ONTARIO ENERGY BOARD

May 2025

Discussion Paper

Distribution System Operator Capabilities

EB-2025-0060

Ontario

Ontario Energy Board

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Distributed energy resources (DERs) will continue to have an important role in realizing Ontario's energy vision. DERs – distribution-connected generation, storage and controllable loads – create new ways for entities to provide services to the electricity system and for consumers to exercise customer choice. The adoption of greater Distribution System Operator (DSO) capabilities in Ontario is expected to help the electricity sector unlock greater value from DERs and their aggregations (collectively DER/As) at the wholesale, distribution and customer levels.

Purpose and Background

The Ontario Energy Board (OEB) is consulting with the sector on steps it can take to facilitate the efficient adoption of DSO capabilities in Ontario. This work is informed by:

- **Expert Advice**: Advice provided by the OEB's consultant, DNV Energy Insights (DNV), including DSO model design and the costs and benefits of DSO models.
- **Recent and Ongoing OEB Initiatives**: Initiatives at the OEB, including those facilitating distributor use of DERs as non-wires solutions to more cost-effectively meet system needs.
- **Independent Electricity System Operator's Transmission & Distribution Coordination Working Group (IESO TDWG)**: Work of the IESO and stakeholders in the TDWG.
- **Pilots**: Insights from pilot projects related to DSO capabilities.

> In his 2024 Letter of Direction to the OEB, the now Minister of Energy and Mines requested that the OEB, in coordination with the IESO and Ministry, "develop and assess local and market opportunities for DER, including through alternative energy business models (e.g., Distribution System Operator capabilities)" as well as "… examine the regulatory landscape including identifying specific legislative and regulatory changes that may be required to enable future potential utility business models."

DSO Concepts

Interest in DSO capabilities is driven by three benefits. DSO capabilities:

- **Further facilitate the use of DERs as non-wires solutions**, by equipping distributors with tools to meet system or reliability needs using DERs, where such approaches are more favourable than conventional poles-and-wires solutions.
- **Increase DER hosting capacity**, which would allow more DERs to connect to the distribution system without triggering costly infrastructure upgrades.
- **Expand DER compensation mechanisms**, which would allow the electricity sector to take advantage of program- and market-based approaches to

compensating DER/As for a greater portion of the value they provide to customers and the electricity system.

DSO capabilities and associated grid modernization investments span the range of activities undertaken by distributors in the electricity sector today, and in some cases represent new functions. They include:

1. **Distribution planning and network development**, including identifying needs, planning non-wires and conventional solutions, and building systems accordingly.
2. **Distribution network operations**, including monitoring and active management of the distribution system.
3. **Distribution program and market development**, including establishing the framework for administering programs or markets.
4. **Distribution program and market operation**, including administering programs and markets to procure services from DER/As.
5. **Distribution connections provision**, including establishing the framework for offering flexible and firm connections to DERs.

DSO Models

DSO models are the possible frameworks that set out the roles, responsibilities, relationships and conduct of actors in the electricity distribution sector. DSO models can be defined using three primary design features:

- **DER/A Wholesale Market Participation Pathway**: The role of the DSO in enabling DER/A participation in the wholesale electricity market can vary across DSO models. This was the primary design feature used to distinguish DSO models in the IESO's TDWG. Options include the DSO taking no direct role (Dual Participation); facilitating market bids/offers and other communications for DER/A participation (Market Facilitator); and serving as a commercial aggregator for DER/A participation (Total DSO).
- **Degree of Separation**: DSO models can vary in the degree to which DSO functions are separated from conventional functions undertaken by electricity distributors today. Options include having no separation (with all DSO functions integrated within today's distributors); functional separation (with separate departments residing in one entity); legal separation (with DSO and conventional functions housed in separate legal entities); and ownership separation (where the DSO and distributor do not share a common owner).
- **Distribution Activation Mechanism**: DSO models can vary in the way in which DER/As are activated or curtailed. Options include rule-based (with dynamic operating limits communicated to DERs in real-time); program-based (where DER/As are compensated based on pre-established methods

or values); and market-based approaches (where DER/As are compensated through local flexibility markets).

Regulatory Considerations

OEB staff conducted an analysis of regulatory considerations associated with DSO model development for Ontario. Its assessment includes an illustration of how to evaluate whether a novel activity constitutes a distribution activity under the *Ontario Energy Board Act, 1998* (the OEB Act). This analysis was used to develop OEB staff's view on potential legislative amendments that may be required to facilitate DSO adoption in Ontario.

In OEB staff's view, key questions related to whether the existing regulatory framework permits the evolution of particular DSO models turn on the nature of the purposes behind new DSO capabilities. With few exceptions, distributors can only engage in activities where distribution is the driving purpose.

The main conclusions of this regulatory analysis are summarized in Table 1 below. Based on this analysis, OEB staff is of the view that legislative changes would likely be required if Ontario were to:

- Implement a Total DSO model, where an electricity distributor, as DSO, would adopt a commercial position with respect to the aggregation of DERs for participation in the wholesale market.
- Require a separate entity to serve as a DSO, distinct from today's electricity distributor; in such a case, a new regulatory regime would likely be required to provide oversight of this new class of entities.

The need for legislative change does not preclude the consideration of a design option in this consultation.

Expert Analysis

DNV undertook the following activities to support the OEB's consideration of appropriate ways to facilitate DSO adoption in Ontario:

- Completed a jurisdictional scan.
- Completed a high-level qualitative assessment of opportunities that can be unlocked through DSO capability adoption in Ontario.
- Developed four analytical models to assess the costs and benefits of design choices with respect to DSO models for Ontario.

Based on its analysis, DNV highlighted the following takeaways:

- There have been challenges in European jurisdictions where market-based approaches have seen limited success, primarily due to low customer interest.

- The rationale for DSO capabilities would depend on system characteristics and DER penetration levels within a given area, both of which vary across the province.
- There are low-regret steps that Ontario can take to facilitate DSO capability adoption and provide a foundation for more advanced DSO models to evolve as DER penetration levels increase.

Proposal

OEB staff proposes a graduated approach to facilitating the adoption of DSO capabilities in Ontario, beginning with DSO model design choices that reflect the existing regulatory framework, anticipated system conditions and foreseeable DER penetration levels. This approach will also allow for development of more advanced DSO models that become of greater value as the electricity sector attracts DERs and matures in its use of DER/As to meet needs at the wholesale, distribution and customer levels.

OEB staff proposes to work with the sector on these three next steps:

- **Mandatory and Standardized Assessment Methods**: This work will establish standardized tools for distributors to assess the need for certain grid modernization investments and DSO capabilities to address system needs. The results of the assessment would support distributors in bringing forward proposals for grid modernization investments in their rate applications.
- **Simplified DSO Model Development**: This work will develop a simplified DSO model suitable for most circumstances expected in the near term. This model will include supporting rules, requirements and guidance on cost recovery and cost responsibility. This model would not seek to alter the roles of distributors and aggregators with respect to the operation of the wholesale market. Under the simplified DSO model, DER/As would continue to directly participate in the wholesale market. At the same time, DER/As would be activated to provide services to the distribution system through programs, rather than markets.
- **Advanced DSO Model Development**: This work will investigate and develop advanced models to address more complex needs as warranted, including the use of local flexibility markets to secure DER/A services. This will also include the exploration of service models where a distributor contracts for DSO services from another entity (DSO-as-a-service).

This approach is expected to facilitate the adoption of DSO capabilities in Ontario and provide clarity with respect to associated grid modernization investments.

Table 1: Summary of Regulatory Analysis of DSO Design Features

Design Feature	Design Option	OEB Staff's View on Permissibility Under the OEB Act
DER/A Wholesale Market Participation Pathway	Dual Participation	No new role for distributor; enabled under current legislative framework (status quo).
	Market Facilitator	Permissible distribution activity, provided facilitation activity is incidental to a primary distribution purpose. Additional clarity via legislative change may be beneficial.
	Total DSO	Would require legislative change to enable a distributor to actively participate in wholesale market.
Degree of Separation Between DSO and Distributor	No Separation	Permissible.
	Functional Separation	Permissible.
	Legal Separation	Would likely require legislative change and new licensing regime for an independent DSO; Affiliate Relationships Code would apply.
	Ownership Separation	Would likely require legislative change and new licensing regime for an independent DSO.
Distribution Activation Mechanism	Rule-Based	Permissible distribution activity.
	Program-Based	Permissible distribution activity.
	Market-Based	Permissible distribution activity.

1 INTRODUCTION

The energy transition underway in Ontario and elsewhere has extensive implications for the provision and regulation of electricity service. The prospect of widespread DER adoption may have significant implications for how the distribution system is used and the potential activities of distributors.

DERs are expected to play an important role in realizing Ontario's clean energy vision. They contribute to safe, reliable and affordable electricity service. DERs can help maximize benefits for consumers, support increasing electrification, enhance energy security and power economic growth. As DERs become more prevalent, new functions, services and pathways are needed to help capture the full potential of DERs.

The now Minister of Energy and Mines, in his December 2024 Letter of Direction, requested that the OEB "develop and assess local and market opportunities for DERs, including through alternative energy business models (e.g., Distribution System Operator capabilities)." The Minister also asked for the OEB to examine the regulatory landscape, including the potential need for legislative or regulatory changes, to enable future utility business models to support Ontario's broader DER strategy.

DSO capabilities refer to advanced functions to integrate, manage and optimize DERs and DER/As to meet system needs. DSO capabilities, enabled through investments in grid modernization, can provide new ways of providing reliable and cost-effective distribution services while also enhancing opportunities for DER/As.

In response to the Minister's direction, the OEB initiated a consultation to define a policy framework and set expectations for electricity distributors regarding the development of DSO capabilities.

The goal of this work is to develop a regulatory policy framework that enables the implementation of DSO capabilities in a manner that maximizes opportunities for unlocking DER value while ensuring that the pace and scope remain aligned with consumer interests and system requirements.

To support this consultation, this Discussion Paper seeks to establish a shared understanding among stakeholders of key DSO concepts, including drivers and opportunities. It also seeks to explore the regulatory issues the OEB must address to ensure that the implementation of DSO capabilities appropriately facilitates innovation, supports economic efficiency in service, delivers value to consumers and protects their interests with regard to price, quality and reliability of service.

A companion report by the OEB's consultant, DNV, investigates the scope, roles, requirements and value proposition surrounding the potential introduction of greater DSO capabilities in the Ontario energy sector. DNV's report sets out to:

- Characterize the international DSO landscape through a jurisdictional scan to inform what is feasible and desirable in the Ontario context.
- Investigate and compare the implications of DSO implementation in Ontario using analytical models. These models were used to help understand how DSOs can be structured through roles, activities, services and products.
- Understand current drivers of DSO value and indicators for unlocking value in the Ontario context.
- Understand the potential introduction of DSO capabilities in Ontario through considerations and comparisons from a strategic perspective (cost, benefits, risks, opportunities).

1.1 Overview of the Discussion Paper Structure

This paper proposes, for stakeholder feedback, an evolutionary strategy for developing DSO capabilities in Ontario. The structure of this paper is designed to progress from a descriptive foundation to an evaluative exploration, culminating in recommendations on how to move forward.

- **Background**

This section defines the opportunity and objectives of the OEB's work on DSO capabilities and contextualizes this work by discussing:

- The broad policy context informing the OEB's work.
- OEB initiatives that support grid modernization and DER integration.
- The DSO-related work that has been carried out by the IESO's TDWG.

- **DSO Concepts**

This section describes high-level DSO concepts including:

- Drivers for the adoption of DSO capabilities in Ontario.
- An overview of DSO capabilities.
- Descriptions of different DSO models.

- **Regulatory Considerations**

This section focuses on the various regulatory considerations associated with the implementation of DSO capabilities and models in Ontario including discussion of:

- The feasibility of different DSO models and design features under the current legislative and regulatory framework.
- Tradeoffs, risks and opportunities associated with different ways of organizing DSO functions, considering the current roles of distributors and other sector actors.

- How DSO roles can be appropriately structured within the broader electricity sector.

- **Ontario's Path to DSO Implementation**

The final section synthesizes insights from the preceding regulatory analysis, DNV's work and Ontario-specific conditions to chart a potential path for implementing DSO capabilities in Ontario.

What is a DSO?

A DSO is an entity with advanced capabilities to integrate, manage and optimize DERs for distribution and wholesale market services. DSOs actively manage distribution systems, and the sophistication of their capabilities would evolve as system needs or DER penetration levels increase. 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.

What is Grid Modernization?

Grid modernization refers to investments in advanced monitoring and communications infrastructure that distributors make to support goals such as DER integration, enhanced resiliency and more efficient operations. Although not synonymous with a DSO, the underlying tools and investments are similar.

What are DERs?

As described by the IESO's TDWG, DERs are resources that generate, store and discharge electricity, or dynamically modify electric load. They are connected directly to an electric distribution system or an end-use customer's premises within a distribution system. They can include solar photovoltaics, combined heat and power plants, backup generators, energy storage, electric vehicles and consumer devices that can reduce or increase electricity use on demand. Energy efficiency measures are excluded from the definition of a DER because their performance is not dynamically variable.

For the purpose of this Discussion Paper, OEB staff has intentionally chosen not to define DERs. It is important to note that the TDWG definition differs from the OEB's definition of DERs that is used for regulatory purposes in documents such as the DER Connection Procedures, where a context-specific definition was required.

What is a Distribution Network Operator (DNO)?

Although the role and function of DNOs can vary across jurisdictions, they focus on efficient ownership and operation of the assets forming the distribution network.

In Ontario, DNO functions are a subset of the activities undertaken by electricity distributors; in addition to DNO functions, today's electricity distributors are expected to consider, and, where warranted, use non-wires solutions to meet distribution system needs.

2 BACKGROUND

This section outlines the energy policy landscape in Ontario and defines the OEB's DSO objectives. It introduces key interrelated concepts like grid modernization, DERs and DSOs. It also describes OEB initiatives, IESO's TDWG efforts, and pilot projects related to DSOs in Ontario. This foundation helps illustrate how DSO capabilities can unlock benefits, including enhancing consumer value, optimizing the distribution system and improving overall system efficiency.

2.1 Provincial Energy Policy

The potential benefits of DERs for Ontario, and the opportunity to capitalize on those benefits through the adoption of DSO capabilities, have been identified in recent policy statements and reports, as described below.

- In 2023, the Ministry of Energy released a report titled *Powering Ontario's Growth*, which highlighted the evolving role of electricity distributors in integrating customer-side solutions for the energy transition. It noted that the government is exploring models like the DSO to enhance customer participation and reduce system costs.

- Released in 2024, *Ontario's Clean Energy Opportunity: Report of the Electrification and Energy Transition Panel* further emphasized that new ways of organizing distribution system operation and DER participation, for example through DSOs, hold significant potential in enabling and maximizing the cost-effective potential of DERs.

- The Ministry of Energy and Electrification vision document titled *Ontario's Affordable Energy Future: The Pressing Case for More Power*, also released in 2024, noted the ongoing opportunity to expand the use of DERs where it is cost-effective and beneficial to meeting local and system needs. The document also emphasizes the need for clarity on grid modernization activities to guide electricity distributors in making prudent investments to meet growing energy demand.

The 2022 *DER Potential Study* by the IESO also highlighted the potential capacity and cost-effectiveness of DERs, emphasizing their role in enhancing grid reliability, efficiency and reducing system costs. It highlights the potential of DERs in meeting local distribution needs and supporting broader system services.

Together these documents underscore the development of DSO capabilities as a means to help secure the full range of potential benefits that DERs can offer for consumers and the electricity system. They also speak to the

interconnected nature of DER integration, grid modernization to facilitate this integration, and DSO capabilities to help further unlock the benefits of DERs.

2.2 DSO Opportunities & Challenges

The evolving energy landscape and increasing integration of DERs present both opportunities and challenges for Ontario's electricity system. One of the main challenges is creating ways to ensure that DERs can deliver value at the customer, distribution and bulk-system levels, which in turn can enable more efficient use of energy assets. DSOs have the potential to directly address this challenge.

When guided by system needs and strategically paced, investments in DSO capabilities can be a key driver of grid modernization. These investments enable more advanced system planning, real-time grid management and the efficient integration of DERs, ensuring a more flexible and resilient grid.

However, determining when DSO capabilities are needed and how they should be implemented requires careful consideration of many factors discussed later in this paper.

Potential DSO models vary significantly and may have numerous permutations. Identifying the most suitable approach for Ontario depends on jurisdiction-specific factors, such as:

- Current and forecast DER penetration
- System conditions and applicable use cases
- Electricity sector structure and distributor characteristics
- Existing market and system operation structures and practices

Developing the most suitable model will be informed by DSO use cases that offer the greatest value for Ontario’s distribution systems and the wider energy system. As discussed later in this paper, benefits that drive interest in DSO capabilities include facilitating DERs as non-wires solutions, increasing DER hosting capacity and expanding DER compensation mechanisms.

The work on DSOs must also account for potential challenges. Ontario’s electricity distributors differ significantly in size, technical capabilities and system characteristics, adding complexity to the implementation of DSO capabilities. Any material change to the distributor’s roles is likely to require significant investments in systems, data infrastructure and workforce skills. Similarly, in developing the way forward for DSO capabilities and DER participation, Ontario is not starting from a blank page. The approach must acknowledge and, where appropriate, account for existing market and

operational practices for integrating resources and procuring system services.

Acknowledging these challenges, the OEB recognizes the importance of adopting a deliberate, evidence-based approach to determine when and how DSO capabilities should be implemented to maximize customer value and manage risks.

To leverage these opportunities while also appropriately addressing challenges, the OEB must work with the sector to:

- Assess when and under what conditions DSO capabilities are necessary and beneficial.
- Identify the most appropriate approach for Ontario from the range of models and design features available, including identifying, for consideration by the Minister of Energy and Mines, specific legislative changes that may be required or beneficial to facilitate the most suitable model for the province, as requested in the 2024 Letter of Direction.
- Define clear regulatory expectations, guidance and requirements for regulated entities to ensure DSOs deliver value and meet system needs.

2.3 Building on OEB Initiatives to Advance DSO Capabilities

The OEB's work to develop a policy framework for DSOs builds upon other OEB initiatives and policy guidance that aim to support DER integration and grid modernization, since these are intrinsic to developing DSO capabilities. These efforts include:

- **Framework for Energy Innovation (FEI)**: Published in January 2023, the FEI Report set out the OEB's policies and next steps with respect to the integration of DERs into distribution system planning and operations, as well as the use of DERs by electricity distributors as non-wires solutions. Among other things, the FEI Report established the OEB's expectation that distributors begin to modify their planning and operations to cost-effectively integrate DERs and consider non-wires solutions when assessing options for meeting system needs.
- **DER Connections Review**: This ongoing initiative is streamlining the requirements for connecting DERs to the distribution system, ensuring consistent, efficient and transparent connection processes across Ontario. This informed Distribution System Code amendments to facilitate distributor experimentation with flexible connection offerings.

- **System Capacity Information Map**: The goal of this project, which stems from the DER Connections Review, is to improve access to information about grid capacity to support all types of connections, including DERs. In the first phase, the OEB required electricity distributors to post capacity information maps using existing systems. Phase 2, now underway, aims to provide customers with easy access to more consistent, detailed system capacity information across all distributors' service areas.
- **Non-Wires Solutions Guidelines for Electricity Distributors**: Published in March 2024, these guidelines help distributors implement alternatives such as conservation programs and DERs to address system needs, enhancing efficiency and reducing costs for customers.
- **Benefit-Cost Analysis Framework for Addressing Electricity System Needs**: This framework standardizes the evaluation of various solutions, including non-wires solutions, for electricity system requirements. Phase 1 focused on distribution-level impacts, with optional assessments for upstream benefits like avoided generation and transmission costs. This benefit-cost evaluation framework has since been incorporated into the Filing Requirements for Electricity Distribution Rate Applications (Chapter 5 – Distribution System Plan). Phase 2 of this work will refine the analysis of upstream impacts and explore societal impacts.
- **Pilot Projects Supported through the OEB-IESO's Joint Targeted Call and the OEB's Innovation Sandbox Challenge**: These projects test innovative energy solutions to drive advancements in the energy sector.

These initiatives support DER integration and the use of DERs to meet distribution system needs. Together they provide a strong foundation upon which to build a policy framework for enhancing DSO capabilities that will help fully realize the potential value DERs can offer.

2.4 DSO-Related Work in Ontario

2.4.1 IESO Programs and Projects

a) TDWG

The IESO launched the TDWG to develop coordination processes for DER participation in wholesale markets, including where DERs are providing services to the distribution system. The TDWG served as a forum for in-depth engagement with electricity distributors and other stakeholders on transmission-distribution coordination and was aimed at informing future market integration activities for DER/As.

In developing a policy framework for DSOs, the OEB is building upon the work of the TDWG, which focused on developing conceptual coordination protocols for the IESO, electricity distributors and DER/As to enable DER/A participation in the wholesale electricity market. Discussions in TDWG have centred on three models for facilitating DER/A participation: Total DSO, Dual Participation DSO and Market Facilitator DSO.

OEB staff and DNV considered the TDWG models when selecting models for DNV's analysis. The TDWG examined book-end DSO models that focused on the design features related to how DER/As would participate in the wholesale electricity market. Because of the scope of the TDWG, the models considered in that working group did not include design features related to the relationship between DSOs and distribution companies.

While the primary focus of the TDWG was coordination protocols, the scope of work was expanded in response to stakeholder feedback to explore additional areas of research. The TDWG and its members explored four areas of inquiry:

- **Transmission and Distribution Coordination Protocols**: Developing implementation-ready protocols for DSO models, led by the IESO.
- **Functional Assessments**: Conducting a capabilities gap analysis for electricity distributors and exploring DSO investment costs, led by Toronto Hydro and Alectra.
- **Communication Assessment**: Mapping coordination interfaces and data exchanges for DSO models, led by Toronto Hydro.
- **Shared Platform Concept**: Developing a "one-stop-shop" data sharing platform, led by Alectra.

The TDWG informed the sector's technical understanding of the ways in which enhancements in communication and coordination at the interface of the transmission and distribution systems would support DER/A participation in the wholesale market under conditions with greater distribution automation and higher levels of DER penetration. Although the OEB is not undertaking a detailed technical assessment of the type explored in the TDWG, the outputs of the TDWG inform the OEB's consideration of regulatory policy interventions necessary to support ongoing enhancement of DSO capabilities in Ontario, aligned with system and sector needs.

b) The Enabling Resources Program (ERP)

The IESO's ERP seeks to enable emerging resources to provide system services and contribute to the safe and reliable operation of the bulk power

system in Ontario.[1] The ERP is exploring the enablement of DER aggregations and smaller standalone DERs in the wholesale electricity markets, and will provide a no-regret step to facilitate dual-value DERs procured through the IESO or an electricity distributor/DSO.

2.4.2 Pilot Projects in Ontario

Industry-led pilot projects have also explored DSO models and related topics such as local demand response programs, flexibility markets and non-wires solutions for peak demand management. The OEB, through its Innovation Sandbox, provided support to some of these projects through the Joint Targeted Call on DER Integration with the IESO's Grid Innovation Fund. Additional details about the projects, their objectives and accomplishments can be found in the Joint Targeted Call Interim Report and The Innovation Sandbox Annual Report.

These pilots help enhance the sector's collective understanding of DSO capabilities by highlighting their potential benefits and informing future policy and operational decisions.

[1] Enabling Resources Program

3 DSO CONCEPTS

This section sets out foundational concepts related to DSOs. This includes a description of drivers for DSO capabilities, a high-level overview of what DSO capabilities entail and a description of how DSO models can be developed.

3.1 DSO Drivers

Broadly, three types of benefits drive interest in DSO capabilities in Ontario:

- **Further Facilitating DERs as Non-Wires Solutions**: DSO capabilities can improve the ability of distributors to use DERs to meet distribution system needs. For example, active management of DERs may serve as a means to meet distribution system capacity or reliability needs that would otherwise be met through investment in less cost-effective conventional electricity infrastructure upgrades.
- **Increasing DER Hosting Capacity**: DSO capabilities can increase distribution system capacity to host DERs, where additional DER connections may otherwise trigger costly infrastructure upgrades. This is especially true as distribution systems are operated in different configurations and the number of DER connections across the province increases.
- **Expanding DER Compensation Mechanisms**: DSO capabilities can create new ways for DERs to be compensated for a greater portion of the value they can provide at different levels of the electricity system. This can take the form of providing program or local market mechanisms to compensate DER/As for distribution-level services, and having DSOs undertake investments to facilitate greater DER/A participation in the wholesale electricity market.

3.2 DSO Capabilities

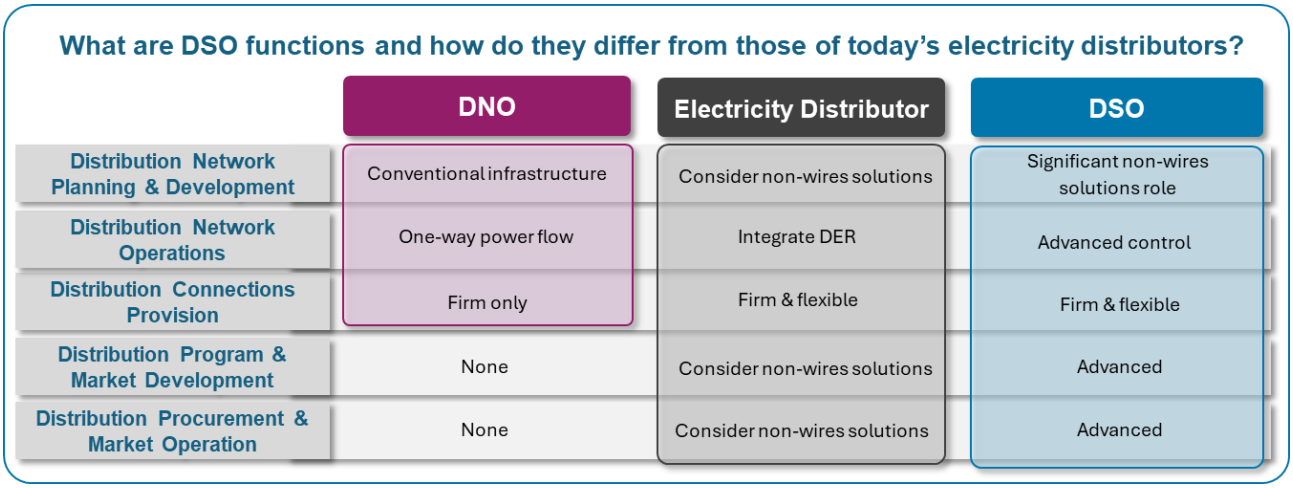
DSO capabilities and associated grid modernization activities span the range of activities undertaken by distributors in the electricity sector today, and in some cases represent new functions. Key DSO capabilities are described

below[2] and Figure 1 illustrates the different functions of DNOs, electricity distributors and DSOs.

1. **Distribution Network Planning & Development**. This includes identifying system needs, forecasting DER penetration, identifying required investments, assessing conventional investments and non-wires solutions, and building out the distribution system according to plans.
2. **Distribution Network Operations**. This includes operation of the distribution system, including, in more advanced permutations, monitoring of real-time power flows, real-time assessment of DER operating limits, and active management of the distribution system.
3. **Distribution Program and Market Development**. This includes putting in place the framework, infrastructure and processes for DER/As to participate in programs and distribution-level markets (as applicable).
4. **Distribution Program and Market Operation**. This includes the administration of programs or operation of markets to procure services for the distribution system and enable DER/A participation in the wholesale electricity market (as applicable).
5. **Distribution Connections Provision**. This includes the framework and requirements to offer flexible and firm connections.

[2] This categorization follows a similar grouping of functions set out by the U.K.'s Office of Gas and Electricity Markets in Appendix 4 of its RIIO-ED2 Business Plan Guidance, and is reflected in the accompanying DNV report. We note that other descriptions of functions are being developed in Ontario, notably in the TDWG, and they will inform future work related to DSOs under the DSO Capabilities Consultation.

Figure 1: DNO, Electricity Distributor, DSO Comparison



3.3 DSO Models

DSO models are the possible frameworks that set out the roles, responsibilities, relationships and conduct of actors in the electricity distribution sector. The section below sets out the three primary DSO model design features that can aid in understanding the range of DSO models that can be conceived. Following this, the analytical models developed by DNV are summarized.

3.3.1 DSO Model Design Features

DSO models can be defined using three primary design features. These design features – DER/A participation model, degree of separation and distribution activation mechanism – are considered "primary" since they reflect the foundational policy choices Ontario will need to make with respect to the evolution of the electricity distribution system.[3] The design features are as follows:

[3] We note that DNV considered eight design features in its detailed assessment of DSO models. Those eight design features were helpful in aiding OEB staff understand the range of possible options for DSO model design, but OEB staff believe the three primary design features described in section 3.3.1 reflect the foundational policy choices necessary to support ongoing evolution of DSO capabilities in Ontario.

- **DER/A Wholesale Market Participation Pathway**: This refers to the role of the DSO in facilitating DER/A participation in the wholesale electricity market. This was the primary design feature used to define models in the IESO's TDWG, due to the technical scope covered through that stakeholder engagement. Possible options include:
    - The DSO having **no direct role** in facilitating DER/A participation in the wholesale electricity market (an approach referred to as "**Dual Participation**" in the IESO's TDWG, and reflective of how eligible DER/As would participate in the wholesale electricity market today);
    - The DSO serving as a **market facilitator**, relaying offers from DER/As to the IESO and communicating dispatch instructions from the IESO to DER/As ("**Market Facilitator**" in the IESO's TDWG); and
    - The DSO serving as a **market participant** in the wholesale electricity market, aggregating DER/As for participation in the wholesale electricity market and taking a commercial position with respect to that participation ("**Total DSO**" in the IESO's TDWG).

  Other DER/A participation models are also possible. In all cases, there would need to be communication and information sharing amongst the IESO, DSO and DER/A to ensure DER/A operation poses no adverse impact to the electricity system.
- **Degree of Separation**: This refers to the degree to which DSO functions are separated from conventional functions undertaken by electricity distributors today. Possible options can include:
    - **No separation**, where all DSO functions are integrated within the distributor;
    - **Functional separation**, where certain DSO capabilities are part of the distributor but have internal separation to enable information compartmentalization and separate accounting;
    - **Legal separation**, where a separate legal entity serves as the DSO but may be affiliated with the electricity distributor; and,
    - **Ownership separation**, where the DSO and electricity distributor are legally separate and do not share a common owner (i.e., a third-party entity that is not affiliated with the distributor).

- **Distribution Activation Mechanism**: This refers to the way in which DER/As are curtailed or activated to meet distribution system needs. Possible options can include:
  - **Rule-based**[4], where operating limits are communicated to DERs in real-time and DERs must respond to those limits in accordance with rules;
  - **Program-based**, where DER/As are activated to meet distribution system needs and are compensated through programs, for example using standard fee schedules and,
  - **Market-based**, where services are offered and DER/As are activated through local flexibility markets.

Any DSO model defined using the above primary design features can have further variants that reflect a variety of additional policy choices, for example with respect to:

- Whether a DSO should be able to provide "DSO-as-a-service" to multiple distributors;
- Whether a DSO should be able to own DERs directly;
- Whether a shared platform should be used to facilitate DER/A service to the distribution system and participation in the wholesale electricity market; and,
- Other matters that arise as DSO models are developed with greater levels of detail.

These additional policy choices are expected to be reviewed in later phases of the OEB's consultation on DSO capabilities, as set out in Section 5.

3.3.2 Analytical Models

The OEB's consultant, DNV, was retained, in part, to aid the OEB in understanding the ways in which DSO model design can impact policy outcomes. Assessing all – or even several – permutations of DSO design features would have been impractical. Accordingly, DNV developed four analytical models, each with distinct design choices, and assessed how each model would be expected to perform with respect to costs and benefits for Ontario. The four analytical models are not meant to be the only models that can be pursued by Ontario; instead, they are meant to aid in the sector's

[4] In DNV's Report, the term "rule-based" is also used to refer to mechanisms for the horizontal integration of DNO-DSO functions.

understanding of the implications of choices in DSO model design. The analytical models also supported the regulatory analysis presented in Section 4.

The four analytical models used by DNV are summarized below.

Table 2: DSO Analytical Models

Analytical Model	DER/A Participation in the Wholesale Electricity Market	Degree of Separation	Distribution Activation Mechanism
Regulated DSO	DSO procures DER/A for distribution system. IESO procures DER/A for wholesale electricity market. DER/A serves as wholesale electricity market participant.	No separation.	Program-based.
Dual Participation DSO	DSO procures DER/A for distribution system. IESO procures DER/A for wholesale electricity market. DER/A serves as wholesale electricity market participant.	Functional separation.	Local flexibility market.

Analytical Model	DER/A Participation in the Wholesale Electricity Market	Degree of Separation	Distribution Activation Mechanism
Market Facilitator DSO	DSO procures DER/A for distribution system. DSO facilitates offers of DER/A into the wholesale electricity market and activation of DER/A by IESO. DER/A serves as wholesale electricity market participant.	Functional separation.	Local flexibility market.
Total DSO	DSO procures DER/A for distribution system. DSO aggregates DER/A for participation in the wholesale electricity market and serves as a market participant in the wholesale electricity market for the purpose of this DER/A participation.	Legal separation.	Local flexibility market.

4 REGULATORY CONSIDERATIONS

The range of options for assigning DSO roles and functions across entities within the electricity sector and four different analytical models for delivering DSO capabilities were discussed in Section 3 of this paper.

This section aims to assess how well each of these models is likely to perform with respect to the OEB's objectives of promoting economic efficiency in electricity service, facilitating the maintenance of a financially viable sector and protecting consumers' interests with respect to price, reliability and quality of electricity service.

This assessment considers the scope and likely efficacy of any new instruments that the OEB would require to ensure fairness and efficiency and support other objectives. It also examines whether amendments to legislation or regulation would be advantageous or required to enable incumbents or new entrants to serve the roles envisioned in each model.

This section begins with an analysis of permissible activities for electricity distributors and whether DSO is a distribution activity. Then it investigates aspects of models that pertain to the provision of services to markets upstream of the distributor. Finally, it examines what expectations and requirements might be put in place when a distributor takes on DSO functions within the utility business.

The intent of this discussion is not to establish whether one or more models should or cannot be implemented in Ontario. Rather, consistent with the purposes expressed in the January 2025 launch letter for this initiative, it is intended to describe issues and considerations to support further discussion with stakeholders, with a view to enhancing understanding of any requirements or dependencies that may need to be addressed as part of any new policy framework.

4.1 DSO Activities and Roles

As indicated under the DSO models section, a DSO could take on a range of roles. Depending on the implementation, needs and maturity of the environment in which it operates, a DSO could have responsibility for

- The definition and execution of standard agreements for products and services to provide system flexibility.
- The design, implementation and operation of flexibility markets.
- Other market-oriented activities that involve the use of third-party devices and behaviour to support power system operation within safe and reliable limits.

To help ensure that the DSO's capabilities are efficiently used, a DSO may also become involved in more traditional distribution activities such as forecasting, network planning and selection of options to meet identified system needs, especially to ensure that non-wires solutions are factored into solutions being considered.

The scope of these potential responsibilities allows them to be divided into three categories:

1. Services involving the use of non-distribution, distribution-connected resources to meet needs on the distribution system (such as a customer-owned and operated storage, referred to in the FEI Report as a "third-party DER").
2. Services involving the use of distribution-connected resources to meet wholesale electricity market needs.
3. Activities to identify needs on the distribution system and options to meet those needs.

Of these three categories, the first set of functions contemplates an activity permissible for distributors today, as set out in the Non-Wires Solutions Guidelines issued in March 2024, as well as, among other documents, the OEB's January 2023 FEI Report and the associated filing guidelines regarding FEI incentives, issued in March 2023.

The second set of functions is performed today by entities that participate directly in the wholesale electricity market.

The third set of functions is performed today by distributors.

The emergence of DSO capabilities raises questions about the scope of distributor activities, namely:

- Can a distributor perform the activities under 1) above via the creation and operation of a market?
- Is the set of activities under 2) above appropriate for a distributor to engage in considering the legislative restriction on business activities and the interest in an efficient division of responsibilities across the electricity sector? Under what conditions is it permissible within today's framework?
- What are the merits of having a DSO entity distinct from the distributor carry out some or all of these activities?

Analysis of the issues these questions raise will inform the need and rationale for any legislative change required to enable future implementation of DSO activities. The task begins with assessing how distribution service is defined.

4.1.1 Current Framework: Distribution and Non-Distribution Activities

a) Defining distribution service

Distribution service refers to the business activity of delivering electricity at less than 50 kilovolts. That service requires many different activities by distributors that would in and of themselves not constitute distribution of electricity. This includes construction, maintenance, billing, purchasing, managing vegetation growth, customer support and many others.

While many different companies may engage in construction, vegetation management or other related activities, the marker of a distribution activity is its purpose. Distribution activities are those that serve distribution purposes – generally speaking, those activities pertain to the reliable conveyance of electricity to interconnected consumers. Purposes are generally examined with reference to the OEB Act and OEB instruments including licences and codes.

When distinguishing distribution from other activities, an important indicator is the centrality of distribution as the intended purpose. A distribution activity should serve a distribution purpose as its primary objective; the distribution purpose should not be secondary to other aims.

As can happen within an interconnected service such as electricity, engaging in a distribution activity may provide other benefits in the course of doing so. However, a distributor is generally expected to refrain from the pursuit of those other benefits unless they are incidental to an overarching distribution purpose.

An example of this distinction is described in an OEB staff Bulletin regarding the ownership and operation of behind-the-meter storage solutions installed to ameliorate distribution service reliability for customers facing significantly worse rates of interruption.[5] In that case, OEB staff recognized that the battery energy storage system could provide value beyond avoiding or minimizing the consequences of long-duration outages for which it was supplied. As noted in the Bulletin, the distinguishing characteristic of the activity was that “the purpose driving the distributor’s decision to” implement and operate the storage device was to address the reliability issue; other benefits were incidental rather than explicitly pursued.

b) Can a distributor carry out non-distribution activities?

Legislation places limits on what business activities distributors can engage in. Under s. 71 of the OEB Act,

[5] https://www.oeb.ca/sites/default/files/OEB-Staff-Bulletin-ownership-of-BTM-storage-20200806.pdf

> Except as provided by this section or the regulations, and subject to subsection 70 (9), a transmitter or distributor shall not, except through one or more affiliates, carry on any business activity other than transmitting or distributing electricity.

For the most part, any activity other than distribution must be carried out in a separate affiliate of the distribution company; however, some exceptions apply. In addition to the ability to create exceptions via regulation under section 71(1), the OEB Act also describes more specific cases:

- Under s. 71(2), a distributor may engage in conservation and demand management activities provided they support government in the achievement of its goals regarding electricity conservation.
- Under s. 71(3), distributors may own renewable energy, combined heat and power and storage facilities, subject to size and other conditions.
- Under s. 71(4), the OEB may, if in its opinion special circumstances of a particular case so require, authorize a transmitter or distributor to carry on a business activity other than transmitting or distributing electricity other than through one or more affiliates.

However, it is important to note that generally these activities themselves do not constitute distribution activities, even if carried out within the distribution utility business. In these cases, distributors are carrying out permissible non-distribution activities, not subject to the OEB's regulation as distribution. Under section 72 of the OEB Act, distributors must maintain separate financial accounts for these activities. This provision helps protect the interests of customers by ensuring that the costs and revenues associated with distribution activities do not cross-subsidize other activities in which the distributor is engaged.

4.1.2 The Implementation and Use of Markets for Distribution Services

a) Can a distributor create and operate local markets to deliver its services?

Consideration of DSO roles appropriate for distributors to undertake requires examination of the role most commonly associated with a DSO: local market operation. In OEB staff's view, markets are properly considered a technique for delivering reliable services. Like other buyers in a global supply chain for goods and services, distributors regularly access competitive markets to procure equipment and contractors to cost-effectively carry out programs and projects. In the case of creating and operating local markets for delivering their own services, what matters is the purposes served by the markets being implemented. A central promise of a DSO is that it should be able to harness disparate types of resources to solve a distribution problem, and to engage

resources on the basis of their cost. The aim of the market is to identify the least-cost resource to provide a given service for a given duration to meet a given need. In the case of a distribution-level market, the need may be to keep system loading or voltage within a certain band; the resource may be demand response, injection of energy or any other intentional change that produces the required result.

A distributor can build new wires, poles or other conventional plant to safeguard reliability. The OEB's Non-Wires Solutions Guidelines also make clear that a distributor can enter into contracts with resources to serve the same end. These solutions differ with respect to the time period over which reliability is safeguarded – whether over a 40-year asset life or a year-long contract. Markets, likewise, can function to serve the same end as building conventional plant or entering into a contract. The core functional difference with a market, relative to traditional plant or a contract, is its interval – which can be as short as days or minutes. However, provided each alternative performs substantially equally (with respect to cost, dependability and controllability by the distributor), and provided in each case that distribution service is the primary purpose for which the distributor engages in it, the regulator should be indifferent as to the technique a distributor chooses.

b) Requirements of a Market

Dynamic markets are a means by which to serve distribution purposes. Markets are usually the preferred means of securing goods and services since they are efficient, under the right conditions, at revealing the prices at which different producers will provide a service and at which consumers will pay for it. These principles and expectations are reflected in many of the OEB's own requirements, including, for example, the expectation that distributors establish a market price prior to retaining any goods or services from an affiliate.

Generally, the effectiveness of markets is assessed with reference to two features:

- Avoidance of undue discrimination. Markets must be fair. Generally, markets must provide like treatment to participants in like circumstances.
- Avoidance of market power. Markets must engage a sufficient number of diverse participants that no single entity can exercise its power to set prices or quantities such that pricing ceases to be cost-reflective.

The regulatory means by which to assess these two features is discussed in later sections.

4.2 Consideration of DSO and Distributor Roles

The ability for a distributor to use markets to meet its needs establishes the initial feasibility of it taking on the market role most commonly conceived when considering DSO capabilities.

In considering further whether distributors can and should take on the roles and activities of a DSO, and what regulatory considerations arise if they do, it is first useful to recognize and consider that all of these responsibilities could be assigned to a new, separate entity – a standalone independent DSO, and to evaluate what would be required to enable its creation.

4.2.1 Separate DSO

An independent DSO would identify and commit resources required to ensure reliable service, under the constraint of ensuring the distribution system is operated within the design limits selected by the system's owner.

A DSO serving this role would therefore be instrumental to a distributor's obligation to serve customers reliably. Once committed and operational, few substitutes for the DSO's functions would be available, at least in the short run. A DSO's conduct could also raise public interest concerns, especially about the need to ensure participants and customers were being fairly treated and their interests were well served.

The typical regulatory response in the presence of these service characteristics is to license the service provider in exchange for service quality, conduct and cost commitments.

To do this for an independent DSO's services would require legislative change. The responsibilities of a separate DSO would need to be set out in the *Electricity Act*, the OEB Act or both. Legislation would describe the DSO's functions and delineate them, as appropriate, from the roles and activities performed by other sector entities, such as electricity distributors and the IESO.

Legislative change would also likely be required to grant the OEB the ability to develop and issue new licences, since a DSO, if conceived as an entity separate from a distributor, would be a new class of licensee in Ontario.

Licensing provisions could be used to ensure the DSO would be obligated to provide service to all participants who requested access to its platforms in a given service area. The receipt of a licence would also help provide a new entrant the exclusivity it could rely upon to make investments in the equipment required to deliver DSOs.

Development of the licence would require consideration of any conditions to add to the licence. Re-use of common conditions for licensing other entities in the sector – such as maintaining the same financial disclosures required of

other licensees – could help mitigate uncertainties with a new licensing regime. Consideration of any other conduct expectations would also be required; obligations would typically be laid out in a Code. The applicability of any existing rules or codes, such as affiliate relationships and transactions, would also need to be contemplated.

The development of a DSO licence would also provide an opportunity to consider how best a DSO's services ought to be enmeshed or distinguished from any role with respect to embedded resources serving the upstream wholesale market and broader transmission system.

Whether an independent DSO engaging in these kinds of operations ought also to carry out distribution level planning activities – activities falling under type 3 functions discussed in Section 4.1 – is discussed later in this section.

4.2.2 Carrying out DSO Roles within the DNO

Just as an independent DSO is a design choice that could be selected, it could also be decided to assign DSO roles to a distributor. The advantages and drawbacks of a distributor engaging in DSO activities need to be evaluated based on the types of DSO services outlined earlier: those activities at the distribution level; those serving the wholesale electricity market; and those pertaining to planning and option selection.

a) Use of resources at distribution-level

As discussed above, a distributor is permitted to create and operate a local market to deliver services, provided the services retained through these processes serve distribution purposes. However, any market a distributor operates – or, for that matter, any market an independent DSO operates – must operate fairly, avoid undue discrimination and enable competition to deliver value to customers.

i) What risks need to be addressed if a market is created and operated to deliver distribution services?

The core regulatory risk of the creation of a flexibility market is the absence of sufficient resources to generate competition. Unlike a rules-based or program-based activation mechanism for a DSO, which would set out compensation rules in contracts or other instruments, a market relies on the prospect of competition between suppliers to set prices for a given interval. In the absence of a sufficient number of suppliers, one market participant could use its market power to distort clearing prices, stifling competition or raising the cost of service for customers.

The OEB's Market Surveillance Panel (MSP) assesses indicators of the potential exercise of market power in the wholesale electricity market by

evaluating the diversity of ownership of supply resources participating in the market, as well as via what is known as the pivotal supplier test.

> "A Market Participant is said to be pivotal if offers from at least some of the generation under its control are required for the market to clear. When a large participant is pivotal, in principle, there is insufficient competition from other suppliers to discipline the large supplier's price setting ability. If one or more Market Participants is frequently pivotal, it is a sign of a highly concentrated market. The pivotal supplier test is an indicator of suppliers' ability to exercise market power. It is not evidence that an actual exercise of market power has occurred. More direct measures of market power are required to establish the actual exercise of market power."[6]

Another risk is ensuring that the rules and operation of the market do not unduly discriminate among participants. While undue discrimination is difficult to identify prior to a market's creation, it is reasonable to assume that the greater the diversity of resources participating in a DSO market, the higher the risk that a given category of resources is treated unfairly.

Finally, an insufficiently competitive market could pose a risk to a distributor's financial viability if the market failed to produce the services a distributor required, because, for example, it was prematurely launched or poorly administered. In such a case, not only would the distributor have sunk costs into market mechanisms and processes, it would also have to fund traditional infrastructure it had planned to avoid via a services market. These additional expenditures may strain a utility's finances until its rates could be restored into alignment with its prudently incurred costs.

ii) What regulatory measures would be required to deploy a market to meet distribution needs?

To combat these risks, rules would be required to stipulate how the market would operate and set the terms for participation. A review process would be needed to support the development of rules. A market oversight and monitoring function, similar to the functions in place to provide oversight of the wholesale electricity market, would also be required to oversee the market's operation, and to assess whether any individual participant could assert market power or engage in market manipulation to distort outcomes.

Experience within the IESO and OEB regarding the development and review of market rules used in the wholesale market would provide guidance on approaches that could be used to develop distribution-level markets. The undertaking would require significant investment in resources nevertheless.

---

[6] OEB MSP Report, 2022, p 16 https://www.oeb.ca/sites/default/files/msp-monitoring-report-202203.pdf

The design and implementation of markets are resource-intensive exercises. To reduce the risk of deterioration in a distributor's financial viability, a distributor should be expected to demonstrate the need, or likely need, for a flexibility market well in advance of committing the resources required to implement one. To reduce the risk and effort required to design and implement markets on individual networks, a common set of rules and other tools could be developed and adopted.

The effectiveness of markets lies in their ability to create a liquid supply and dependable demand for the good or service they are designed to trade. To help demonstrate the likely viability of competitive distribution-level markets in producing necessary liquidity, the OEB could consider whether reliable indicators of competition could be constructed from factors such as the quantity and location of interconnected load and generation resources, the mix of customers and the flexibility of their demand, in the context of different kinds of distribution needs (such as deferral, operability or congestion relief). Utilities could use these indicators to buttress their proposals to invest in markets based on anticipated needs. This approach would also ensure consistency within the sector about the preconditions for market investments and related commitments to be made.

b) Provision of resources to upstream markets

The question of whether a distributor can engage in the provision of resources to upstream markets requires evaluation of the two separate roles for a DSO described in Section 3: the Total DSO (T-DSO) role, in which a DSO bids embedded resources into an upstream market; and the market facilitation (MF) role, in which the distributor only relays certain offer information to the upstream market.

i) Can a distributor operate as a DSO to bid in resources and provide services to the upstream IESO-controlled grid?

Under the T-DSO model, a distributor would aggregate offers and activate resources for provision to the wholesale electricity market upstream of a distributor's network. The DSO would determine offer prices for embedded resources and receive and send dispatch signals for delivery. As the bidding agent for embedded resources, the distributor would also be liable for any penalties associated with non-performance.

The scope of these activities, much of which involves interaction and engagement with markets upstream of the distributor's service area, raises the question of whether a distributor is currently permitted to engage in them. As established earlier in this section, a primary means of answering this question involves evaluating the purposes served by these activities.

OEB staff's regulatory analysis highlights a number of questions about the relationship between these market activities and a distributor's purposes. The role of a distributor in this model appears to focus on provision of services to satisfy objectives and obligations of the IESO and the markets it administers. It is not clear to staff how these activities relate to a distributor's objectives of the reliable and safe conveyance of electricity to customers. In OEB staff's view, these types of roles appear to lie outside a distributor's business as currently conceived.

OEB staff acknowledges that many Ontario distributors are directly connected to the IESO-controlled grid and settle with the IESO like other market participants. However, unlike other directly connected large loads, a distributor's role is largely passive. Its load is not dispatchable and it does not submit bids and offers of its own. While a distributor settles costs with the IESO on behalf of its customers, these transactions are conducted on a pure pass-through basis. There is no financial risk associated with the settlement of commodity costs. Also notable is that these activities stem from a distributor's retailing obligations, which, under the OEB's Standard Supply Service Code (s.2.3.1), are not distribution activities.

OEB staff grants that a distributor engaged in the functions contemplated under this model may well be assisted in carrying out other activities expected of it – for example, ensuring that distribution elements and the overall network are operated safely, reliably and within design limits. However, in OEB staff's view, this benefit would only arise incidentally to the core purpose of the function, which focuses on the provision of energy, capacity, reserve or other services to systems above 50 kilovolts – clearly beyond the distribution system. The OEB staff 2020 bulletin on the ownership and operation of behind-the-meter storage for distribution purposes provides some guidance on a conceptually similar matter of complementary purposes. The bulletin notes that,

> "… an investment made for the purpose of addressing a distribution concern should be considered a distribution activity, even if there are other incidental benefits to the customer – but an investment driven by another purpose, even if there are incidental benefits to the distribution system, should not be."[7]

In OEB staff's view, activities undertaken and investments made in support of objectives for the upstream system would appear to be driven by the purpose of service provision to the wholesale market; distribution concerns are secondary.

The fact that these activities seem inappropriate for a distributor to engage in today does not preclude further consideration of any DSO model that contemplates such a role for a distributor. If there is merit in assigning to a

[7] 2020 bulletin.

distributor the responsibility for bidding resources connected to its own distribution system into the wholesale market, legislative change would likely be required to clarify and confirm these roles as part of the responsibilities assigned to licensed distributors or as a function that licensed distributors are permitted to carry out. Once these duties and responsibilities are clear in legislation, related obligations could be further defined in OEB instruments such as its licences or codes.

ii) Can a distributor operate as a DSO to facilitate participation in the IESO-administered markets?

A similar analysis is required when considering whether market facilitation activities are appropriate for distributors to undertake.

Under the MF-DSO model, a distributor operates its own distribution level market. It accepts and reviews all offers from eligible resources and clears its market in accordance with its needs and available resources. In addition, the MF-DSO relays offers from embedded resources that do not clear its own market to the system operator for inclusion in its dispatch algorithm. The MF-DSO likewise relays any dispatch instructions to resources on its system. In these circumstances, the distributor is neither modifying bids of resources nor taking on any performance risk should resources be committed. The distributor's role is to accept and relay bid information (such as price quantity pairs) to the system operator in order to facilitate market operation.

From a regulatory perspective, the central question is whether these are distribution purposes under the MF-DSO model. As with the T-DSO model, there would be distribution benefits associated with the distributor compiling and facilitating bids for provision to the wholesale market. Direct knowledge of dispatch instructions would enable a utility to understand system impacts of an activation and take action, if required, to safeguard the safety and reliability of its distribution system in the event that a resource's response to the IESO's dispatch would violate any constraints or system limits.

But there remains some question as to the directness or overarching driver behind these activities, and therefore whether it is permissible for distributors to engage in them. In OEB staff's view, the activity of forwarding laminations (price/quantity pairs) from embedded resources needs to be appraised within the context of activities the distributor is already carrying out for its own ends. In this case, the distributor is already assessing bids and offers to operate its own market. What it forwards to the IESO are simply those bids that are unused in its own market for a given interval. This arrangement and sequencing appear to fit with the concept of an incidental purpose, secondary to the distributor's predominant activity of administering its own market operations. Put into terms from the 2020 bulletin, the purpose driving the activity is distribution; the ancillary benefits to the operation of the IESO's

market appear incidental. In OEB staff's view, this form of arrangement would appear to be consistent with other permissible distribution activities.

Further support for this view is the similarity to a distributor's activities in the delivery of conservation and demand management resources. The OEB's Non-Wires Solutions Guidelines recognize that resources installed for local energy and capacity benefits can sometimes provide positive spillover effects for the transmission system as well. Accordingly, distributors are expected to assess these benefits as part of regional planning and have the ability (contingent on OEB approval) to apportion costs among benefiting parties, including if benefits extend beyond the service or regional area.[8] The spillover benefits of passing on unused offers from embedded resources appear analogous. Forwarding bids to the wholesale market enables these resources to contribute to meeting needs on that part of the system, and for the cost of those resources to be recovered from those who benefit.

Also notable is that this type of synergy may well support economies of scale and scope in the administration of both local and bulk markets. This feature is consistent with the OEB's objective of supporting economic efficiency in all aspects of electricity service.

Even if closer examination raises questions about the sufficiency of distribution purposes in this example of market facilitation under the MF-DSO model, changes to legislation could provide sufficient clarity for distributors to take on this role if there were sufficient confidence in the benefits of assigning it to them.

iii) Is the offering of resources and provision of services to the wholesale electricity market a permissible non-distribution activity?

An alternative to carrying out wholesale electricity market-related activities as part of a distributor's distribution activities is for a distributor to perform these tasks as a permissible non-distribution activity. As discussed earlier, the OEB Act allows distributors to engage in non-distribution activities within their utility businesses under certain conditions. One such exception is if the

[8] The default cost responsibility approach under the Non-Wires Solutions Guidelines where it involves a non-wires solution of one or more distributors to address regional needs is aligned with the approach in the OEB's Transmission System Code for transmission (wires) investments (i.e., proportional benefit). Where the transmission connection investment also addresses a broader transmission network system need, some portion of the costs is attributed to the network pool (i.e., recovered from all consumers in Ontario). The same approach applies to a non-wires solution where it involves deferral of transmission investments. Similar to the Transmission System Code, distributors need to provide confirmation from the IESO that the non-wires solution will also address a broader transmission network need under the Non-Wires Solutions Guidelines.

activity would help the government achieve its conservation goals. The OEB recognizes that the Ontario government is engaged in a number of initiatives that may clarify its policy priorities and objectives. However, OEB staff notes that even if a linkage between conservation goals and distributors' engagement in the wholesale market were established, any ensuing undertaking would necessarily be a permissible yet non-distribution activity, not recoverable through distribution rates.

While section 71(4) of the OEB Act enables the OEB to grant exemptions from the general rule against carrying out non-distribution activities within the distribution business, such exemptions must be determined on a case-by-case basis (in the "special circumstances of a particular case"); it does not permit the OEB to make a finding that would apply to licensed distributors on a generic basis.

iv) Can DSO activities be provided via an affiliate of the distributor?

Another option for implementing DSO activities that involve the provision of wholesale market services within the current regulatory framework would be via the establishment of a DSO in an affiliate of a distributor. The distributor itself would not engage in DSO activities. In OEB staff's view, the same considerations identified under "Independent DSO" would apply; a licence for the activity would likely be required – primarily to ensure that the DSO discharges its responsibilities fairly and with due regard for the interests of customers.

Clarification or updates to the OEB's Affiliate Relationships Code could identify what distributors would need to consider when establishing the affiliate, including requirements for accounting and issues such as information sharing between the DSO and distributor.

It should be noted that OEB staff's comments on the need to license an affiliate engaging in distribution system operation applies to the case where a DSO's responsibilities are set out and distinguished from those of a distributor – for instance, if the DSO itself were entrusted with the design and operation of a market at the distribution level, and the distributor's responsibilities were substantially the same as they are today. However, in a case where a distributor operated a market as part of its distribution obligations, but relied on an affiliate to carry out its day-to-day functioning, it would be expected that the distributor would retain accountability for the market's fairness and integrity. Any codes or rules would be the distributor's responsibility to comply with; the affiliate would merely be a service provider. In this case, no separate licence for the affiliate (or any other service provider) would be expected to be required.

c) Other considerations associated with distributor activities in relation to the wholesale electricity market.

The role of distributors in turn raises questions about the impact on other sector entities, as well as the interaction of markets adjacent to each other.

i) Would any other sector participant be harmed by a distributor acting as a DSO to provide resources to the wholesale market?

In the event that distributors engage in the offering of resources or services to markets upstream of their own networks, the impact on the market position of aggregators will require further examination. A core consideration arising from any potential overlap in roles is whether competitively provided services are more likely to serve customers' interests rather than a monopoly utility business; a related question would be what restrictions or expectations would apply to utilities participating in an otherwise contestable services market so that competitive forces can be maintained.

ii) What risks might be associated with the operation of multiple markets?

In the event that resource markets are instituted within distribution systems as well as at the wholesale level, there may be risk of spillover effects from one market into the other that have negative consequences for customers.

It is conceivable that high prices in one market might drive behaviour in an adjacent market that could compromise competition. A resource could potentially withhold or modify its offer prices in one market interval in one market in order to chase higher prices available in an adjacent market at a later interval. (Consider, for example, an energy-limited facility withholding offers from the wholesale market in order to be able to offer into a distribution market later). This behaviour, which may beefficient, may lead to price convergence between the two markets even if resources are much scarcer in one market than another, potentially raising questions about the match between costs and benefits of the use of a market to retain services. The likelihood and materiality of these kinds of risks will require further evaluation, as well as the means to mitigate these risks if rule changes or other actions are required to protect consumers' interests. Creating a clear hierarchy or sequencing for resources' obligations – for instance, to the distribution market first, and any adjacent market second – is perhaps one means of addressing this risk.

iii) How do the DSO models differ in terms of relative risk?

From a wholesale electricity market perspective, another important consideration is the relative risk between the four DSO models discussed in this paper. A key reason for that is the options evaluated cross the spectrum from relatively high risk to no such risk at all. For example, T-DSO is the highest risk model since the DSO would make offers to the IESO (after aggregating the DER/A offers). As the market participant and the bidding agent for embedded DER/A resources, the T-DSO would be liable for any IESO penalties associated with DER/A non-performance under the IESO's Market Rules. In relation to the other DSO models discussed in this paper, DER/As are the market participants and therefore take on the risk associated with penalties for non-performance, rather than the DSO.

While the DSO still plays a role in relation to DER/A participation in the wholesale market under the MF-DSO model, the related risk associated with the T-DSO model is mitigated to some extent because MF-DSO only facilitates DER/A participation in the wholesale market by relaying offers from the DER/A to the IESO, rather than making offers. As noted above, the DER/A would be the wholesale market participant under the MF-DSO model.

Under the Regulated and Dual Participation DSO (DP-DSO) models, there is no wholesale electricity market risk to the DSO since the DER/A would continue to make offers directly to the IESO (i.e., DER/As would participate in the wholesale market as they do today in the absence of DSOs).

iv) How would relationships between utilities and other sector entities need to evolve and be defined?

In all configurations of markets, coordination between the IESO, DSO (if independent) and distribution utilities would be essential to ensure that system limitations and operating envelopes are defined and respected, and that products and services can be delivered where they are required. Requirements and methods for IESO-distributor cooperation would need to be defined. The OEB may need to set out expectations for utilities to follow, or define best practices in safeguarding reliability, security and safety of supply to customers. A common set of rules to be used in any distribution level market would not merely help to deliver needed uniformity of expectations, but also reduce the efforts required of individual entities to design and establish their own distribution level markets. The merits of a standard form of cooperation agreement should be explored.

4.3 Merits of separating DNO and DSO Functions

Another consideration for the allocation of roles among DSOs and DNOs is whether the DSO ought to be charged with certain responsibilities that are carried out by distributors today.

A reallocation of these functions to the DSO would help address possible distributor planning biases, a commonly cited barrier to the identification and adoption of non-wires solutions. The risk of biases arises in part from the risk of differences in the performance, degree of control and certainty of operability between traditional distribution investments and non-wires solutions. The risk of biases may also emerge from the rate-base rate-of-return method used to determine distributors' revenue and earnings opportunity. While incentives are available to Ontario distributors to make use of third-party non-wires solutions to meet distribution needs, some distributors may still prefer to deploy their own infrastructure solutions given its centrality to the utility business model.

Migrating responsibility for planning, forecasting, alternatives analysis and option selection to a DSO (whether housed within a distribution utility or independent of a distributor) may help counteract the risk of entrenched biases perpetuating preferences for traditional wire-and-pole solutions when other means may be viable and available at lower cost. A DSO may be more effective at developing relationships and processes that bring alternative solutions to market. Housing these functions outside a traditional distribution utility may also send a signal to prospective solution providers that investment decisions are independent of and free of influence from distribution network owners who may prefer traditional investments.

Separation of DSO functions within a distributor's business may also retain greater flexibility to modify and adopt different DSO structures over time. Even if conditions do not currently support, for instance, the creation of an independent DSO to operate distribution-level markets and conduct distribution-level planning, the separation of that functionality within a distribution business today may enable an easier transition to such a structure – or to other structures altogether – given these functions have already been compartmentalized into a distinct module.

Confidence in the likelihood of more robust markets, and the value of optionality, would need to be established to justify the additional administrative costs of separating these functions. DNV's analysis concluded that costs increase with greater business separation between the DNO and DSO. For instance, DNV anticipates that the Total DSO (widest separation) will be more costly than Dual Participation DSO (wider separation) in part due to duplicated costs resulting from the degree of business separation assigned to this model, particularly in business support areas such as human

resources, training, information technology and telecommunications, and board functions.

DNV's analysis noted nevertheless that the Total DSO analytical model specified for the purposes of its study has the highest potential benefit expected in part because the widest business separation makes it the least restricted, and most incentivized, to pursue commercial returns, which lie in maximizing its ability to deliver benefits for electricity distributors.[9] DNV also suggests that a clear separation of functions between the DNO and DSO could mitigate or remove potential conflicts of interest and could create more transparency, which can in turn raise DER/As and consumer confidence in flexibility markets . At the same time, DNV's analysis also holds that a narrower separation between DNO and DSO activities may have offsetting benefits as a result of better access to DNO staff's knowledge and insights that may more effectively support reliability, resilience and planning services.

4.3.1 What new regulatory measures would be required if some distribution planning functions migrated to a DSO?

The segregation of functions is permissible under today's framework. Just as some utilities receive services from non-utility businesses, a distributor could decide to procure forecasting, planning and other services from another party. This party could be an affiliate of the distributor. It is also possible that the DSO could simply be a different business unit within the distributor.

The degree of separation between a distributor's in-house DSO unit and the rest of the distribution business could be determined by such factors as whether the DSO operates a market, the confidentiality of cost and other information from vendors that provide network services to the distributor, and the degree to which the independence of planning decisions from utilities could help stimulate market offerings. At the same time, it would be important to pursue opportunities for reducing duplication on activities such as information exchange with the IESO and other entities where cooperation is required.

The activities that should not be removed from the distributor's business also need to be specified. Customers with market-participating DERs may be indifferent to dealing with a distinct DSO or with the legacy distributor, but many smaller traditional customers would be expected to continue to prefer to deal only with the distribution company they are familiar with. For this reason, the distributor would likely be expected to retain accountability for most load customer relationships.

[9] DNV report, section 3.5.2.4. Mature flexibility markets and DSO processes are necessary to reach the full potential of the Total DSO model.

The OEB could consider compiling best practices on the separation of DSO from distribution activities, as well as provide guidance on requirements of the Affiliate Relationships Code should utilities wish to pursue the establishment of DSO capabilities via an affiliate.

An alternative or complement to the separation of a DSO from other utility activity is the use of standardized methods and processes for distribution planning and related activities, including such crucial tasks as the calculation of benefits associated with different options. If a distributor retains responsibility for evaluating distribution and non-distribution alternatives for meeting a given need, the use of a standard framework would be expected to help demonstrate that a utility's evaluation is free of bias. Similarly, if a utility is permitted to own and operate a DER, the publication of a regularly updated map of hosting capacity on the distribution system could help ensure that the distributor does not enjoy any information advantages when it comes to selecting optimal connection locations. Each of these instruments – a standardized cost-benefit assessment methodology, as well as hosting capacity mapping – are already available or planned.

The respective roles of the distributor and the DSO will also need to be clarified in the regional planning process, as distributors currently have regional planning obligations in the Distribution System Code. For example, distributors must share information, such as their load forecast, with the IESO and the lead transmitter. It is expected DSOs will also need to play a role in the process. Therefore, clarity will be needed to avoid duplication and maintain process efficiency. Factors such as DSO-as-a-service will need to be considered since the distributor that becomes a DSO and provides the services may be in a different region than the distributor(s) receiving the DSO services.

4.3.2 What approach to DSO implementation can best support sector efficiency?

The specification and proliferation of the DSO role also requires consideration from a sectoral perspective.

As discussed in this paper and in DNV's report, the separation of DSO from DNO responsibilities is advisable to increase certainty that the different means and methods for delivering distribution services can be realized and maximized. Even though these measures may raise costs, the aspiration is that stronger market incentives that result from separation will overcome the additional expenses required.

A further means of driving efficiency in sector structure may rest in consolidating DSO activities within a single entity. Rather than dispersing and replicating DSO capabilities within many distribution service areas, a single

DSO could conceivably be created to deliver functionality to all areas where resource penetration is sufficient to warrant a given level of functionality.

The benefits of such a structure may lie not merely in reduced duplication but also in closer integration in the wholesale electricity market. A dedicated DSO may be able to increase efficiency through better optimization of dispatch between any distribution and bulk level markets, potentially over longer durations or more intervals. Such a feature may prove valuable in an environment with greater amounts of storage deployed or other energy-limited resources.

This arrangement may also enable the interdependencies between a DSO and DNO – some of which likely cannot be avoided – to be operationalized with greater efficiency. Requirements for planning, for example, will inevitably require protocols for sharing information about system characteristics, asset condition and other factors, just as planning today requires a level of cooperation and coordination between the IESO and Ontario transmitters for bulk electricity system planning, or among different wires companies and the IESO for regional planning. Standardized engagements between DNOs and one DSO may reduce overhead costs and the risks of inefficient information sharing that could arise if DNO-DSO relationships are replicated across the province.

The feasibility of such a structure would require more investigation. The complexity of systems required for visibility, real-time evaluation and dispatch of DERs across numerous territories, voltages and network topologies may not be practical. The computational requirements for optimization over many more nodes and resources may not be attainable either. Whether systems could adequately scale with increasing DER penetration is another open question. Beyond these technical matters, it is unclear whether a DSO could provide more value by increasing its focus on distribution level reliability and efficiency rather than on integration with bulk electricity system needs already overseen by the IESO.

An alternative middle ground may lie in the pursuit of service sharing agreements that would reduce the total number of DSOs required to enable service in each area. In this approach, a DSO with capacity and capability to manage and implement required DSO capabilities could be contractually committed to provide the necessary services to a given DNO; the DNO would compensate the DSO for services rendered. Such a structure could enable smaller distribution networks to achieve market functionality at lower cost and complexity, and possibly sooner than if carried out internally. It may also be especially suitable for Ontario's numerous embedded distributors whose operations and options may be circumscribed or at least need to be informed by characteristics of the distribution networks to which they are connected. The viability of a shared-service approach to the implementation of DSO capabilities will require consideration on the basis of its economic efficiency,

as well as implementation practicalities such as utility preferences, sector inertia and shareholder appetite. Under a shared services model, a range of voluntary and mandatory tools may need to be developed to ensure implementation delivers the benefits expected.

4.4 Summary: Regulatory Impacts of DSO Design Features and Mitigation Instruments

The preceding discussion summarized the main techniques for assessing whether and how distribution activities can be identified, and the kinds of conditions and considerations that apply to the identification of activities permissible for licensed distributors to undertake in Ontario. The main considerations regarding an entity's ability to assume a given role are summarized in Table 3 below.

The central criterion for identifying activities permissible for a distributor to undertake is whether the purposes involved pertain to distribution. While distributors can employ a range of techniques in their provision of services – including, importantly, markets – what matters is whether distributors' activities serve distribution ends. Absent distribution as a primary purpose, a distributor would be expected to refrain from engaging in a given activity.

This analytical approach – which OEB staff has articulated to support further discussion among stakeholders as this consultation proceeds – suggests that roles for distributors that involve increased engagement and participation in the wholesale electricity market may benefit from legislative or regulatory clarity as a prerequisite for undertaking them. This does not dismiss altogether the notion of a distributor adopting new responsibilities regarding the wholesale electricity market; rather, it indicates that some new activities for distributors, in OEB staff's view, would benefit from legislative clarity should the merits of the model and role allocation be identified as worthy of pursuit.

OEB staff also recognizes that, despite the range of roles and models evaluated in this paper, various other DER/A participation models and different investment drivers may prompt consideration of additional or alternative roles and focus areas for distributors. OEB staff agrees that other variants warrant consideration during the consultations. However, OEB staff nevertheless maintains that the same techniques and principles used in this paper – analysis of purposes – should be applied in evaluating the permissibility of distributors to undertake any new roles within the current regulatory framework.

This section also examines the kinds of instruments and expectations that would need to be in place to ensure that consumers and other parties' interests would be protected in the event that markets were implemented to deliver distribution or other services. Any implementation of markets, for instance, would require rules and other mechanisms to ensure they function fairly and without undue discrimination. Coordination protocols would be required among the IESO, DNO and DSOs to ensure safe and efficient operations. And DSOs may need to implement certain standardized tools to increase consistency and transparency in their selection of options to meet identified distribution needs. Many of the main aspects discussed are summarized in Table 4 below.

A final consideration presented in this section is the question of the number and structure of the DSO-DNO relationship, including whether fewer DSOs would present efficiency benefits relative to an approach in which the count of DSOs in the province remained at or near the number of DNOs.

Table 3: Permissibility of DSO Roles Under Current Framework, by Entity

	Distribution market operator	Wholesale market participation: As bidding agent (T-DSO model)	Wholesale market participation: As market facilitator (MF-DSO model)
Independent DSO	Would require legislative change to set out roles, licence.		
Distributor engaging in distribution activity, funded through distribution rates	Permissible under current framework, provided the activities involved serve distribution purposes.	Not permissible under current framework, given absence of distribution as primary purpose. Could be addressed through legislative change.	Permissible under current framework, if wholesale market facilitation is secondary or incidental to an activity driven by a distribution purpose. Legislative change to clarify or confirm role(s) may be beneficial.
Distributor engaging in permissible non-distribution activity under s. 71	N/A	Permissible under s. 71(2) of the OEB Act, provided there is a linkage between Ontario government conservation goals and distributors' engagement in the wholesale market as bidding agent.	N/A, provided facilitation role remains incidental (see above). Otherwise, permissible under s. 71(2) of the OEB Act, depending on a linkage between

of the OEB Act		Permissible under s. 71(4) of the OEB Act if the OEB determines that "special circumstances of a particular case" require an exemption from s. 71(1). In both cases, activity would be non-distribution and not recoverable in distribution rates.	facilitation role and Ontario government conservation goals; or under s. 71(4), if special circumstances require an exemption (see left).
Distributor Affiliate	Likely similar considerations identified under "Independent DSO"; roles would need to be set out; a licence for the activity would likely be required if the DSO itself bore responsibilities distinct from those of a distributor.		

Table 4: Regulatory Considerations of Core DSO Design Features

Design Feature	Regulatory Consideration	Regulatory Instrument (Mitigation)	Applies to Model(s)
Distribution level market	Fairness, market power, undue discrimination	Market oversight to ensure competition Rules review process	T-DSO, DP-DSO, MF-DSO
Adjacency of distribution level and the wholesale electricity market	Competition, price distortion	Market oversight, clarity on market priority/hierarchy	T-DSO, MF-DSO, DP-DSO
IESO-DSO-DNO communication	Coordination, call order, reliability/safety	Expectations and standardization of protocols, actions in contingency, etc.	Any model
DNO retains planning, alternatives analysis	Distributor planning biases	Standardized benefit-cost methodology	Any model with this allocation of roles
DNO owns/operates DER	Preferential access to optimal sites	Regular publication of hosting capacity maps	Any model with this allocation of roles

5 ONTARIO'S PATH TO DSO IMPLEMENTATION

The role of DER/As as another option for providing electricity service will continue to grow. Informed by the work of its consultant and other stakeholder activities, among other factors, OEB staff is of the view that DSO capabilities can contribute to the broader efforts of the energy transition, especially in helping capture the potential benefits DERs make possible.

Additionally, investments in DSO capabilities and associated grid modernization will help enhance system reliability and optimize local electricity networks. Introducing DSO capabilities aligns with Ontario's policy objectives, including supporting electrification and ensuring cost-effective system planning. By enabling more dynamic and efficient grid operations, these investments help the province adapt to evolving energy needs while maintaining affordability and reliability for consumers.

However, questions remain regarding the manner and pace at which DSO capabilities should be adopted. Investments in DSO capabilities should be timed and scaled in relation to the degree of benefits available, in keeping with the OEB's overall interest in supporting investments that are necessary, economically efficient and appropriately facilitate innovation, while protecting the interests of consumers.

Accordingly, this section proposes for discussion a practical strategy and initial action plan that can guide the adoption of DSO capabilities commensurate with established need and anticipated net benefits. It also outlines the key factors and criteria the OEB needs to take into consideration in this consultation to establish a clear policy framework for the implementation of DSO capabilities.

5.1 A Graduated Approach to Implementing DSO Capability in Ontario

5.1.1 Key Takeaways from DNV

OEB staff's recommended approach is informed by the analysis and jurisdictional experiences synthesized in DNV's report. Its insights include observations and lessons learned from DSO implementation elsewhere that can inform a regulatory approach and strategy for DSO implementation.

OEB staff's key takeaways from DNV's analysis are as follows:

- Ontario DER penetration is highly variable, and further assessment is required to identify where DSO capabilities may have value:

"While ... interviews suggest that parts of the Ontario system would benefit from a DSO, additional research should identify specific networks and parts of networks that would gain the most value. This research should include a quantitative assessment of system indicators such as the length of interconnection queues, levels of curtailment, and network visibility."

- Markets can be an effective tool, but involve considerable effort and cost to realize potential benefits:

  "Market-based solutions stimulate innovation, can be technology-agnostic, and can reduce overall costs of the energy system and energy transition … (Yet) developing competitive and liquid flexibility markets requires significant investment, time, industry coordination, regulatory steering, and a high implementation effort to ensure that there is sufficient reliable flexibility to manage congestion and that the benefits of competition are fully leveraged."

- A simpler approach can enable lower-risk acquisition of flexibility:

  "The market-based approach in Europe, albeit still in its infancy, has not been consistently effective, mainly because of low customer interest/participation. A regulated, rule-based approach may prove to be more effective in enhancing the reliability of, and derisking, DER flexibility – especially in the early development stage of flexibility use cases and flexibility supply."

- There are low-regret actions that can be pursued while a more advanced DSO model for Ontario is developed:

  "Ontario does not need to select a preferred model at this stage. Even in the absence of a more quantitative assessment, developing the core functionality and capabilities to forecast, manage, and deploy DER has little downside and these kinds of 'low regret activities' could begin right away. Additionally, work can start on the design and standardization for DER flexibility products and services. As the urgency of market signals increases, the OEB should consider funding flexibility market capabilities."

5.1.2 Key Regulatory Criteria

In addition to DNV's observations about the implementation, costs and scope of DSOs, the OEB's work also needs to be guided by core regulatory and rate-making principles and informed by Ontario-specific circumstances.

- **Customer Benefit** – DSO capabilities should enhance customer choice, participation and value by enabling fair and transparent opportunities for DER owners, aggregators, users and other participants to provide services. The scope of services available should be commensurate with the degree of DERs present on the network and the range of system needs that DERs can help address.

- **Need** – DSO capabilities should only be implemented where confidence is high that these functions can address identified needs.

- **Cost Effectiveness** – The cost of DSO-related investments should remain proportionate to the expected benefits. Costs for capital intensive, large and complex systems should be incurred only when commensurate with the magnitude and certainty of needs to be addressed.

- **Flexibility** – Implementation will also need to take into consideration that Ontario differs from other jurisdictions, such as the U.K., in that Ontario's 57 electricity distributors vary substantially in terms of size, the capability to implement the various DSO models and the level of DER penetration in their service areas.

- **Practicality** – A coordinated approach to DSO implementation is likely preferable. Permitting electricity distributors to independently choose from the multiple DSO models being contemplated is unlikely to be efficient relative to the benefits that can come with standardization of the DSO model to be implemented at the outset.

- **Adaptability** – The prospect of changes in distribution system use and DER penetration suggests that investments made to address current and foreseeable needs may not include all the features required or desirable to meet more expansive requirements in the future. A phased and graduated approach is likely to be required.

5.2 Proposals

This consultation aims to define a policy framework to set expectations for electricity distributors regarding the development of DSO capabilities. The result of this work will be to define requirements regarding the introduction, pacing and scope of new functions at the distribution level, including the roles of electricity distributors.

Toward this end, the OEB proposes to work with stakeholders on three fundamental steps:

1. Standardize the method by which distributors assess the need for DSO capabilities as a means of using DERs to help address distribution system needs.
2. Develop a simplified DSO model suitable for most circumstances expected in the nearer term.
3. Explore and develop advanced models that address more complex needs as warranted, including the development of service models where a distributor contracts for DSO services from another entity.

5.2.1 Proposal 1: Require distributors to assess the need for DSO capabilities to be implemented to address system needs

As DNV notes, and as many distributors themselves have reported, the penetration of DERs on distribution networks is highly variable and distribution network needs are diverse. The availability and interest of DER/As to meet identified needs is also unknown. OEB staff therefore proposes to require all distributors to conduct two mandatory assessments to inform preparations to integrate DER/As effectively into their systems and take advantage of DER/As to meet system needs when cost effective to do so:

1. An assessment of current and future needs to identify DSO use cases (such as non-wires solutions, congestion management and operational efficiency) applicable to its service area.
2. An assessment of current capabilities to identify what capabilities the distributor needs to develop and when, including requisite grid modernization investments, to support the identified use cases.

OEB staff proposes to work with stakeholders on setting out specific requirements for these assessments, including the use of screening criteria, indicators and other techniques to ensure the level of effort required of distributors remains efficient and proportional to the likelihood of capabilities needing to be developed.

The intended result of requiring these assessments is that each distributor will classify its capabilities and anticipated needs in a suitably standardized manner. Depending on their system uses and needs, some distributors may conclude that DSO capabilities are not immediately warranted. Any distributor whose assessments indicate new capabilities are required will be positioned to bring forward a business case in an application and prepare its systems and operations as necessary.

The overall policy vision for this mandatory action is that it will help ensure that grid modernization investments are made where and when appropriate. It will also help ensure distribution systems in similar circumstances with respect to factors such as distribution need and DER penetration will provide similar levels of opportunity for DER/As and other customers. This approach is premised on the principle that the opportunity to engage in provision of services should not be contingent on the interests or priorities of the distributor who owns and operates a given part of the distribution network.

The OEB anticipates that this work, which is in keeping with the expectations set out in the FEI consultation, can leverage efforts already underway through the IESO's TDWG, particularly the Functional Assessment, and other lessons and research expected to be forthcoming through the OEB's Innovation Sandbox.

5.2.2 Proposal 2: Develop a simplified DSO Model

OEB staff proposes to work with stakeholders to develop a simplified DSO model that can be implemented where system conditions warrant.

OEB staff is of the view that an approach adapting features of DNV's Regulated DSO model would constitute the most appropriate default architecture at the outset. This pathway constitutes a pragmatic step forward that would also allow time for consideration of more sophisticated DSO models as DER penetration grows. DNV's cost-benefit analysis concluded that, across the analytical models considered, the Regulated DSO Model is the most cost effective, least costly and least complex option for implementing DSO functions. It also does not require the systems, data and skills necessary to design and enable a flexibility market.

In OEB staff's view, the term "regulated model" used by DNV may connote too narrow a concept for DSO implementation. OEB staff believes a simplified DSO model, adopting a rule-based approach for certain DER/As and use cases, complemented by voluntary programs (such as distribution-managed electric vehicle charging as a non-wires solution), can more fully capture the economic potential of DER/As. Such programs, standardized as appropriate for rollout by multiple electricity distributors, would encourage broader DER/A participation.

This model would not seek to alter the roles of distributors and aggregators with respect to the operation of the wholesale market. Under the simplified model, DER/As would continue to directly participate in the wholesale market through IESO mechanisms, capacity auctions or programs with some electricity distributor or DSO operational control (e.g., Peak Perks).

OEB staff proposes to work with stakeholders to develop the Simplified DSO concept, as well as define roles, rules and responsibilities for a regulated- and program-based model. Consideration would also be extended to the definition of prototypical programs or replicable, standardized resource-retention agreements around which local programs could be built.

Once the model design is sufficiently advanced, this stream of work would also involve the development of guidance on cost-recovery, conduct, consumer protection, and implications for existing processes and requirements, as appropriate, considering the nature and details of the Simplified DSO model.

Distributors that identify the need to implement DSO capabilities on the basis of DER penetration and system conditions will need to include investment proposals in their rate applications. Work to develop assessment requirements under proposal 1, and standardized rules and programs for a Simplified DSO under proposal 2, could then inform the development of filing requirements in relation to DSO capabilities.

5.2.3 Proposal 3: Further Development of Advanced Models

OEB staff recognizes there may be a need for regulatory flexibility to address the diversity of electricity distributors. Some distributors may face challenges and volumes that necessitate the development of capabilities that outstrip those contemplated for the Simplified DSO. This prompts the opportunity to define an advanced model that best suits Ontario's conditions given the roles of distributors, other incumbents, the design of current markets and other factors canvassed earlier in this paper.

To do so, OEB staff proposes to examine the following with stakeholders:

- What capabilities and tools – such as market rules – are required for distributors to develop and implement markets and other advanced procurement techniques? How best can they be standardized to generate efficiencies while enabling modifications where local circumstances require?
- What role, if any, should distributors play with respect to resources looking to provide services to wholesale electricity market? If distributors were to play an active role in the wholesale market, what steps, if any, can be taken to mitigate any associated risks?
- What measures should be expected of distributors to ensure fairness and confidence in any markets they administer?
- What requirements should apply to the segregation of business functions and activities to support competition, minimize conflicts and protect consumers' interests?

- What arrangements and expectations are likely to provide optimal flexibility to adapt approaches and roles as conditions change?

Examining these questions should enable the identification of preferable combinations of roles and functions for sector entities. At the same time, this work would also be expected to identify whether any legislative or regulatory changes would be required to enable distributors or others to take on new roles that may be desirable.

This stream of work would also examine requirements and supports that are necessary for delivery of DSO capabilities on a shared basis, including assessments of the benefits of a common platform. As DNV noted in its report, it is possible that many electricity distributors would not have the capability to become a DSO in the near term. Staff believes it is also likely some distributors have the technical capability but face circumstances where they could not carry out DSO functionalities in a cost-effective manner. One way to address that issue is for some distributors that develop DSO capabilities to provide DSO services to other distributors (i.e., DSO-as-a-service). As discussed earlier in this paper, this approach may facilitate expanding the scope of DSO functionalities across the province in a cost-effective, and possibly timelier, manner.

5.3 Engaging Stakeholders to Ensure the Right Path for DSO Evolution

The approach set out above ensures that DSO implementation is guided by demonstrated need while maintaining flexibility to adapt to changing circumstances. By adopting an evolutionary, evidence-based approach, the OEB can support the development of DSO capabilities in a manner that considers Ontario-specific circumstances and minimizes the risk of stranded investment.

The goal of this approach is to start with what analysis suggests is the most cost-effective option – simplified DSO model – as the default, with the flexibility to transition to more advanced and costly models in the future when the conditions enable robust flexibility markets to emerge and mature. It also allows for more advanced models where distributors can demonstrate it is cost-effective to implement. The approach further leverages DSO-as-a-service to achieve economies of scale and reduce duplication.

Ultimately, the objective of this consultation is to ensure that when DSO capabilities are needed to maximize DER benefits for customers, distributors and other sector participants have a clear understanding of:

- The legislative and regulatory changes that may be required to enable certain DSO capabilities or activities;
- What distributors are permitted, prohibited, expected and required to do in relation to DSO activities, including the evidence required to support proposals for grid modernization and DSO-related investments in rate applications;
- How costs related to DSO activities will be recovered, including cost responsibility and considerations related to rate-setting, utility remuneration and performance incentive mechanisms;
- The conduct rules and requirements associated with DSO activities to ensure fair and competitive DER/A participation and appropriate consumer protection; and,
- The implications of introducing DSOs for existing processes and requirements, such as regional planning.

By enhancing DSO capabilities, Ontario can support its broader efforts to adapt to evolving energy needs, integrate DERs and ensure that the distribution network is equipped to meet future challenges while maintaining reliability and affordability.