation - Voltage Reduction	Valuation - Asset Management and Maintenance
						Valuation - Outage Management	Valuation - Switching	
						Valuation - Locational Price (NWS/DSO)		
						Valuation - Comparison		

Work Package #5 – High-Level Investment Costs

Maturity Level							
IESO – LDC Coordination					**DSO MVP**	**Full DSO Rollout**	
1 Laying the Foundation (Smaller LDC)	2 Laying the Foundation (Larger LDC)	3 Emerging Capabilities	4 Advanced Capabilities	5 Full Maturity	6 DSO MVP	7 Advanced Capabilities	8 Full Maturity

$7-14 m

$21-30 m

$35-55 m

$50-80 m

$ 9-12 m*

$ 9-12 m

$ 9-12 m

Notes and Assumptions

1. Pricing is based on similar implementations, referencing SSEN Transition Project, SPEN FUSION Project and AustNet DER Marketplace
2. Costs reflective of effective deployment in Ontario (economies of scale)

* Assuming minimum of level 4 maturity level exists

Work Package #5 – High-Level Timeline

Maturity Level							
IESO – LDC Coordination					**DSO MVP**	**Full DSO Rollout**	
1 Laying the Foundation (Smaller LDC)	2 Laying the Foundation (Larger LDC)	3 Emerging Capabilities	4 Advanced Capabilities	5 Full Maturity	6 DSO MVP	7 Advanced Capabilities	8 Full Maturity

1-2 years

2 years

3-5 years

5-7 years

2-3 years*

2 years

2-4 years

Notes and Assumptions
* Assuming minimum of level 4 maturity level exists

Key Takeaways

1. Ultimately, the work of the TDWG was meant to support evolving system needs related to the integration of a broader range of DERs while maintaining both transmission and distribution-level reliability.
2. The development of coordination protocols are meant to enable the effective participation of Distributed Energy Resources either individually or in aggregation—in the IESO-administered wholesale markets, and eventually in DSO-administered local markets.
3. Effective T-D coordination ensures all relevant parties (e.g., DER/A, IESO, LDC) have the information they need to maintain safe, reliable and efficient operation of the grid.
    i. Especially critical for LDC's given the dynamic operations and complexity of the distribution system
4. The B1 Work Packages 1-5 (as well as of A, B2, & B3) provide a baseline to inform and support sector innovation in the near term and the long term and support transition towards enabling DSOs within Ontario.
5. The B1 team wants to emphasize the positive collaboration and contributions between the IESO and TDWG members and looks forward to working with the OEB on the DSO consultation

Appendix

Work Package #2 – Major Model Process Differences

Process	Dual DSO (DP-DSO)	Total DSO (T-DSO)	Market Facilitator (MF-DSO)
Planning	▶	▶	▶
Pre-Market	▶	▶	▶
System Condition	●	●	●
System Operation and Needs	■	■	■
Needs Communication	▶	■	▶
Needs Response & Reception	▶	■	▶
Response Evaluation	▶	■	▶
DER Operations – Selection	●	●	●
DER Operations – DER Outage	■	■	■
DER Operations – Distribution Constraints	■	■	■
DER Operations – Dispatch	■	■	■
Measurement & Verifications	▶	■	▶
Settlement	▶	▶	▶

● **Minor Difference** ▶ **No Difference** ■ **Major Difference**

1. Generally, the differences between models are related to the exchange and coordination of information between different actors/systems
2. For User Journeys without the Shared Platform, the main difference is that communication between the IESO, LDC, DSO and DER/A would be managed through point-to-point integration between the parties
3. In the case of an Embedded and Host LDC, the major additional difference is an extra communication/co-ordination step that includes the Host LDC

TDWG – B2 'Communication Assessment'

June 21st, 2025

Scope of Communication Assessment

‘Communication Assessment’ deliverable sought to provide the following, for TDSO, Market facilitator and Dual Participation Models:

- Map data interactions among IESO, LDCs, and DER(A) for with respect to outages, thermal/voltage grid constraints, limits on DER(A), and dispatch of DER(A).
- Identify key data exchange nodes (DEN’s) of the network where telemetry is required.
- Identify the available communication medium (s) that will be used to exchange the data in (near) real time.
- Consider cyber security protocols that will also apply to all scenarios outlined in this deliverable.

Hydro One partnered with Electrical Power Research Institute (EPRI), to provide global insight and perspective.

Omissions & Future Considerations

- This assessment was required to follow the interactions mapped in IESO’s ‘Deliverable A’. It does not account for re-iterative processes that might be required when constraints are determined.
- This assessment does not include costing. For example, in the Dual Participation model, the DER/A is required to communicate with both the IESO and DSO. It is assumed the telecommunication costs would increase for the DER(A)’s, but this has not been quantified.
- This report did not outline specific telecommunications solutions for each DSO / Utility.

Key Components of the Report

1. Interaction Between Entities

- Describes three coordination models and their implications on data flow and communications.

2. Interaction Mapping

- Six use cases analyzed based on the IESO’s Deliverable A ‘Communication Protocol’ report:
  - Day-ahead scheduling
  - Real-time dispatch
  - DER and distribution system outages
  - Resource plan changes
  - Telemetry

3. DER Forecasting

- DER growth projections (2025–2035) based on IESO’s DER Potential Study

4. Byte-Count Analysis

- Quantifies daily data traffic across interfaces and DSO models

5. Telecommunication Technology Assessment

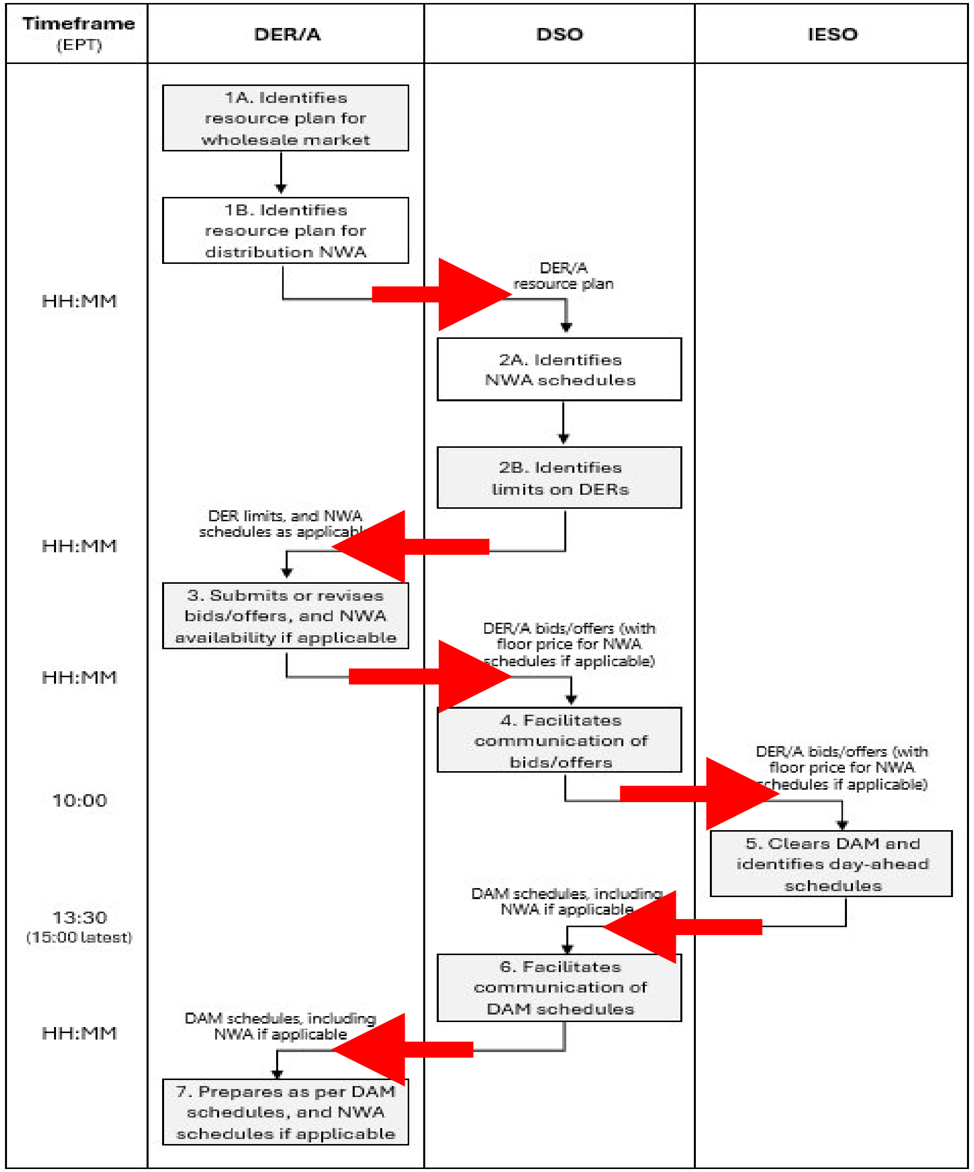
Analyzes suitability of medium based on;
Data Rate, Latency, Reliability, Cost, Cybersecurity, Deployment ease Scalability.

Interaction Mapping

This analysis broke down each use case into the sequence of individual messages. For example, the process swim lane diagram (right) involves several horizontal arrows, representing information exchanges between entities. The number of interactions between entities was mapped and calculated.

The table below identifies and quantifies the major data exchanges that occur between each actor / entity.

Parameter	Result
Number of Unique Communication Interaction Types	61
Number of Unique Interaction Types by Interface	
DER/A ↔ DSO Interface	31
DER/A ↔ISO Interface	13
DSO ↔ ISO Interface	17
DER/A ↔ Shared Platform Interface	36
DSO ↔ Shared Platform Interface	42
ISO ↔ Shared Platform Interface	26
Number of Unique Interaction Types by DSO Model	
Total DSO	48
Dual Participation DSO	34
Market Facilitator DSO	48



DER Forecasts: Utilizing 'DER Potential Study'

Below are the DER forecast numbers from the IESO's 'DER Potential Study' that were used in this Communication Assessment report. Both High and Low values included BTM, FTM and DR DER's for the summer (peak) scenario. The low value is based on the BAU (achievable) model and the high value is based on the BAU+ (econo).

Figure 5-12: Market-Wide Economic Potential By Scenario and Resource Type in 2032 (GW)

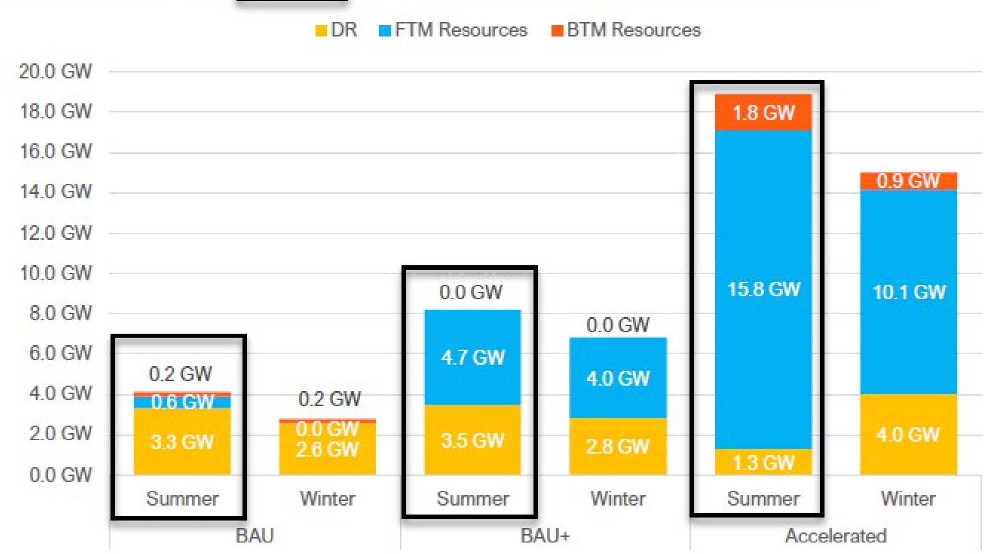
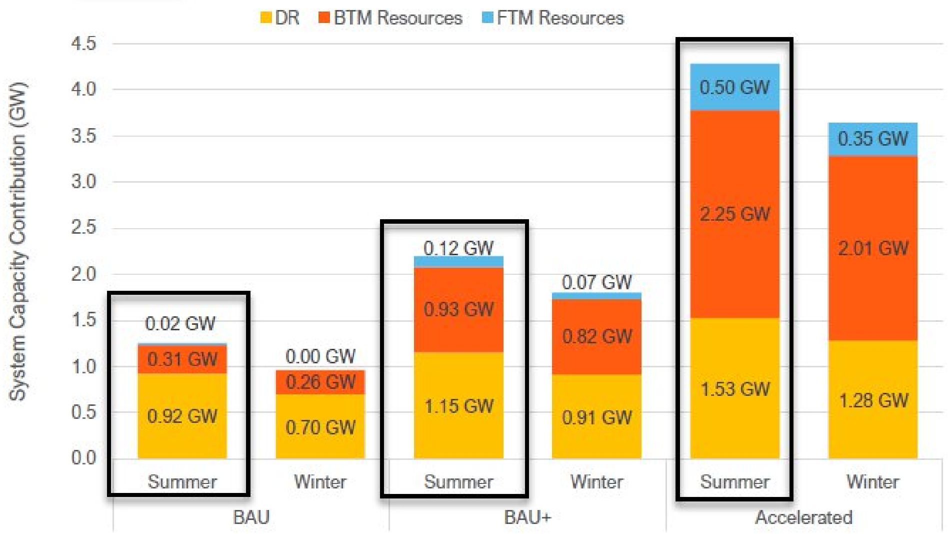


Figure 6-3: Achievable Seasonal System Capacity Contributions by Scenario and Resource Type in 2032



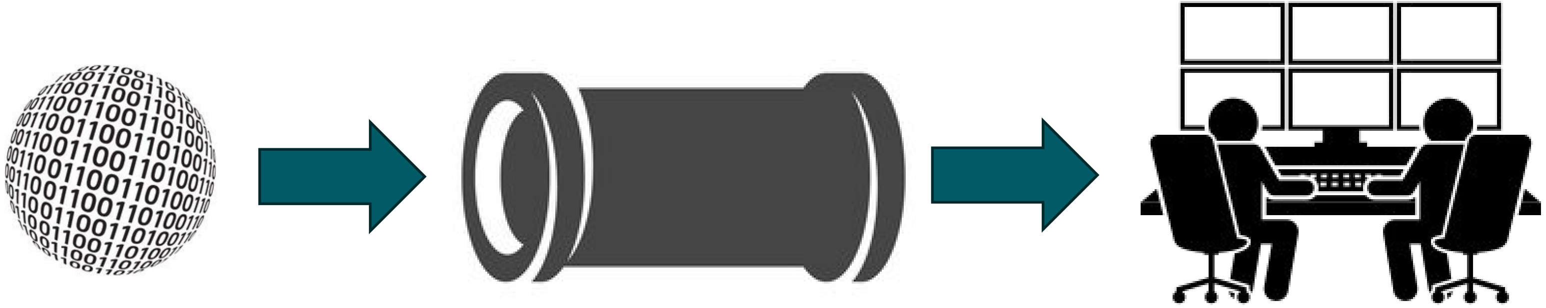
https://www.dunsky.com/wp-content/uploads/DER-potential-study-IESO-Dunsky-Vol1.pd

Byte-Count Analysis

To understand the size of the telecommunications pipe, you need to know how much data will flow through it.

We had to evaluate what data, within a message packet, is required to be sent from DER/A to DSO / ISO (ex time stamps, MW, DER ID etc).

We then had to calculate how many bytes of data are within each message packet.



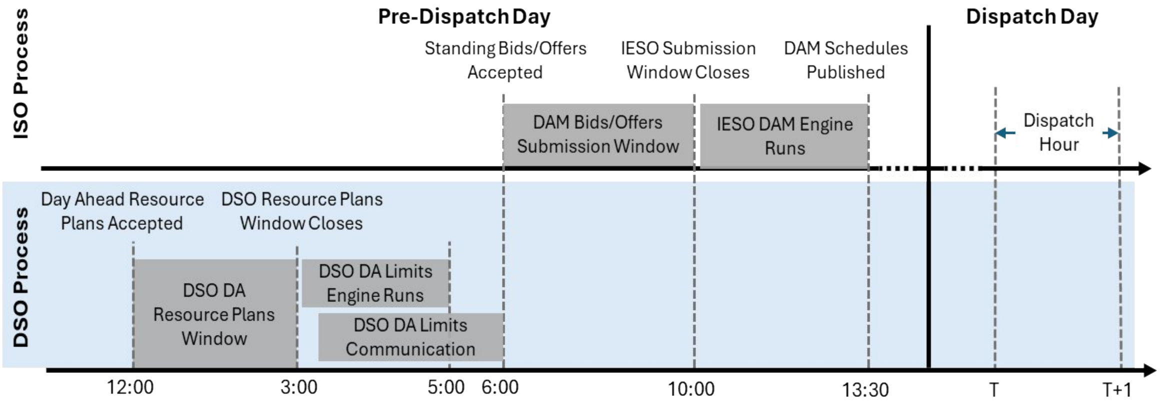
Example of DER/A data packet for bidding to DSO.

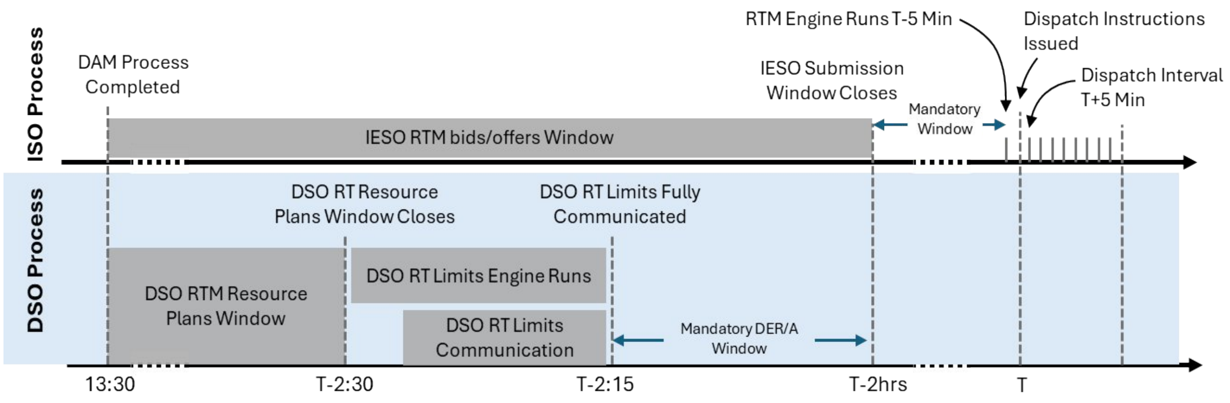

```xml
<ResourcePlan xmlns="http://zigbee.org/sep"
              xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <mRID>0x1234</mRID> <!-- from SubscribableResource or IdentifiedObject -->
  <timeStamp>1601967600</timeStamp>
  <aggregatorID>bd2aa2cb-aefb-4e0b-b917-1d5ba7f34f33</aggregatorID>
  <action>DERA_Service_Plan</action>
  <DERList>
    <DERPlan>
      <DERID>r0lfr2g1l-4541-22fd-7r4y-0123zx542221</DERID>
      <schedule>
        <ScheduleEntry>
          <sch_time>1601967600</sch_time>
          <activePower>
            <target>2000</target>
            <min>1500</min>
            <max>2500</max>
          </activePower>
          <reactivePower>
            <target>-1000</target>
            <min>-2000</min>
            <max>-500</max>
          </reactivePower>
        </ScheduleEntry>
        <!-- Additional schedule entries here -->
      </schedule>
    </DERPlan>
    <!-- Additional DERPlans here -->
  </DERList>
</ResourcePlan>
```

Bursty Data Traffic

This analysis identifies the total daily data traffic. However, there are certain windows of time within each day when traffic levels are higher. We identified how much data (bytes) must be transferred successfully over communication networks within the allowed windows, in order to leave time for processing and computing performed by the various actors.

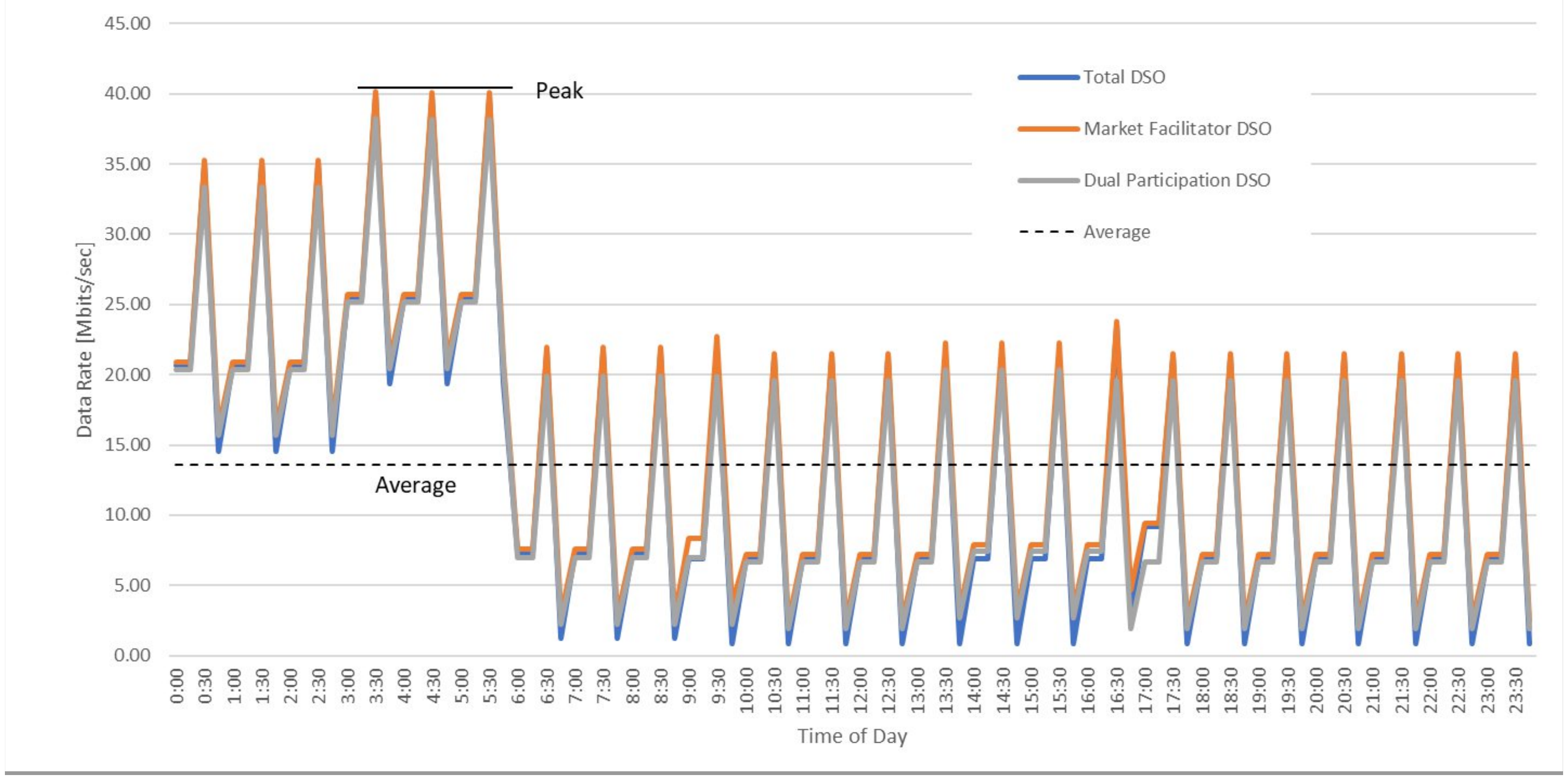
The figures below show example timelines of DSO and DER/A interactions in coordination with ISO day ahead and real time markets.





Data Traffic Results

Putting these day-ahead and real time scenarios together, the peak loading occurs during the 'once-per-day' period when the day-ahead and real time processes overlap and specifically within that period, the window when day-ahead constraints/limits and the RT processes overlap. These 'bursty data' periods result in the effective data throughput rates shown below.



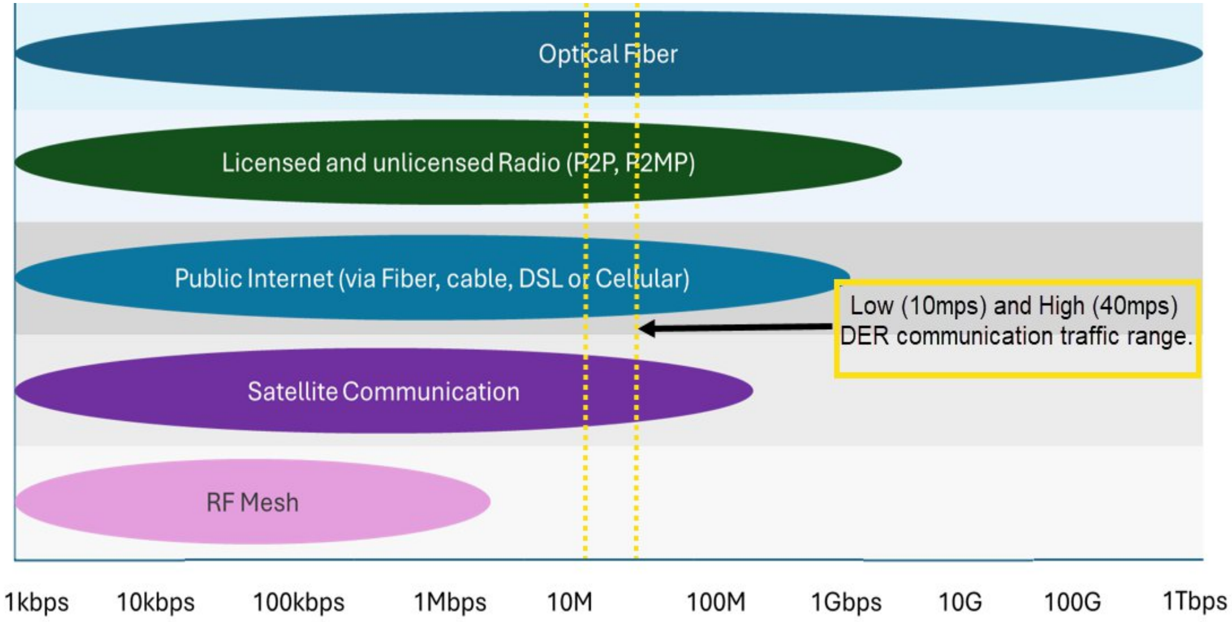
Example Daily Data Traffic Pattern

Conclusions

1. **All three DSO models can** be supported with current telecommunications options.
2. **A hybrid communication strategy**—mixing fiber, microwave, cellular, and satellite—will be essential for scalable and cost-effective deployment. Further evaluation should incorporate additional criteria including geographic location, reliability requirements, and DER density.

In future assessments, we must compare each coordination model against costing and evaluate re-iterative process complexity when constraints are realized.

Communication Medium Vs Performance		
	Data Rate Requirements	Latency Requirements
Optical Fiber	Significantly Exceeds	Exceeds
Licensed P2P Microwave	Exceeds	Exceeds
Unlicensed P2P Radio	Meets and potentially exceeds	Meets and potentially exceeds
Private Cellular	Meets and potentially exceeds	Meets and potentially exceeds
Leased (Wireline)	Meets and potentially exceeds	Meets and potentially exceeds
Public Cellular	May Meet (location dependent)	Meets
Satellite (LEO)	Meets	Meets
RF Mesh	Likely Does Not Meet	May Meet



Thank you

For more information, please contact me at james.mcgowan@hydroone.com

B3 Shared Platform Concept Presentation

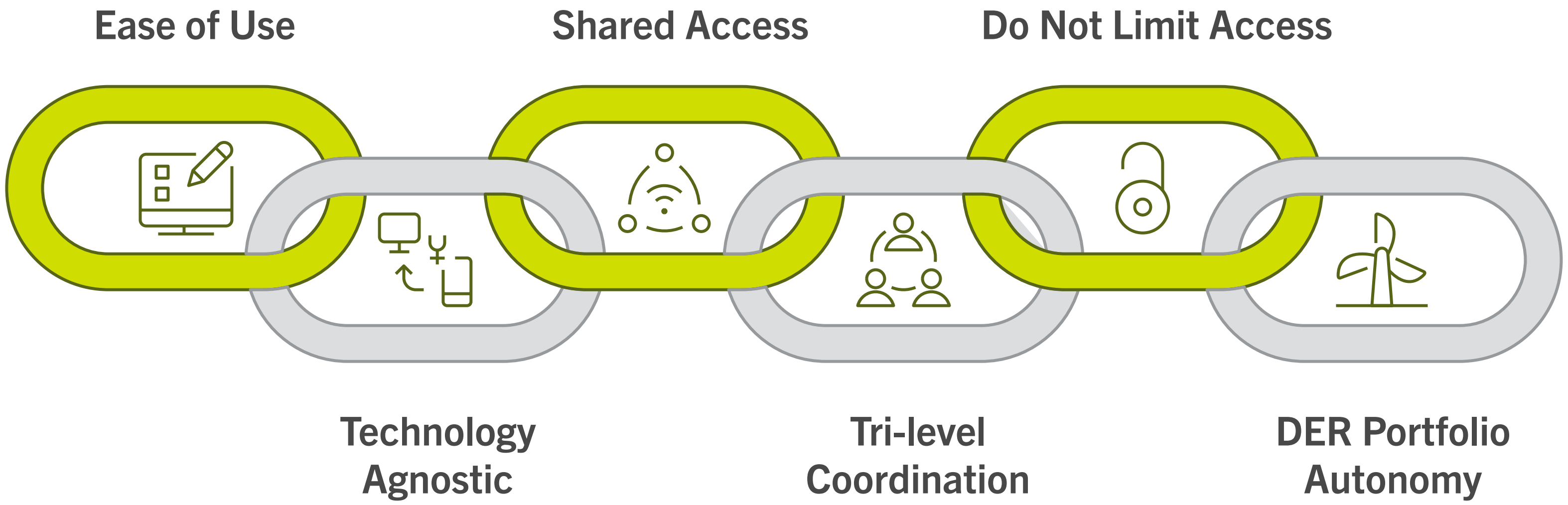
OEB's Stakeholder Symposium on Distribution System Operator (DSO) Capabilities

June 23, 2025

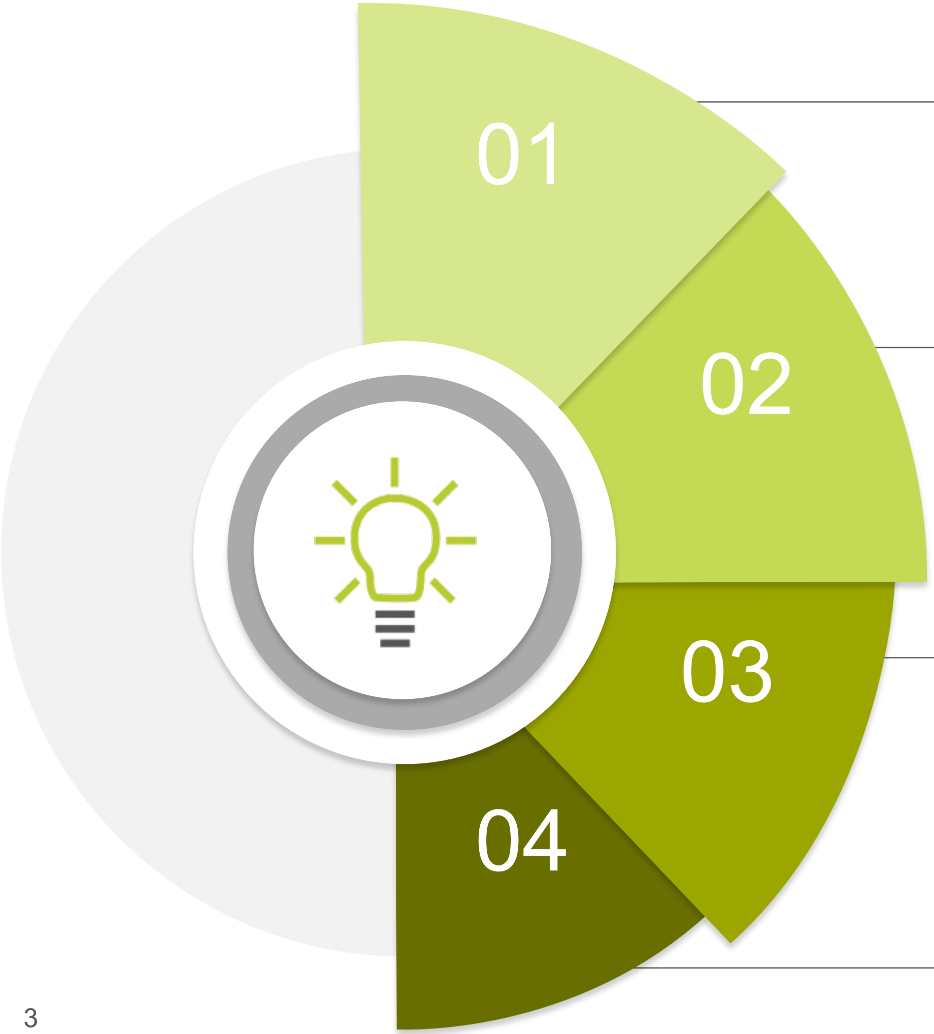
B3 Shared Platform Concept Objective

- Objective: Conceptualize a shared platform concept to support T-D coordination of distribution-connected DERs, focusing on system visibility and information sharing among LDCs, the IESO, and DER owners/aggregators—while also enabling broader benefits beyond coordination.
  The work also aims to gain insights from similar demonstrations and solutions from other jurisdictions.

- Key guiding principles for the shared platform are outlined below:



Key Benefits of a Shared Platform



Removing barriers for DER participation in the province

- Simplifying onboarding and customer experience.
- With 60+ LDCs, standardized registration tools are key.
- Multiple platforms with varying rules would make DER aggregation impractical and unviable in Ontario.

Improving coordination for system operators and utilities

- Avoids point to point integrations.
- Will ensure commitments made to one party doesn't conflict with another.

Shared visibility of available DERs across the province

- The concept of a DER register is important.
- Integrations from existing/new LDC systems can be built.

Offers communication mechanism for responsibilities outlined in the coordination protocols

- The coordination protocols outlined by the IESO requires the LDC to share DER related information with the IESO, and the shared platform could facilitate that data exchange.

Flexibility Platform Landscape

Emerging flexibility platforms in Europe

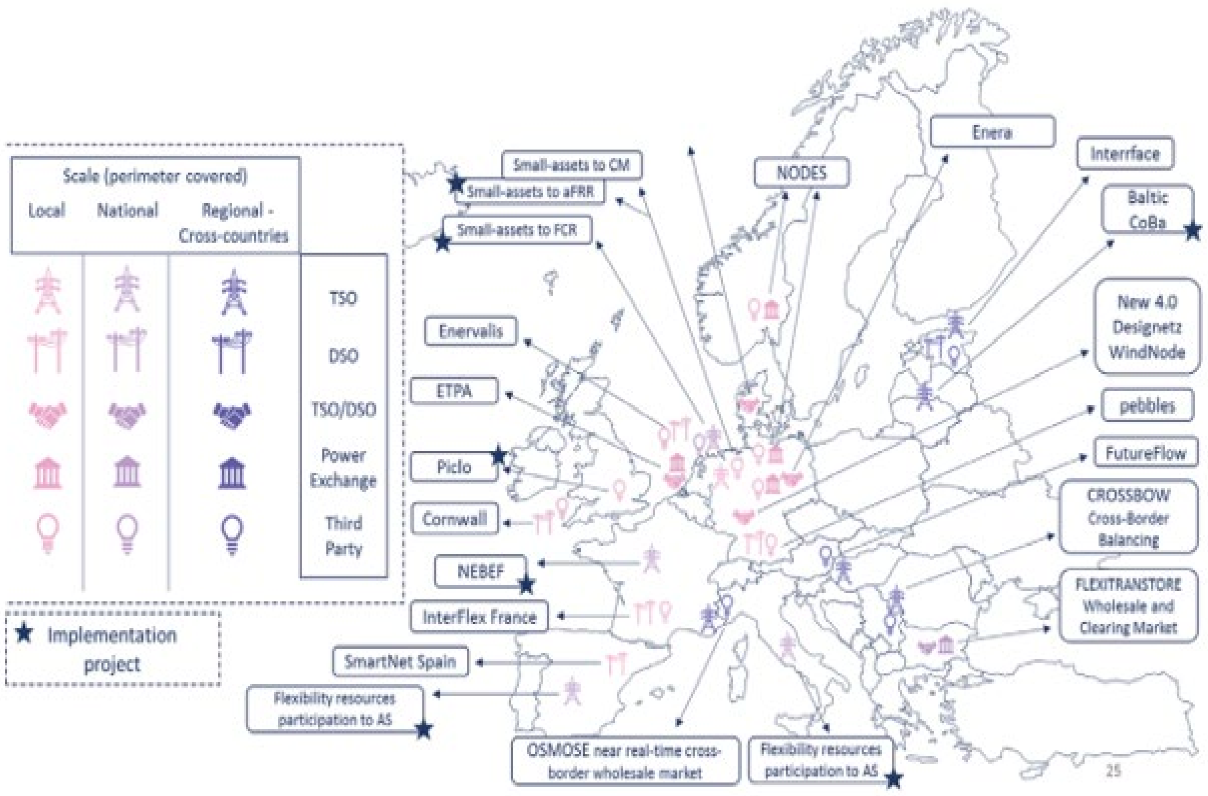


Figure 2: Emergence of flexibility platforms across EU member states

Source: ENTSO-E. Available at: *eepublicdownloads.entsoe.eu/clean-documents/events/2019/191205_Flexibility%20Framework_full_public.pdf?Web=1*

Common DER Services

The most commonly offered DER services in the **operational timeframe*** are as follows:

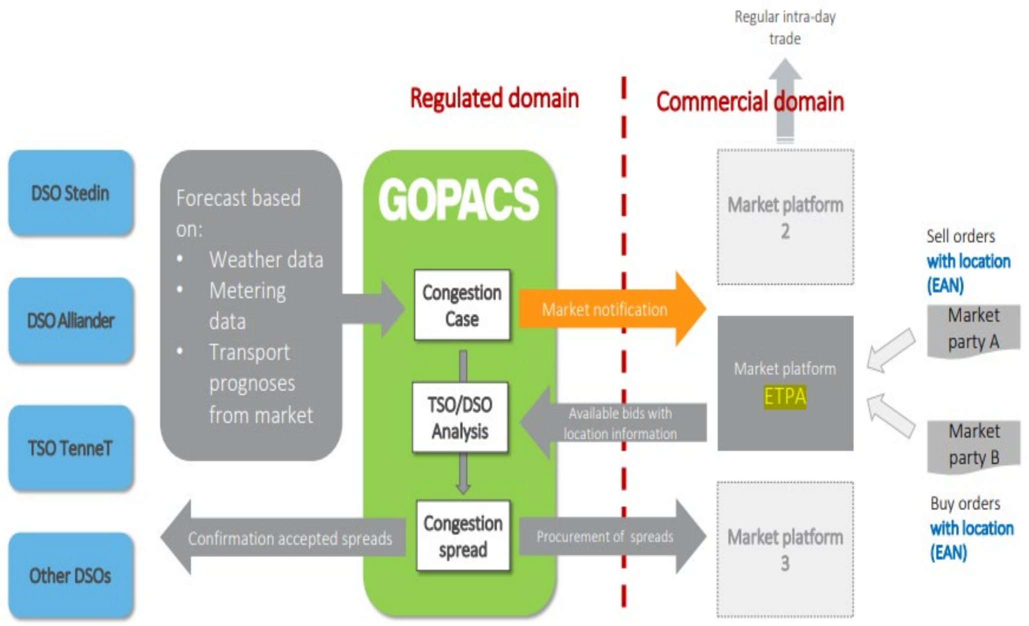
- **Congestion Management:** The set of actions and procedures used to prevent or alleviate congestion in power transmission networks.
- **Frequency Regulation:** Process of maintaining the grid frequency within its nominal value to ensure stable and reliable operation of the power system.
- **Voltage Control:** Maintaining the voltage levels within a power grid at their target values.
- Other services from DERs can include: Black Start, Controlled Islanding, Inertia Response, Redispatch and Load Following.

**Operational timeframe can be defined as Day-ahead and earlier*

Flexibility Platforms Landscape Examples

GOPACS: Netherlands

Grid Optimal Power Availability Control System



EU's Coordinet Project

Spanish Demonstration as part of EU's Coordinet Project

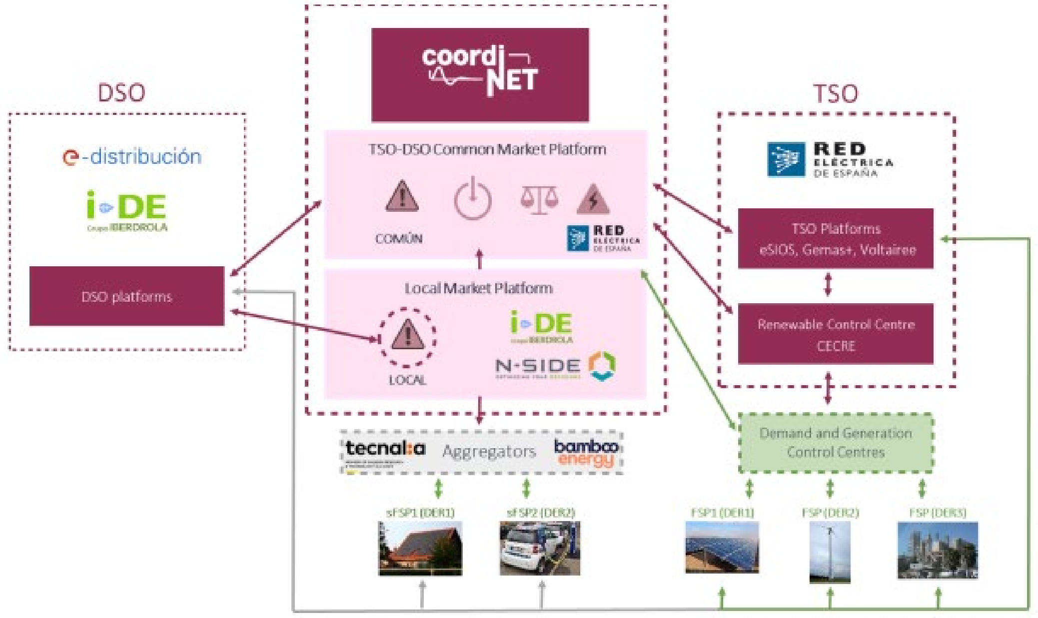


Figure 1 Platforms developed and adapted for the CoordiNet Spanish demonstrator

Effective T/D coordination requires a comprehensive ecosystem of tools, as no single solution fits all; jurisdictions have adopted varied approaches—ranging from building new platforms to enhancing existing ones or combining both—highlighting the complexity of the DER lifecycle and the need for integrated solutions.

Link: Detailed Market Intel presented at the IESO TDWG meeting

Shared Platform – Processes and Users

A Shared Platform Concept can house functionalities within each process of the DER lifecycle:

- Pre-Market/Registration
- Needs Communication, Response & Reception
- System Conditions, Operation and Needs
- DER Operations
- Measurement and Verifications
- Settlements

A shared platform can contain the following user profiles to facilitate coordination:

- DER Aggregator
- DER Owner
- Transmission System Operator
- Distribution System Operator*
- Platform Administrator
- Guest Profile

*The roles and responsibilities of the DSO within the shared platform will be incumbent upon sector alignment on the DSO topic.

Shared Platform Requirements by Process

Pre-Market/Registration

- Supports **multiple user profiles**
- Assigns **unique IDs by feeder, TS station, T-D node**
- Registers **single or aggregated** DERs
- Operator approvals, and tagging Tx/Dx use
- **Prevents duplicates,** supports **aggregation switching**
- Supports standardized contracts, aggregator DER list uploads
- Validates connection assessments and metering data, with potential to centralize interconnection information

System Conditions, Operation and Needs

- DER/As can submit **resource plans**
- Platform integrates with IESO systems
- DER/As **submit bids**
- Bids and offers are **visible to relevant operators**, with notifications sent to DER/As
- **Updates to bids** throughout market processes
- Historical bid data is exportable (CSV/Excel)
- Bidding is blocked during outages or constraints
- Distributor or DER/A can submit **floor price (zero-price)** bids (as per coordination model)
- Distributors can **approve DER participation**
- Operational limits can be set
- Platform displays aggregated DER load at T/D connection points

Needs Communication, Response & Reception

- Distribution schedules will be created in DSO-specific systems but **displayed** in the SP
- For distribution services, DSOs could **submit requests** by market zones, congestion zones etc, may include: “Requests for service”, Advance “standby notices” or Published requirements
- For wholesale market needs, pull information like **pre-dispatch schedules using APIs** (e.g., day-ahead schedules)
- Communication fallbacks, like the use of phone calls when dispatch systems are offline, must be considered in system design

Shared Platform Requirements by Process

DER Operations: Selection and Dispatch

- DERs are selected based on **submitted bids/offers.** Can be displayed in the SP
- DSO and IESO selection happen on respective internal systems, instructions to DER/A is communicated via the SP
- Participants must **acknowledge selections**
- SP should follow prioritization rules as set out in the market design for relevant market(s)
- To avoid **dispatch conflicts**, DSOs and the IESO must maintain **mutual visibility**
- Coordination could include sequenced instructions, **conflict flags**, and real-time data exchange (telemetry excluded)

DER Operations: Distribution Constraints and DER Outage

- **Outages** affecting DER availability must be reported promptly by DER Owners/aggregators
- Information includes **state changes**, affected areas, and estimated **restoration times** can be shared as needed
- Enable operators to log **planned outages** or constraints, **trigger automatic** alerts to DER owners/aggregators, and **notify** the IESO of any potential impacts to wholesale schedules
- A **historical log** of distribution constraints
- DER output may be limited (de-rated) due to system conditions
- Allow LDCs to submit planned maintenance

Measurement & Verification and Settlements

- Integration with IESO **MDMR systems** and LDC Meter Data Management (MDM) systems
- Performance **reporting views**(Activated kWs, Delivered kWs, % delivered)
- Storing **baseline data** (historical loading)
- Record total number of events
- Unofficial **activation and/or delivery** payments
- Assets run time
- Participation set points data
- DER limits
- Outage notices, maintenance schedules

Things to Consider – Moving Forward

Regulatory considerations

- Ensure fair and equal access for all market participants
- Platform must be flexible to adapt with evolving market designs
- Align with regulatory principles to maximize ratepayer and societal benefits

Ownership and Governance

- Define both governance roles and ownership structures clearly to enable effective platform development
- Consider shared ownership models to enable fast, consensus-based decision-making

Platform & Market Design Considerations

- Enable future service stacking through consistent procurement across system actors
- Standardize LDC-level market rules and program designs
- Evaluate pros/cons of a standardized vs. localized platform model

Operational Considerations

- Assess DER growth to identify participation interest across regions
- While remuneration is out of scope, address cost recovery for coordination, system updates, and staffing
- Plan for future discussions on data privacy and security

Thank you!

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APPENDIX

Difference between Shared Platform and other utility tools

Key differences exist between utility tools and the Proposed Shared Platform Concept. Shared Platform will require inputs from multiple utility tools, not replicate functionalities.

Name	Advanced Distribution Management system (ADMS)	Distributed Energy Resource Management System (DERMS)	Shared Platform Concept
Primary functions	Advanced platform that **automates grid operations**: fault location, isolation & restoration (FLISR), volt/VAR optimization, demand management, and supports DERs and EVs. Acts as the "brain" of the distribution grid. Requires accurate network models.	Manages **distributed energy resources** (solar, batteries, EVs, smart devices). Sends dispatch/control signals to DERs to optimize grid performance, reduce peaks, shift loads, or curtail generation.	Shared access between LDCs, ISOs, DER owners/aggregators to **exchange data** re: DER asset information, activation data, DER limits, and grid operator approvals to ensure safe and reliable operations.
Integrations	Integrates with **SCADA,** OMS, GIS, AMI, and optionally DERMS	Integrates with **ADMS,** AMI, aggregators, DERs; often operates independently	Could possibility integrate with utility **DERMs,** aggregator DERMs, utility and ISO internal systems.
Typical users	Utilities, DSOs, grid operators	Utilities, aggregators, VPPs	Utilities, DSOs, ISOs, Aggregators

Source: Camus Energy. (2022, February 28). A glossary of electric utility software systems.

Wholesale System Integrations

The following information can be pulled into the Shared Platform from existing IESO systems:

- **Dispatch Data:** submitted by MPs through the IESO's Energy Management Interface (EMI) application. MPs can either input the data directly via the IESO's web-based application, or they can submit data via an EMI Application Programming Interface (API). Data from EMI then feeds into the IESO's Market Information Management (MIM) system, which is responsible for receiving dispatch data, and then publishing market results.
- **Dispatch Instructions:** Dispatch instructions are sent to MPs via the IESO's Dispatch Service (DS) application. MPs can either receive the data directly through the DS web user interface, or they can receive it through a DS API.
- **Outage Information:** Through the Control Room Operations Window (CROW) application.

Important note: Most of this information will be pulled through point-to-point integrations or API connections. To the extent possible, use standardized communication protocols (e.g., IEEE 2030.5, OpenADR, etc.) for the Shared Platform API.

MPs - Market Participants

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Distribution System Integrations

As highlighted in the B1 (Functional Assessment) Deliverable, the Shared Platform can be linked to utility systems through an operational service bus, integration with DSO systems like:

- **Whole System Coordinator (WSC):** brain of the DSO operations
- **Forecaster (Short Term):** generates forecast at different time granularities as needed
- **Power System Analysis (PSA):** determines system conditions/needs

In terms of specific LDC systems, shared platform can built integrations with the following LDC specific systems to pull DER specific information:

- **ADMS:** Advanced Distribution Management System
- **GIS:** Geographic Information System
- **MDMS:** Meter Data Management System