Alectra/IESO Project

DER Scenarios and Modeling

TDWG
May 16, 2022

Agenda

- Background
- DER Portfolio
- Interoperability Framework Models
- Scenario chart
- Individual Scenario descriptions
  - Transmission Energy Dispatch
  - Distribution Override
  - Distribution Congestion/Non-Wires Alternatives
  - Distribution Operating Reserves
  - Capacity Service

Background

- Alectra and IESO issued a call for modeling and analysis of DER “in the context of Transmission-Distribution (T-D) coordination and the use of DERs as Non-Wires Alternatives (NWAs)”.
- York region
- Assess whether dispatchable DERs actively managed at local level can be operated reliably as NWA
- Investigate distribution impact of DER (losses, network switching, contingencies at T-D interface)
- Examine bi-level participation
  - DERs not needed for local needs could be available for bulk system needs
  - DERs needed for local needs could simultaneously meet bulk system needs

Portfolio of Available DER Types

Utility-scale battery storage

C&I BTM battery storage

Residential-scale aggregated BTM battery storage

Aggregated residential smart thermostats

C&I BTM natural gas engines

Distribution utility-connected natural gas engine

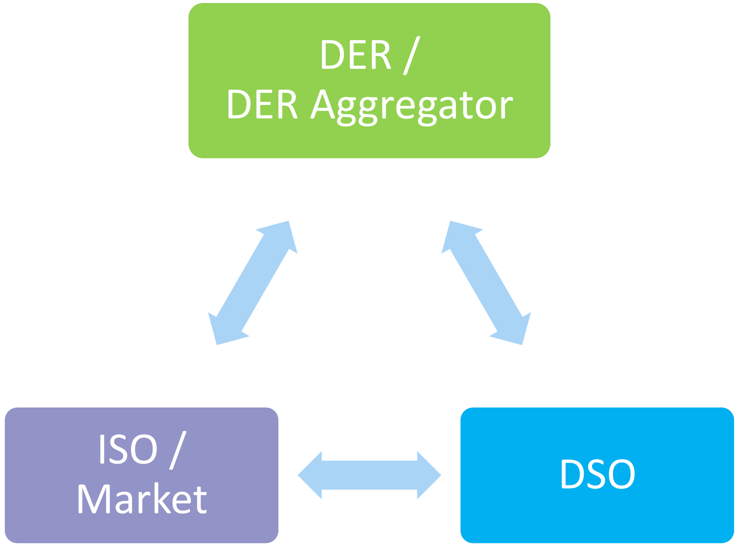
Load curtailment of commercial/industrial load

C&I = commercial & industrial
BTM = behind the meter

Interoperability Framework Models

Two Exploratory Coordination Models

- **Total DSO**
  - Procure and dispatch DERs for distribution needs
  - DSO coordinates all DER market services with ISO
    - >> DER as a single aggregated resource at T-D interface



- **Dual Participation**
  - DSO procures and dispatches DERs for distribution needs
  - DER or DERA directly participates in wholesale market
  - DSO coordinates in case of schedule override

Table of Scenarios and Targeted Services

RFP Scenarios		DER-Provided Services					
		Wholesale Domain			*Distribution Domain*		
		Energy	Capacity	Reserve	Capacity deferral	Reserve	**Value Stacking**
"Transmission Energy Dispatch"	1	●					
"Distribution Override"	2	●					
"Distribution Import-Congestion"	3a				●		
	3b	●			●		●
"Distribution Operating Reserves"	4a					●	
	4b			●		●	●
"Capacity Service"	5		●		●		●

Scenarios

Transmission Energy Dispatch

Scenario 1 – Transmission Energy Dispatch

- Investigate the participation of DERs in the wholesale energy market.
- No distribution congestion considered.

- Relevant "Table 1" domains included
  - Wholesale energy service
  - No distribution domain services

Table 1. Summary of grid services considered in RFP scenarios.

		DER-Provided Services					
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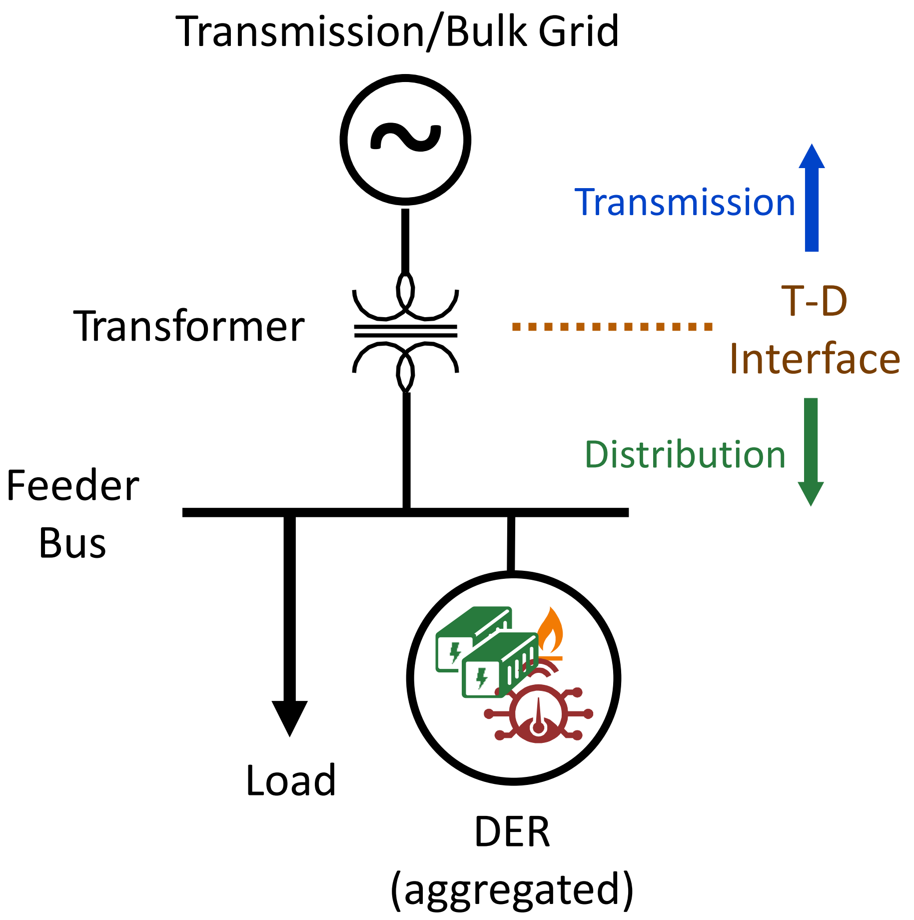
Scenario 1 – Transmission Energy Dispatch

- Evaluate the impact of the participation of DERs in the wholesale energy market on the T-D interface (including losses).
- Emulate setpoints ISO would send to DERs connected to distribution grid



Scenario 1 – Transmission Energy Dispatch

- Investigate the process by which the DSO and DERs intending to participate in the wholesale energy market can submit offers.
- Price quantity pairs, capture the capabilities and costs of DERs.
- Full capability of the participating DERs included
  - Aggregated cost and operating parameters
  - May reflect incremental/avoided distribution losses and capability at the T/D interface.
- T-D communication and data exchanges with DERs evaluated
  - Both interoperability models
  - Submit wholesale energy market offers
  - Receive dispatch instructions
  - Operate reliably

Distribution Override

Scenario 2 – Distribution Override

- Investigates the participation of DERs in the wholesale energy market, this time considering possible distribution congestion.

- Relevant "Table 1" domains included
  - Wholesale energy services
  - No distribution domain services, meaning no need for DER to address existing feeder constraints

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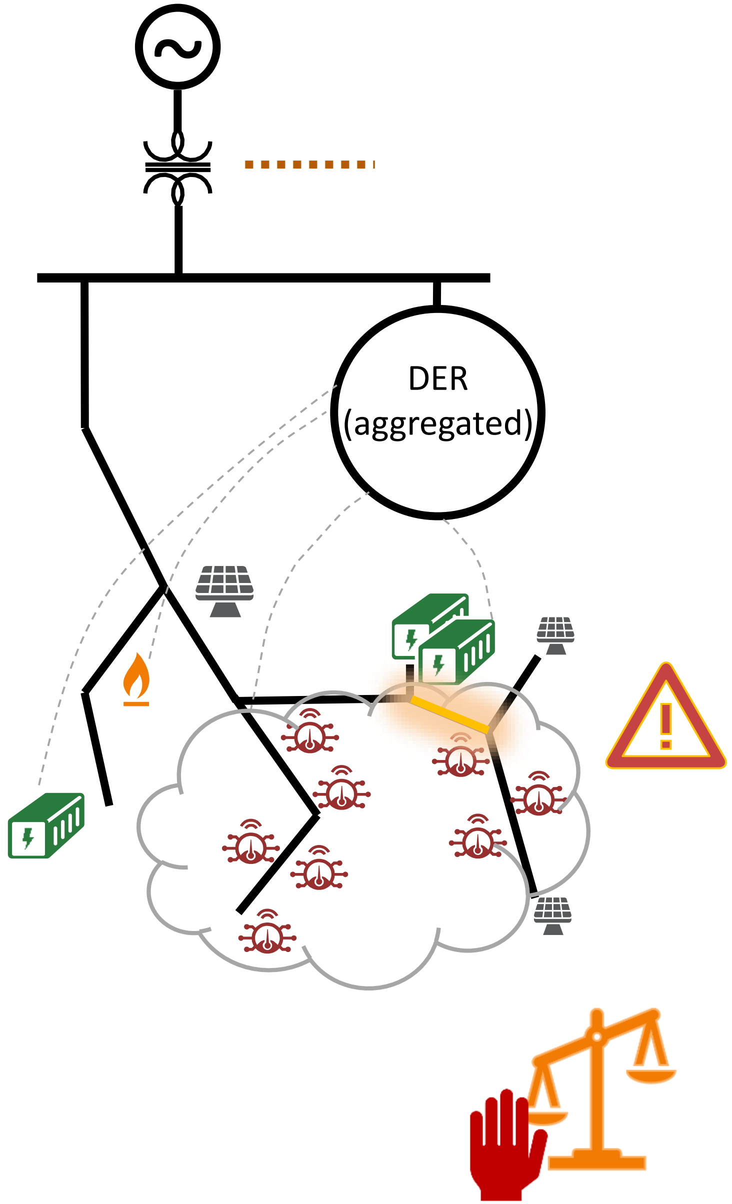
Scenario 2 – Distribution Override

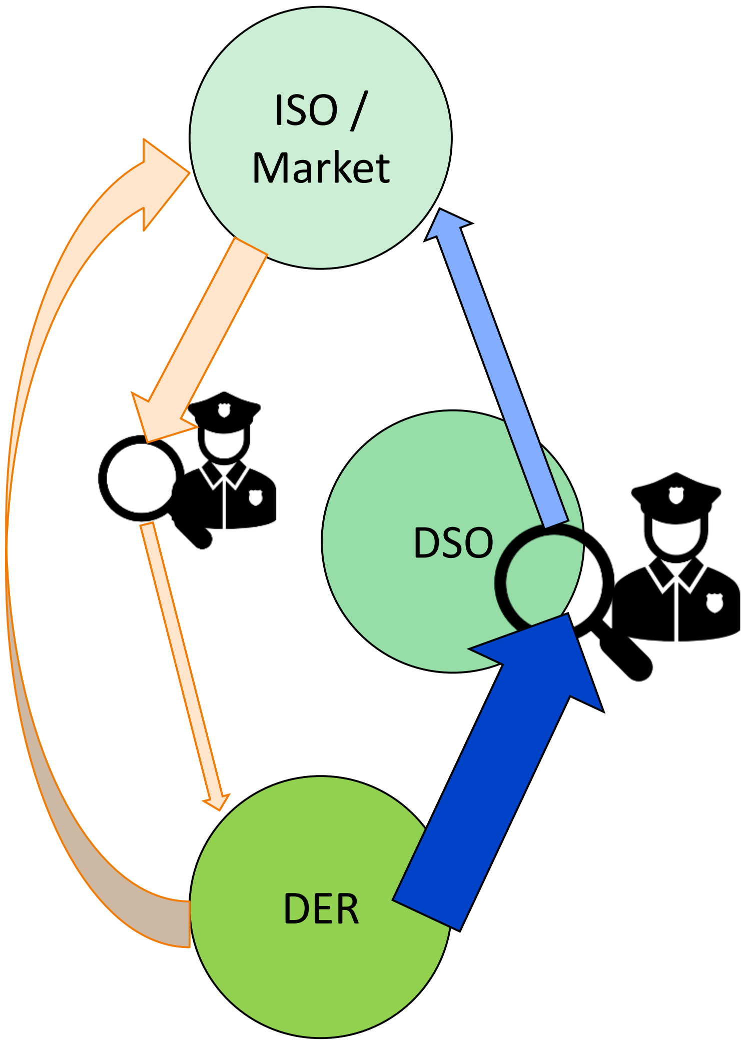
- In addition to the aspects considered in Scenario 1:
  - Evaluate when market dispatch override is needed to avoid any distribution system violations, and
  - Whether normal distribution system operations can be maintained when these overrides are applied.

- Key inputs to this task include
  - Dispatch setpoints emulating energy market awards
  - Scenarios that would potentially lead to override initiation to avoid distribution constraints (e.g., thermal, voltage, etc.).



Scenario 2 – Distribution Override

- Investigate how to integrate override capabilities into the coordination process
  - "Total DSO" model, consider pre-clearing energy bids for distribution congestion prior to submittal
  - "Dual Participation" model, post-award analysis may be required to override market signals potentially creating distribution congestion.
  - Process and financial impacts will depend on the horizon of the override
- The market offer analysis will need to include
  - Where throughout the process the DSO override could occur
  - How / when DER offers could be modified to reflect the DSO override and reduced capability to provide to the market
  - Potential out of market activities needed to reflect the DSO override.
- Override factor clarity and transparency needed for DER providers to understand - overrides may affect market revenues.
- Inform location of DERs and aggregate DERs to where congestion or other potential constraints is less likely to happen.



Distribution Import-Congestion / Non-Wires Alternatives

Scenario 3 – Distribution Import-Congestion (“Distribution Non-Wires Alternatives”)

- Scenario 3a - DERs provide distribution capacity to defer conventional distribution upgrades
- Scenario 3b - value stacking where DERs also participate in the wholesale energy market.

- Relevant “Table 1” domains included
  - Wholesale energy services
  - Distribution capacity deferral
    - Plus value stacking

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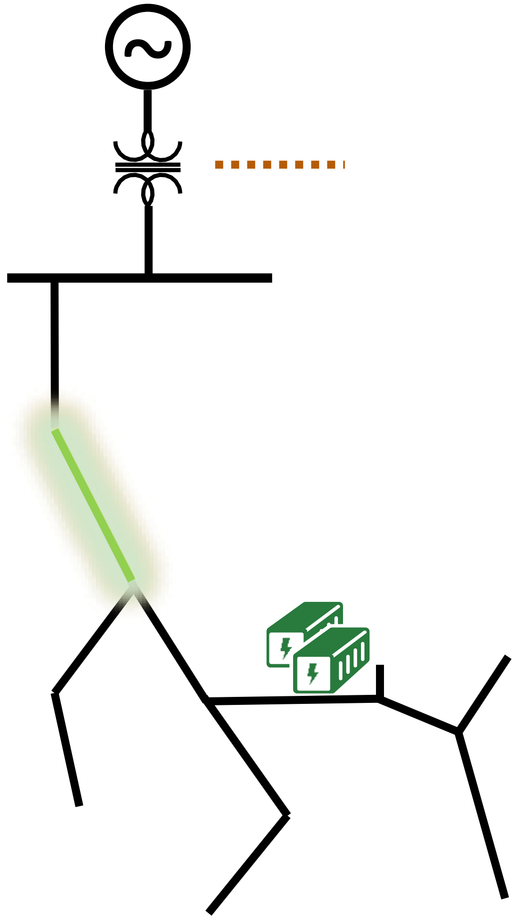
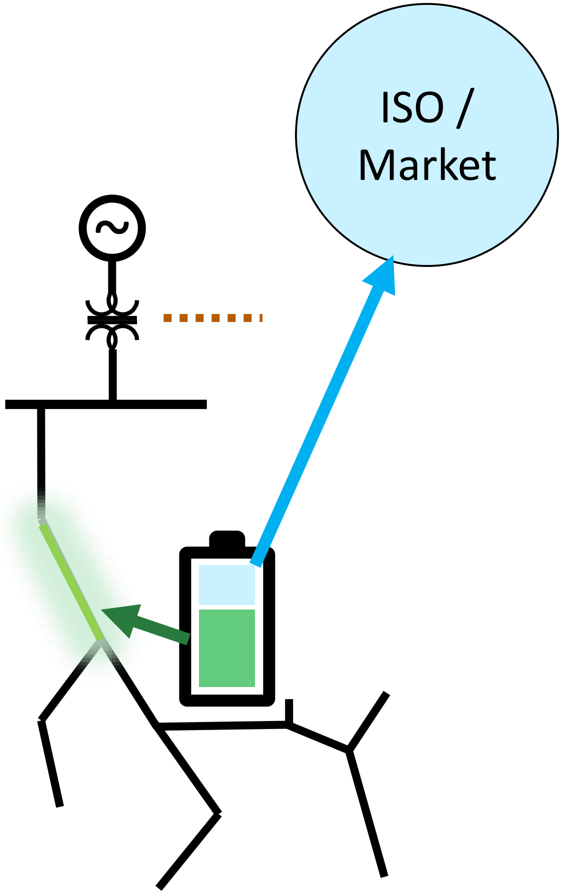
Scenario 3 – Distribution Import-Congestion ("Distribution Non-Wires Alternatives")

- Evaluate whether DERs providing distribution capacity can
  - Avoid conventional upgrades while maintaining normal system operations
  - Provide wholesale energy services to enable additional revenue streams.
- Key inputs
  - Binding distribution constraints serve as dispatch signal for DER(s) providing capacity (Scenarios 3a and 3b)
  - Dispatch setpoints emulating energy market awards are also considered for the value stacking case (3b).
- In both Scenarios 3a and 3b, <u>DERs entirely dedicated to the wholesale energy market participation are included</u>.



Scenario 3 – Distribution Import-Congestion ("Distribution Non-Wires Alternatives")

- Investigate how DERs providing distribution capacity may reflect
  - Distribution service obligations in the wholesale market offers, and
  - Participation in markets (with possible variations based on the coordination model considered).
  - Self-scheduling when applicable
- May utilize minimum generation limits, to reflect distribution service obligation, but also enable additional energy provision when needed.
- Also, consider service compatibility and offer format specifics for DERs which provide capacity deferral and wholesale energy (3b). <u>Ensure double counting is prohibited.</u>
- Relevant industry example: New York's dual participation mechanism - distribution service providers reflect services through self-schedule or a change in operating limits with the ISO/RTO.



Operating Reserves

Scenario 4a and 4b – Distribution Operating Reserves

- Investigate the use of DER-provided local “operating reserves” for distribution system contingencies.
  - 4a: Distribution contingency applications
  - 4b: Distribution reserve and bulk system operating reserve

- Relevant “Table 1” domains included
  - Wholesale operating reserve service
  - Distribution reserve service
    - Plus value stacking

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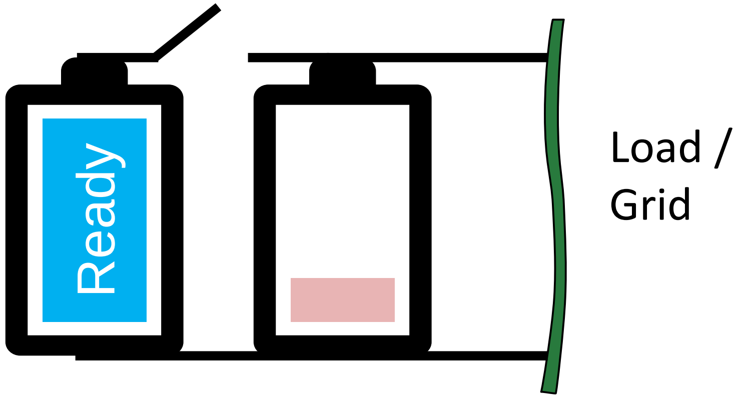
Scenario 4a and 4b – Distribution Operating Reserves

- Distribution simulations in Scenario 4a examine whether DERs providing local reserve can address a default of one or several DERs providing capacity deferral by maintaining normal distribution operating conditions.
- Key inputs include
  - Pre-contingency state, the binding distribution constraints addressed by DERs contracted to provide capacity deferral (similar to Scenarios 3a and 3b)
  - Post-contingency state, the congestions created by the DERs defaulting on their obligations, which determine the setpoints sent to the DERs providing local reserves.
- In Scenario 4b, inputs would also include the dispatch setpoints emulating the market signals activating the local reserve capabilities to address bulk power needs.



Scenario 4a and 4b – Distribution Operating Reserves

Market Offer and Coordination Analysis

- Address possible offer formats and bidding mechanisms enabling DERs providing reserves for distribution applications to also pursue reserve products in the wholesale market.
- Consider an n-1 security constrained economic dispatch
  - Wholesale operating reserves are primarily based on generator or tie-line contingencies rather than transmission contingencies.
  - Wholesale reserve markets will price reserve based on lost opportunity costs of other wholesale services, meaning the offers may need to reflect anticipated opportunity cost from distribution services.
- Because the ISO has little visibility of when a distribution outage may occur, additional coordination needs and offer adjustment may be required between T-D to ensure any activation of distribution system operating reserve does not cause unintended consequence on the bulk power system.
- These type of coordination processes are evaluated for both the Total DSO and Dual Participation scenarios.

Capacity Service

Scenario 5 – Capacity Service

- Extension of Scenario 3a, where DERs providing distribution capacity also pursue capacity products in (supply capacity to) the wholesale market.

- Relevant "Table 1" domains included
  - Wholesale capacity deferral/service
  - Distribution capacity deferral
    - Plus value stacking

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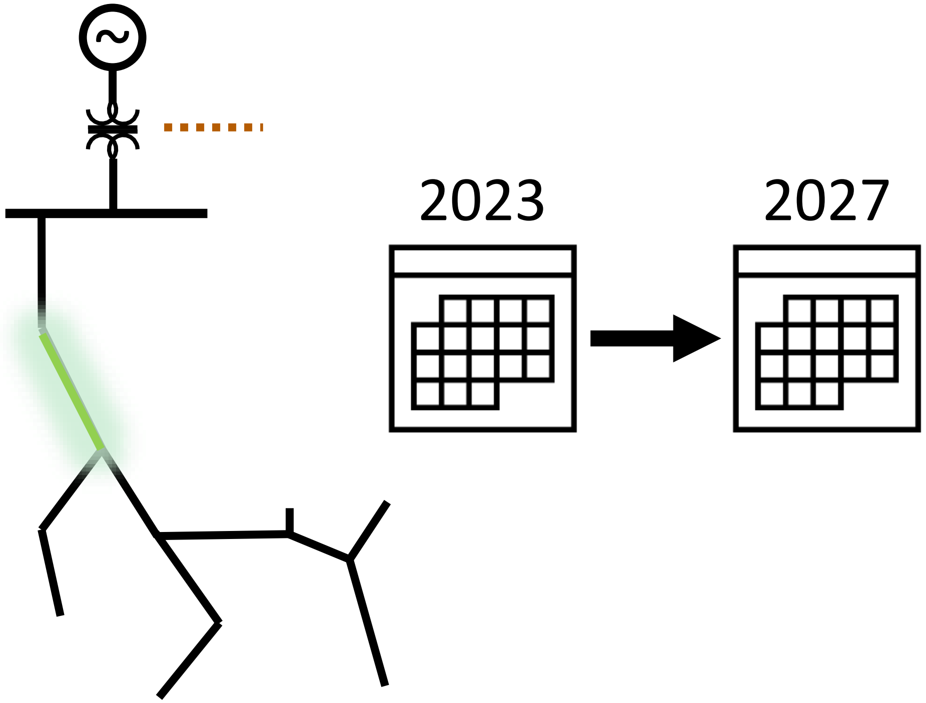
Scenario 5 – Capacity Service

- Evaluate whether DERs providing capacity deferral in the distribution domain can successfully perform the associated service requirements while also delivering capacity to the wholesale market (e.g., during peak hours).



Scenario 5 – Capacity Service

Market Offer and Coordination Analysis

- Investigate how DERs providing Non-Wires Alternatives to the DSO should be submitting offers to the Capacity Auction, for both coordination models.

- Resources selling in the capacity auction often have energy market "must-offer" rules that will impact the way that a DSO or DER may offer into the energy and operating reserve markets.

- Further, this scenario considers the impact of three Load Serving Entity (LSE) structures: private LSEs, DSO as LSE for its load customers, and Transmission System Operator (TSO) as LSE for all load customers.

Summary / Questions

DER Scenario Modeling and Analysis

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Questions?

- Do the scenarios and methodology outlined for the DER Scenarios & Modelling Study make sense?
- Any suggestions?


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