JUNE 13, 2023

Forecasting and Operation of DERs under Different T-D Coordination Models

ESIG Meteorology and Market Design for Grid Services Workshop

Denver, CO

Ali Golriz, Lead, System and Sector Development, IESO

ieso
Connecting Today. Powering Tomorrow.

Who We Are and What We Do

Reliably operate Ontario's province-wide system 24/7

Support innovation

Create electricity market efficiencies

Work closely with communities to explore sustainable options

Plan for Ontario's future energy needs

Enable province-wide Conservation

Ontario's System at a Glance

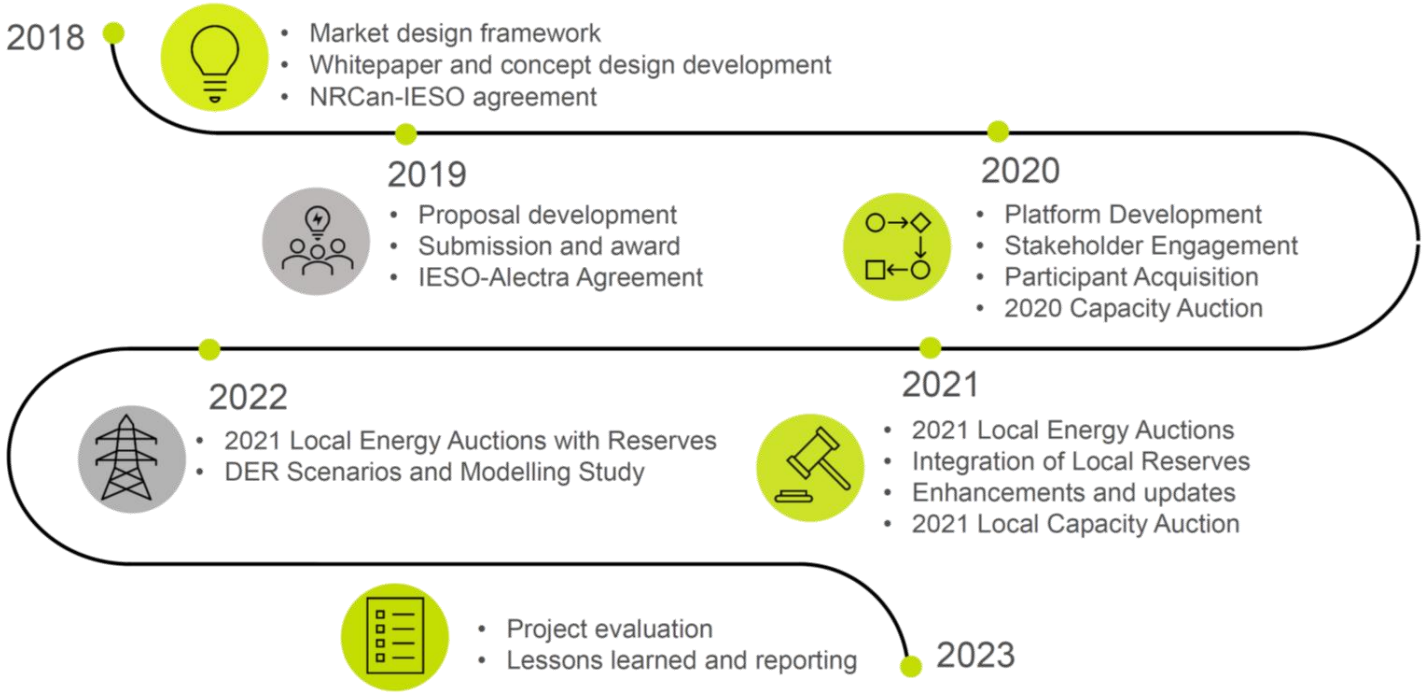
Installed Capacity	38,944 MW
Record Summer Peak (August 1, 2006)	27,007 MW
Record Winter Peak (December 20, 2004)	24,979 MW
Annual Energy Consumed (2020)	132.2 TWh
Retail Customers (2019)	~ 5.2 million
Transmission Lines	30,000 km
Planning Regions	21
Interconnections	New York, Quebec, Manitoba, Michigan, Minnesota

Demonstration Goal and Structure

- Funded by NRCan* and IESO with Alectra Utilities as delivery partner
- Contributes to distribution market and transmission-distribution (T-D) coordination
- Capacity, energy, and reserves services were secured using auctions
- Distribution system operator (DSO), Alectra Utilities, uses local services to manage distributed energy resources (DER) as non-wires alternatives (NWA)
- Envisions a "Total DSO" model, where the DSO manages local services and acts as a "super aggregator" in the wholesale market
- Reliability needs were simulated; the services, auctions and DER operations were real
- Demonstration focused on dispatachable DER, e.g., demand response, batteries, etc.

* Natural Resources Canada (NRCan)

Demonstration Activities Timelines



Local Energy Service Process

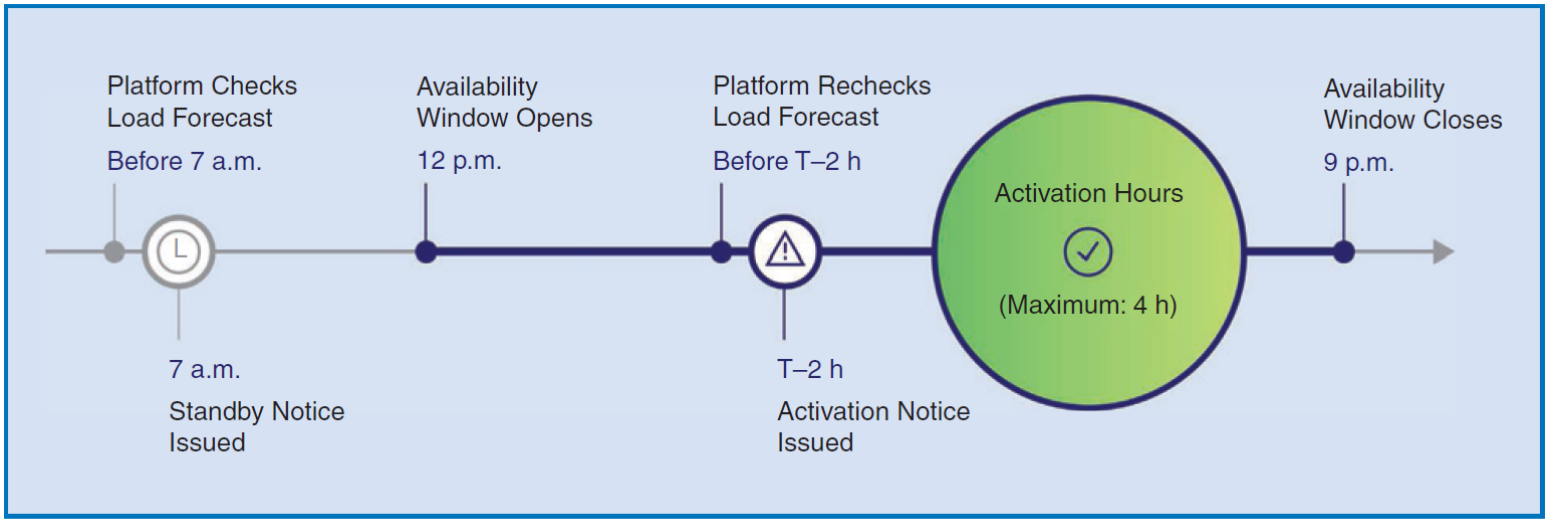


figure 5. A process for local energy service in the demonstration.

Local Loading Forecast and Threshold

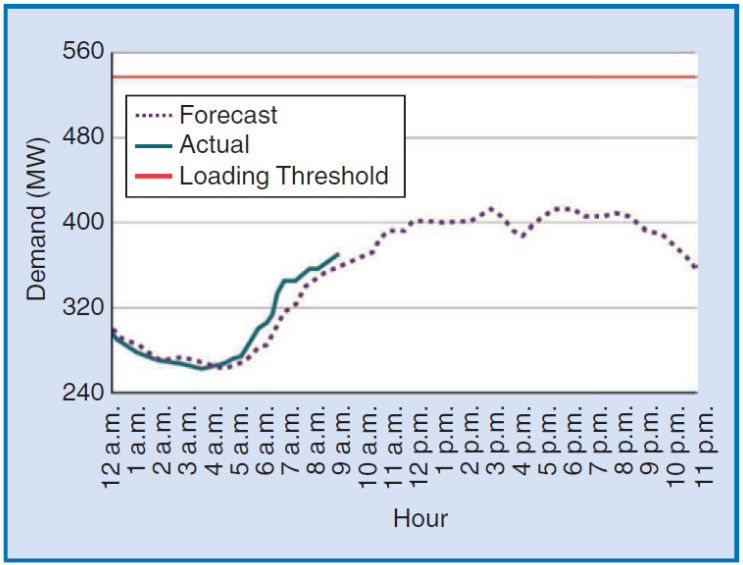


figure 3. The demand forecast for part of the demonstration area on 6 October 2021.

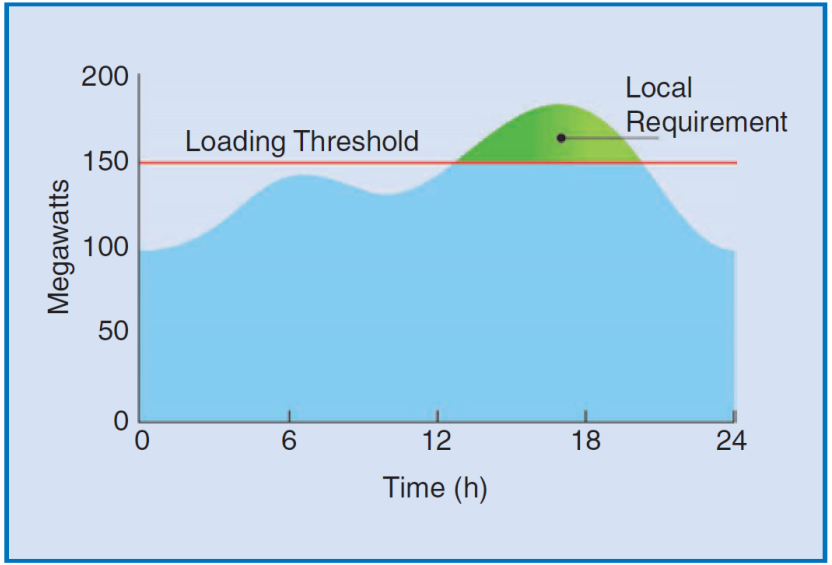
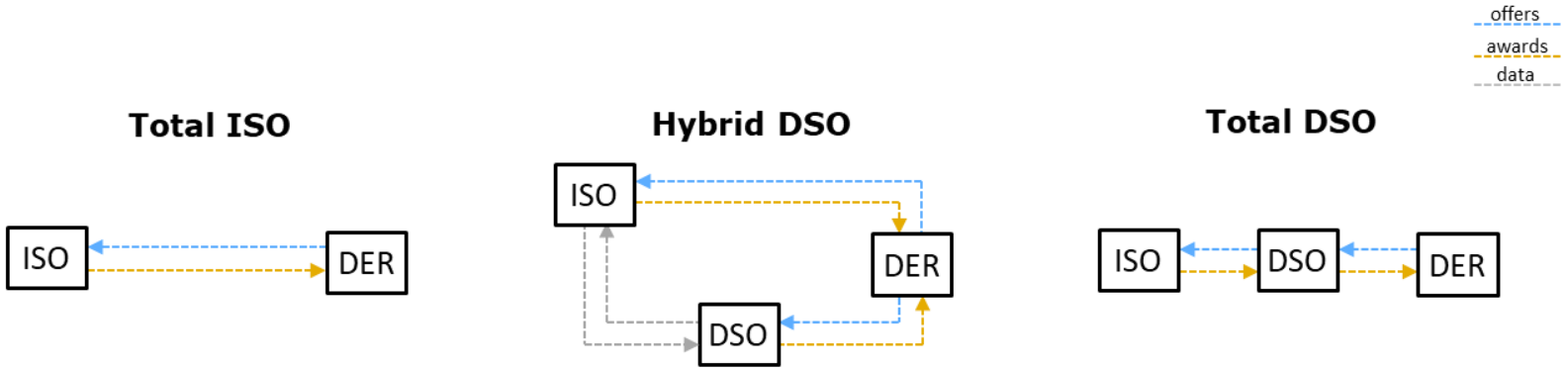


figure 4. The loading threshold and local requirement for energy.

T-D Coordination Frameworks

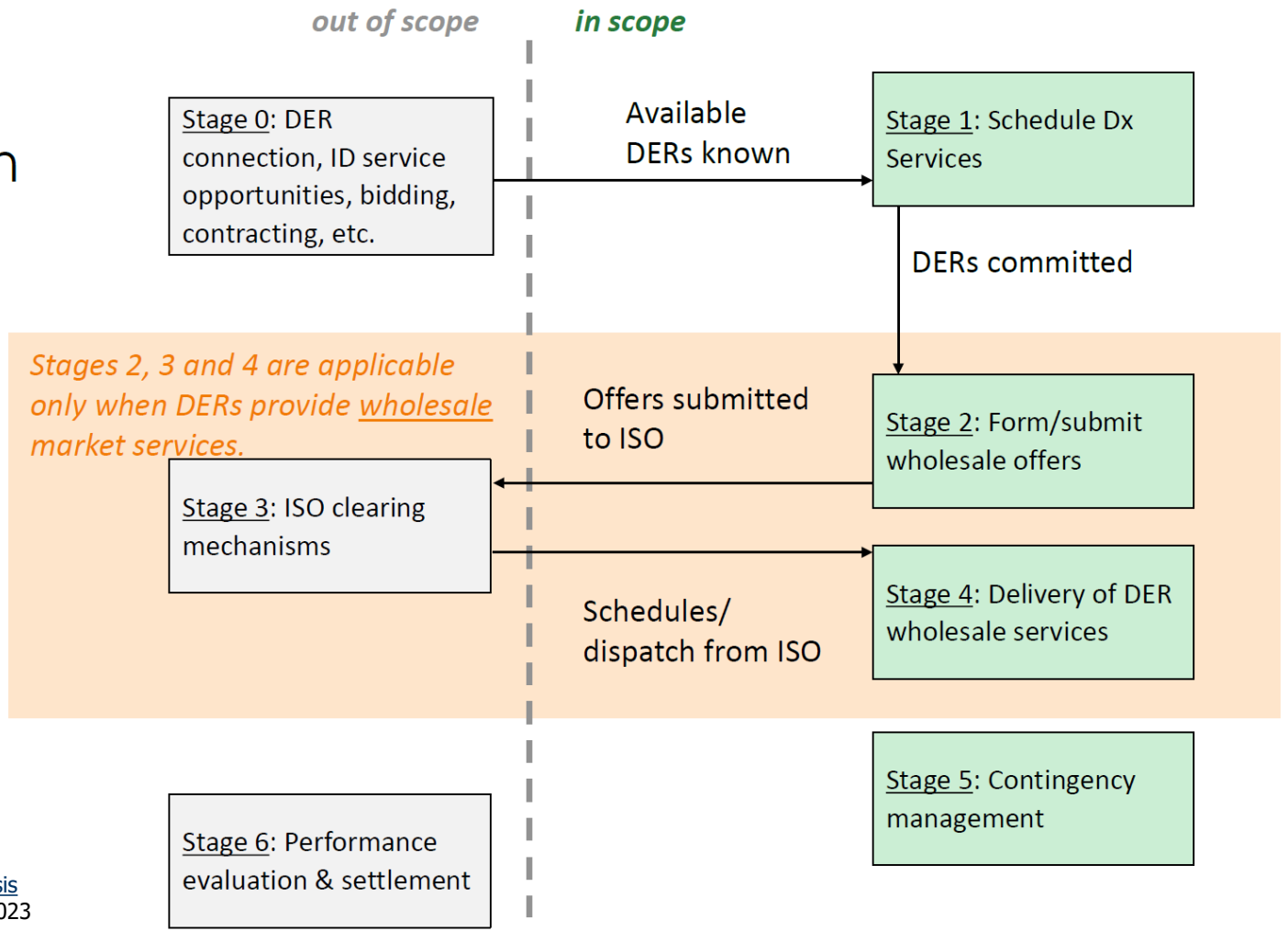


Framework adapted from: De Martini., Kristov, & Taft, Transmission-Distribution-Customer Operational Coordination. U.S. DOE, 2018

Observability into Dispatchable DER at T-D Interface

- As part of demonstration, EPRI developing a study, "Procuring Grid Services from Distributed Energy Resources (DER) - A Scenario-Based Exploratory Analysis"
- Coordination protocols provide the ISO and distributors with advance "visibility" into each other's respective use of DER(A) for services and the expected conditions on the system
- Protocols include distributors' ability to "override" ISO schedules and dispatch of DERs to ensure safety and reliability of the distributions system
- Distribution services "stackable" with wholesale services if distribution services are planned ahead of ISO day-ahead and real-time market processes
- Scheduled distribution services are reflected (e.g., as "price taker") in wholesale market bids/offers by 3rd-party aggregator or DSO, depending on DSO model

Coordination Stages (Apply to Each Scenario)



Source: DER Scenario Modeling and Analysis Project by Stephen Kerr, EPRI, February 2023

IESO's Forecasted and Observable T-D Variables

Observable variables:

- IESO has observability on power at T-D interface and DER participating in the wholesale market
- IESO does not have observability on DER participating in distribution services only and non-dispatchable loads
- IESO requires distributors to notify about material deviations from load forecasts at T-D interface, e.g., due to unplanned contingencies.

Forecasted variables:

- IESO forecasts power demand for non-dispatchable loads at each T-D node using load distribution factors.
- DERs connected downstream of T-D interface that participate in the wholesale market are excluded from the load forecast.
- DERs connected downstream of T-D interface that participate in distribution services only are included in the load forecast.

Impact of Dispatchable DERs on IESO Forecasts

- Material deviations from IESO's load forecasts at T-D interface can impact reliability
- Conclusions from case-based analysis conducted by EPRI for IESO/Alectra:

1. DERs participating in wholesale market: Bidding mechanisms provide sufficient visibility on load demand at T-D interface
2. DERs participating in distribution services only:
    a) Distribution service for normal conditions: IESO's nodal forecast provides sufficient observability
    b) Distribution service for abnormal conditions: Unexpected deviations at T-D interface may occur, requiring DSO notifications if material, which existing coordination processes capture

Developing Forecasting for the T-D Interface

The forecasting approach at the T-D interface depends on the DSO model and needs to consider a number of cases

- DSO model: Hybrid DSO (various), Total DSO, Load Serving Entity (LSE)
- Dispatchability: dispatchable DER, non-dispatchable DER, non-dispatchable load
- Forecast type: day-ahead forecasts and real-time forecasts
- Service provision: distribution service, wholesale service, distribution and wholesale service, none
- Congestion: binding distribution constraints or free-flow distribution power flow
- Condition: normal distribution conditions or abnormal conditions (planned or unplanned)

Thank You

ieso.ca

1.888.448.7777

customer.relations@ieso.ca

engagement@ieso.ca

@IESO_Tweets

linkedin.com/company/IESO

ieso
Connecting Today. Powering Tomorrow.