WHEN TRUST MATTERS

Considerations for Establishing DSO Capabilities in Ontario

Final Report

Symposium Presentation

23 June 2025

Welcome and introductions

Introductions

Project overview

Project findings & path forward

Discussion

- We will have 15 minutes at the end of the presentation for questions.


DNV

CONSIDERATIONS FOR ESTABLISHING DSO CAPABILITIES IN ONTARIO

Final Report

Ontario Energy Board

Date: April 10, 2025

DNV

1 Executive Summary

On behalf of the Ontario Energy Board (OEB), DNV investigated the potential introduction of Distribution System Operator (DSO) capabilities into the Ontario energy sector. DSOs[1] can play a critical role in grid management by steering electricity distribution through the network, including through the flexible deployment of Distributed Energy Resources (DERs) such as solar panels, wind turbines, and battery storage systems.

A number of Local Distribution Companies (LDCs) and entities in Ontario have studied DSO functionality to determine the possible benefits and costs of different DSO models. The current role of an LDC, also referred to as a distribution network operator (DNO), focuses on efficient ownership and operation of (the assets forming) its distribution network. DNV's initiative examines the scope, roles, requirements, and value proposition of implementing different DSO models in Ontario, enabling the OEB to evaluate and compare the viability and appeal of alternative DSO approaches for establishing DSO functionality. This includes the potential development of competitive marketplaces for buying (by DSOs and the IESO) and selling (by aggregators and operators of DERs) flexibility services.

This initiative considers a range of challenges and opportunities when designing and implementing a DSO model into an established energy sector. The following sections of the Executive Summary discuss what the initiative sought to understand for the Ontario energy sector, how we developed those considerations, and our main findings. Subsequent chapters describe the approach for each investigation in more detail as well as the outcomes.

1.1 Objectives

DNV and the OEB established the following objectives and associated research questions (Table 1-1) to guide our work.

[1] While there is no single definition, a DSO can be described as an entity with advanced capabilities to integrate, manage and optimize DERs for distribution and wholesale market services. DSOs actively manage distribution systems with high levels of DER penetration. They perform these functions with capabilities that can be considered incremental to those already undertaken by distributors. A DSO can serve multiple distributors, potentially having more opportunities to optimize DER flexibility.

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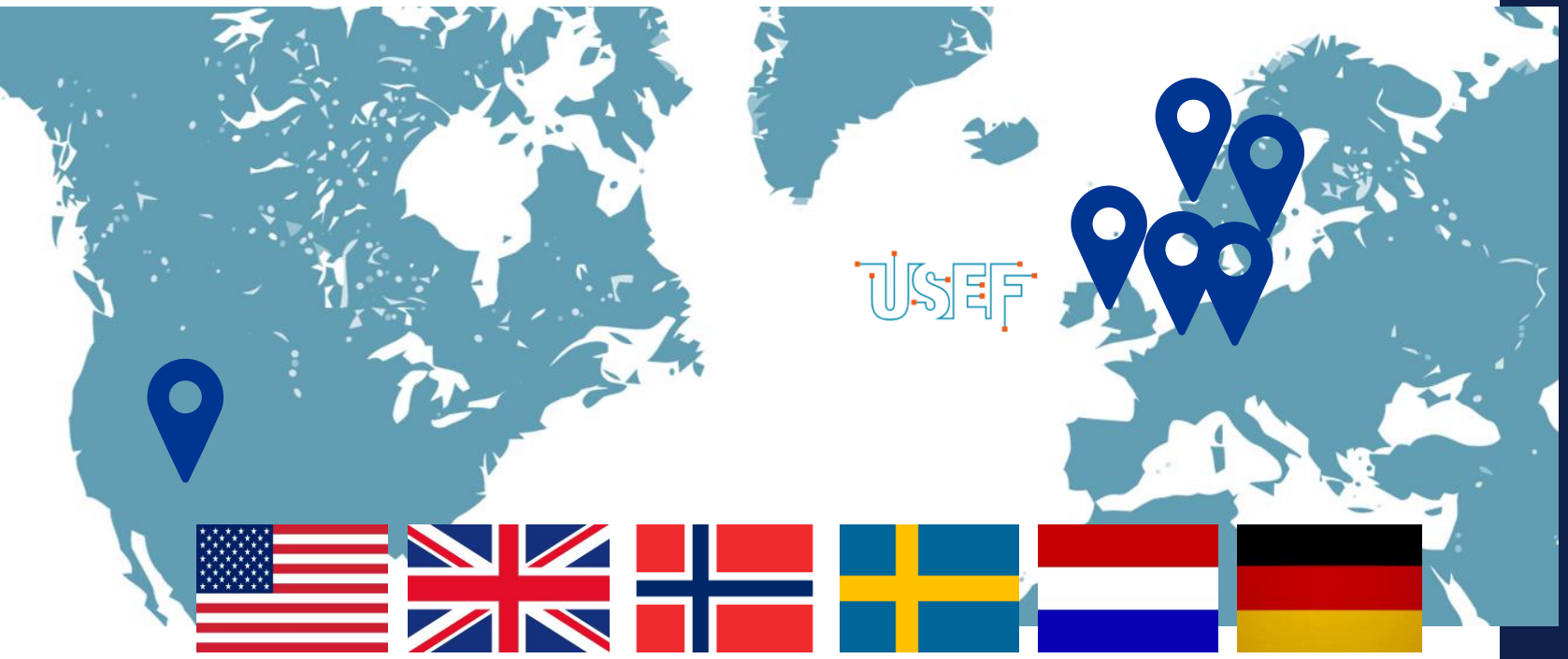
Pioneers in DSO

DNV experts have led the development of flexibility mechanisms, markets and DSO functions and processes in northwest Europe. These jurisdictions now offer a blueprint for DSO implementation in North America and Asia.



Rafiek Versmissen

Head of DNV Energy Strategy Advisory (UK)

Over 20 years of expertise as an advisor in the energy sector, with a focus on economic, financial, regulatory and strategic advice to utilities and investors.

Expert: Universal Smart Energy Framework (USEF)

Chair: Energy UK Flexibility Working Group

Lead: Development of GB DSO Roadmap

Project Objective

The **project objective** investigates the challenges and opportunities when designing and implementing a DSO model into the Ontario energy sector.

	Approach	Sub-Objectives
1	**Design Features Framework**	Develop a common set of design features and considerations that define a DSO's structure, processes, and activities.
2	**Jurisdictional Review**	Understand the international DSO landscape through use cases for the creation, variation in structure, regulatory environment, maturity, themes, and outliers.
3	**Archetypical Model Development**	Investigate and compare the implications of DSO implementation in Ontario using archetypical models.
4	**Archetypical Model Build-Out**	Identify roles, actors, functions, products, and services for the four archetypical models to understand key differences.
5	**Archetypical Model Assessment**	Understand current use case of DSO value and market signposts/indicators for unlocking value in the Ontario context.
		Understand the cost, benefits, risks, opportunities of each archetypical DSO model.

Findings

Design Feature Framework

1. Business separation

The degree of separation between DNO and DSO to insulate against conflicts of interest, potential abuse of market positions, or excessive monopoly infrastructure.

2. Functional separation

The degree to which various DSO activities are separated from DNO functions, including market facilitation, preventing market distortions, and safeguarding against bias towards capital investment.

3. Hierarchy

The structure of the different layers in which a DSO can operate.

4. Ownership of flexible resources

The variations of ownership of flexible resources and their access to markets.

5. Flexibility mechanisms

Various mechanisms for accessing and securing flexibility, ranging from market-based mechanisms to regulated (bilateral) services.

6. Flexibility market procurement and dispatch

The responsible party for procurement and dispatch of services for regional and provincial needs, and the market facilitator.

7. System coordination and operation

The variations of entities with operational responsibility for the local networks and the distribution system, including coordination between DSO and the IESO control rooms and emergency restoration services from DERs.

8. Network design & development

The variations in DSO's role in long-term distribution network design and development.

Jurisdictional Insights

1

Introducing

- Complexity of introducing DSO functionality
- Market development takes time, effort, and cost

2

Structuring

- Market-based solutions can provide long-term benefits
- Customer confidence is critical
- Functional separation builds confidence
- DNOs are diverse

3

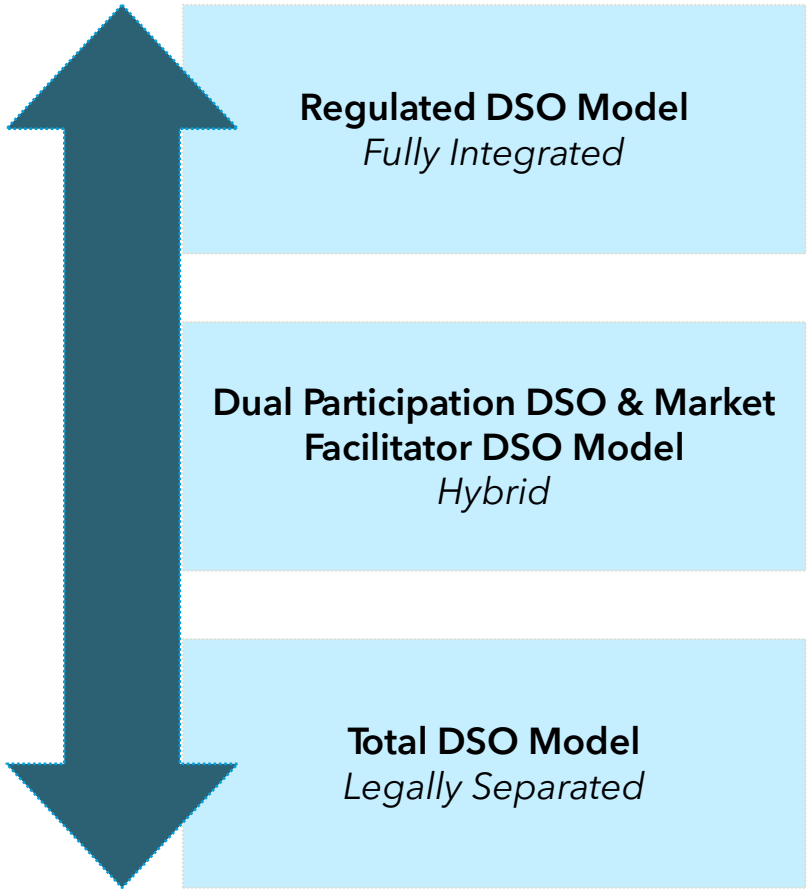
Evolving

- DSO responsibilities can be changed over time
- DSO models can evolve with market conditions

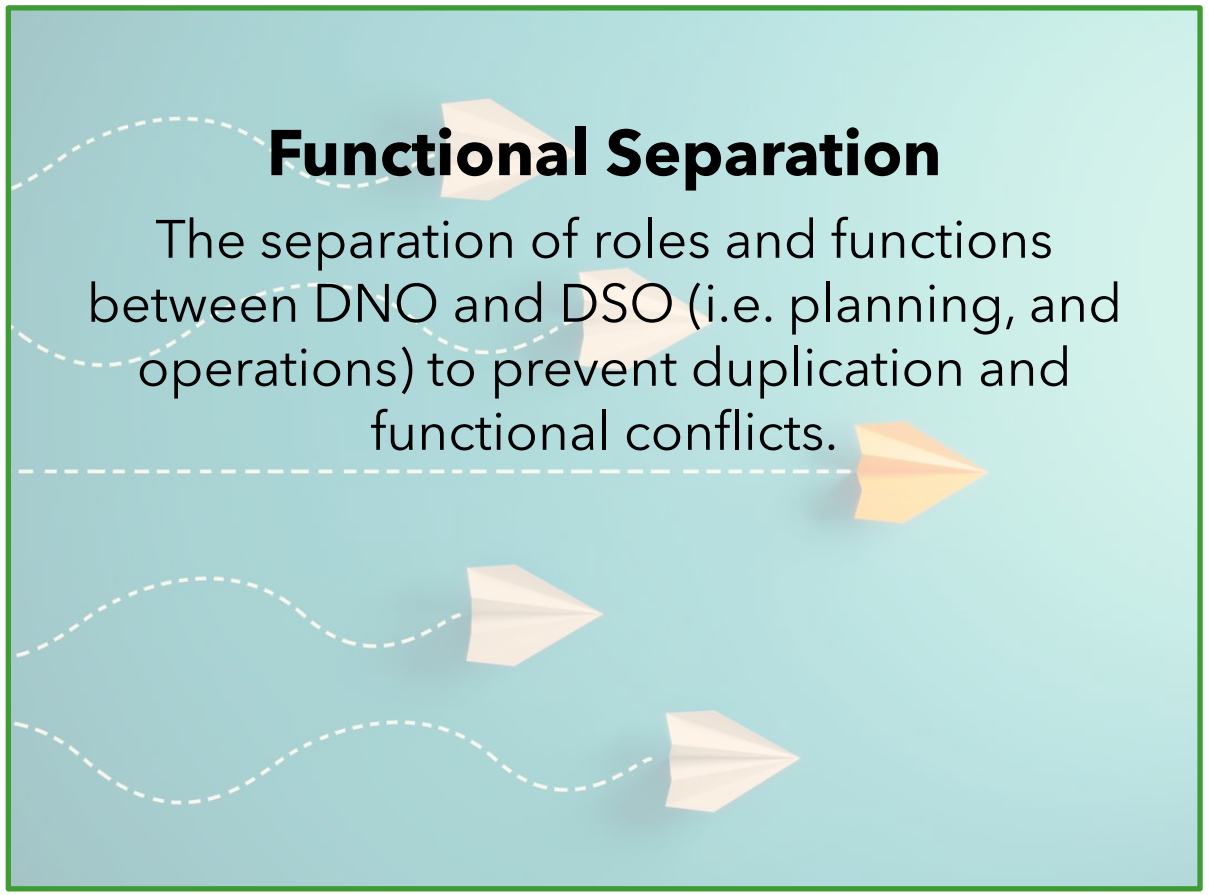
Model Builds & Structural Differences

	Regulated DSO Model	Dual Participation DSO (DP-DSO) Model	Market Facilitator (MF-DSO) Model	Total DSO (TDSO) Model
Synopsis	▪ DNO and DSO functions remain integrated (status quo; acts as baseline model) ▪ Augmentation of DSO functions by applying rule-based mechanisms that may better fit the horizontal integration of DNO-DSO functions ▪ No flexibility markets	▪ Separates the DNO and DSO functions within the same organisation ▪ Limits DSO's network planning responsibilities ▪ Market-based approach to DER compensation	▪ Separates the DNO and DSO functions within the same organisation ▪ No limits on DSO's network planning responsibilities ▪ Market-based approach to DER compensation ▪ DSO acts as a facilitator of flexibility at both Dx and Tx	▪ Separates the DNO and DSO functions and businesses ▪ Wider DSO responsibilities compared to DP-DSO ▪ Market-based approach to DER compensation
DSO-IESO Relation	▪ The DSO directly procures congestion management services through mandatory bilateral contracts and manages distribution network congestion. ▪ The IESO handles transmission network congestion.	▪ The DSO manages services to the distribution system and the IESO manages wholesale market services. ▪ DERs participate in wholesale markets directly or via aggregators.	▪ The DSO acts as a non-commercial aggregator, optimises the distribution network, and coordinates with the IESO for wholesale market services.	▪ The DSO operates distribution-level markets with DERs directly participating. ▪ For (IESO) wholesale market services, the DSO acts as a commercial aggregator. ▪ DERs participate through the DSO.

Structural Model Differences



Structural Model Differences



Regulated DSO Model
Narrow: DNO fully responsible planning and operational responsibilities

Dual Participation DSO Model
Wide: Shared DNO-DSO responsibility

Market Facilitator & Total DSO Model
Widest: DSO planning and operational responsibilities

Structural Model Differences

Regulated DSO Model
Active Network Management and rule-based mechanism (regulated cost-based)

Dual Participation DSO Model, Market Facilitator & Total DSO Model
A combination of market-based mechanisms, bilateral agreements, and Active Network Management

Flexibility mechanisms

Various mechanisms for accessing and securing flexibility, ranging from market-based mechanisms to regulated (bilateral) services.

Flexibility market procurement and dispatch

The responsible party for procurement and dispatch of services for regional and provincial needs, and the market facilitator.

Regulated DSO Model
No flexibility market in place.

Dual Participation DSO
DSO-IESO coordination for procuring DERs from 3rd parties for transmission congestion and balancing, as well as distribution congestion.

Market Facilitator
The DSO acts as a market facilitator for procuring services for its local area.

Total DSO Model
The DSO takes greater responsibility and can provide services to wholesale market as an aggregator.

DSO Drivers in Ontario

Validated

Use case	Detail	Fortis Ontario	Alectra	Toronto Hydro	Hydro One
Non-Wire Alternative	Utilities can defer or avoid the high costs associated with building/reinforcing network infrastructure by using DER flexibility	●	●	●	●
Congestion Management	Utilities can use DERs to manage local congestion on the network and connect more DERs while reducing the curtailment of DERs	●	●	●	●
Operational efficiency	Utilities can deploy smart grid technologies, providing real-time visibility and control over the network, and enabling active network management (ANM) solutions to unlock operational efficiencies.	●	●	●	●
Energy security of supply	As Canada transitions to Net Zero, the volume of DERs connecting to distribution networks is increasing while traditional generation assets are phasing out. DERs can provide flexibility services needed to operate a future-proof, carbon neutral system.	●	●	●	●
Balancing generation and demand/reducing peak load	DERs are used to balance supply and demand, providing additional power, reducing the need for expensive and additional power during peak periods.	●	●	●	●
Decarbonisation and compliance with regulation	Utilities' commitment to achieve net-zero emissions. The DSO model is suited to manage the complexities of integrating DERs into the grid	●	●	●	●

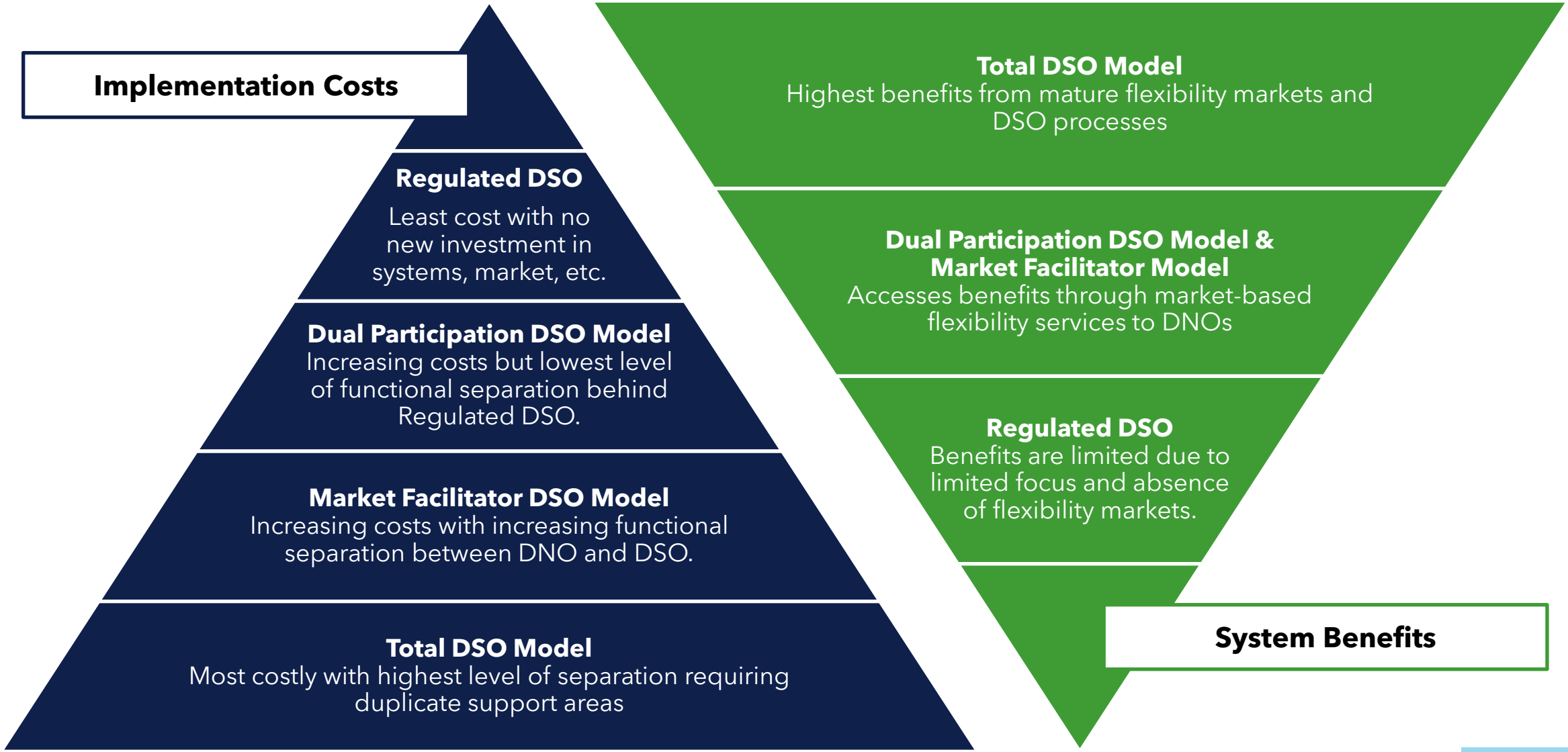
● Not explicitly discussed or supported during the interview (note: this does not mean that the LDC does not support the use case more generally).

● Implicitly supported during the interview based on DNV's interpretation of discussion

● Explicitly supported during the interview

DNV

System Cost and Benefit Analysis



Path Forward

Lay the Groundwork

1 **Evidence for DSO need**
There is qualitative evidence to support some DSO use cases in Ontario.

Obtain quantitative evidence through the following activities.

2 **Monitor key system indicators**
(1) the emergence of DSO use cases
(2) the (timely) development of DSO capabilities and functionality
(3) considerations for (timely) establishment of reliable, liquid markets for flexibility services.

3 **Act on "low regret activities"**
Even in the absence of a more quantitative assessment, developing the core functionality and capabilities to forecast, manage, and deploy DERs has little downside.

4 **Develop strategy & test bed**
Use the insights from our model comparison to consider additional strategies. The Regulated DSO Model has comparatively low cost and might provide a safe test bed for a flexibility mechanism, even if, over the long-term, the benefits it can deliver are limited.

Best Practice
The collective implementation of a common DSO model can maximise the benefits of DSO by facilitating maximum routes to market for DER flexibility and building the supply side confidence that encourages investments in flexibility.

Lay the Groundwork

Even amid an evolving market and a range of dynamic variables, the OEB can prepare for DSO now without prematurely overcommitting or overinvesting.

Setting long-term goals, remaining flexible in the pursuit of those goals, testing strategies within the existing framework, and investing in low regret activities that support several potential futures can all balance the dueling needs of DSO development: preparation and patience.

Q&A

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Thank you!

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