Principles Guiding the Transformation of the Energy System in Ontario

July 2021

ENERGY TRANSFORMATION
NETWORK OF ONTARIO

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1. Introduction

Energy Transformation Network of Ontario Overview

The Energy Transformation Network of Ontario (ETNO), formerly the Ontario Smart Grid Forum, is a group of senior leaders from across Ontario's utility, non-utility solution providers, business and non-profit organizations, government agencies and universities, working together to drive a more efficient, affordable energy system in Ontario.

ETNO's primary objective is to guide the transformation taking place in Ontario's energy sector and to seek to optimize outcomes for the benefit of all Ontarians by influencing tangible policy, market and regulatory enhancements with near- and long-term benefits.

The energy sector in Ontario is undergoing significant change. ETNO's work is driven by a recognition that Distributed Energy Resources (DERs) and new structural models for organizing the sector are all challenging foundational notions of market boundaries, industry roles and responsibilities. Enhanced data and analytical capabilities, advanced transportation technology, environmental policy and other technological changes outside of the energy sector are also having an increasing impact on the energy system. To ensure that these innovations are integrated into existing energy systems in a way that enhances consumer choice, reliability and cost-effectiveness, new approaches to policy-making, regulation and energy markets will be needed.

ETNO is supported by the Corporate Partners Committee (CPC), with representatives from more than 50 public and private sector organizations active in the smart grid space – including, electric vehicle interests, energy retailers, energy management companies, systems integrators and equipment manufacturers.

ETNO and the work produced is supported by a Working Group. Additionally, this year ETNO is supported by MaRS Discovery District which provides support in coordination, facilitation and execution of ETNO and Working Group meetings.

The list of ETNO and Working Group members is in Appendix A for reference.

This report represents the advice of ETNO as a whole. It is not meant to represent the position or opinions of individual members or their organizations. Accordingly, the positions and opinions of members and their organizations may not be reflected in the report, which is without prejudice.

The Sprint Approach

In keeping with the objective of providing tangible recommendations to decision makers to optimize outcomes for all Ontarians, and in order to make measurable progress on key sector level challenges, ETNO focuses its work on discrete topics. As such, ETNO's work for 2021 is following a sprint approach. A sprint is a short, time-boxed period when a team works to complete a set amount of work. In 2021, ETNO will complete two sprints on topics deemed to have high impacts on Ontario's energy sector. Sprint 1 took place from January-June, and Sprint 2 is planned from July-December. This approach, supported by the stakeholders and decision makers involved, enables ETNO to provide relevant and timely recommendations for Ontario's energy sector.

Sprint 1 Focus Area – Principles Guiding the Transformation of Energy System in Ontario

The focus for Sprint 1 was determined following ETNO's discussion with the CEO of the Ontario Energy Board (OEB), the CEO of the Independent Electricity System Operator (IESO), and the Deputy Minister of Energy, Northern Development and Mines (ENDM) in December 2020. The focus of Sprint 1 is on the following question:

> *"What principles, such as consumer outcomes, should direct the transformation of the energy system in Ontario?"*

Sprint 1 also includes research components to provide context to this question. This research includes:

- A Jurisdiction Scan to identify how other geographies are approaching the allocation of roles and responsibilities required for Distributed Energy Resource (DER) integration.
- A layout of the various DER engagements already underway in Ontario, issues/gaps to be addressed in each, and how roles and responsibilities are ultimately allocated.

Report Structure

ETNO developed a set of principles intended to guide decisions and choices made by policy makers, regulators and market operators as they relate to the energy sector in Ontario. This does not mean that decision makers will always be aligned on what's been captured in this report. Conversely, if areas of agreement and disagreement are known, it will lead to more transparent and intentional decision making.

This report outlines the principles that will enable an equitable and customer-centric transformation of the energy system in Ontario. The following items are included in this report, for use as specified:

Section 2A: Overview of The Principles and Categories

- Purpose: visual summary of the 10 principles and associated categories, representing the relation between principles.

Section 2B: Principle Definitions and The Guiding Questions

- Purpose: definitions of the 10 principles and corresponding guiding questions intended to help decision-makers consider the impact of these principles on different choices they make.

Section 3: Next Steps

- Purpose: outlines the focus area that ETNO intends to undertake in Sprint 2.

Research components that informed the discussion on principles are outlined in Appendix B and C, respectively.

2. Principles Guiding the Transformation Of Energy System In Ontario

A. Overview of The Principles And Categories

ETNO identified 10 principles to guide the development of the energy system in Ontario. These are summarized in Figure 1, The Energy Wheel. The 10 principles are divided into four categories namely Customer, Energy Network, Governance and Society. While all principles and their corresponding categories are interrelated, ETNO views the customer as the core stakeholder group, which the energy system in Ontario serves. Therefore, the Customer category is purposefully placed at the center of the Principle Wheel. This reflects the ETNO perspective that the customer should be at the center of all decisions, and that their buy-in is needed for a successful energy sector in Ontario.

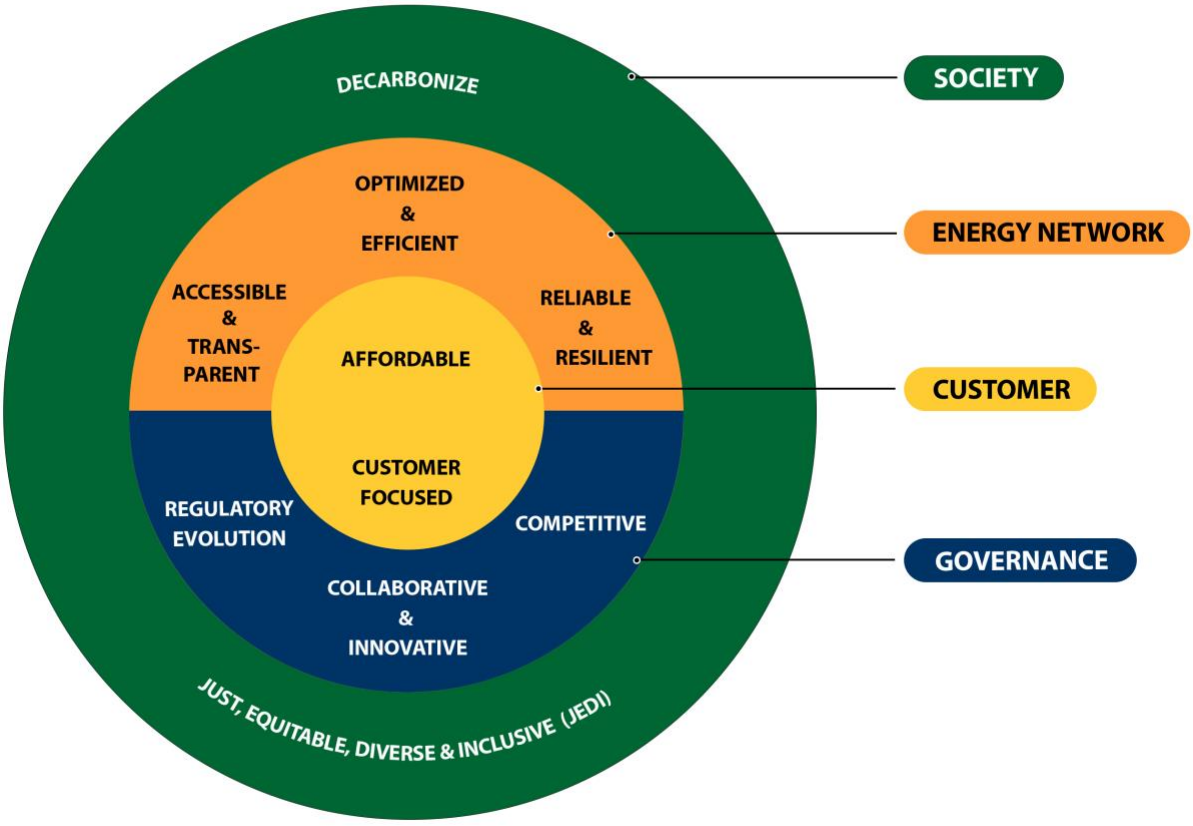

Figure 1. The Energy Wheel: A decision-making framework to guide choices (policies, regulations, or projects) related to the transformation of the energy network in Ontario.

B. Principle Definitions and Guiding Questions

This section outlines the definitions of the 10 principles and corresponding guiding questions. The guiding questions are intended to spark discussion and assist decision makers in understanding the impact of a particular principle on a 'choice' they may consider with regards to energy sector transformation. A 'choice' can be a decision or a series of decisions around a policy, regulation or project. The decision-maker may see these principles as in conflict or healthy tension from time to time, at which point they may need to make value judgements.

In identifying and discussing the 10 principles guiding the energy system transformation in Ontario, overarching considerations were identified, including:

- Customer needs are heterogeneous and vary by type, size, and sector (e.g. residential, commercial and industrial, municipalities, universities and hospitals, small businesses, government facilities). The services provided to customers should reflect the needs of their particular segment.
- 'Affordability' is one of the 10 principles that have been identified. The impact of any choice on 'Affordability' needs to be considered across all principles. There will inevitably be trade-offs against some or all of the principles in any choice.
- Enabling frameworks (e.g. regulations, policies, market structures) are required to implement the choices that are being made. Implementation of desired choices, in absence of these frameworks, is not possible.
- Transparency and accessibility should be prioritized at all stages of a decision-making process, including consultations and communication, for all customer types. Transparency is sometimes traded-off in favor of speed, however, it often results in reduced access and buy-in.
- When considering costs and benefits of a given choice, the time horizon for evaluation should include both the short- and the long-term impacts. Long-term time-horizon refers to an asset life-cycle (which may be 50+ years), as well as intergenerational impacts. Choices with a long-term life cycle can result in high costs and lost opportunities from a new/improved technology perspective.
- The Energy Network, as mentioned in this report, refers to the traditional electricity grid, including variations such as microgrids, as well as the gas network.
- The numbering of principles does not represent prioritization or order of importance, rather it is a codification system for ease of reference.
- The language of this report intentionally frames the focus as the "energy" rather than "electricity" system in order to account for all aspects of energy infrastructure and not just electricity-related elements.

Principle # 1: Affordable (Customer)

Definition

- Affordable is defined as the entirety of costs (without cross-subsidization) associated with the service, regardless of specific rate structure or breakdown.
    - Affordable for all customer types regardless of their location or demand size.
    - Cross-subsidizing includes sharing costs across customer classes as well as with future customers (intergenerational costs).
    - Consider alternative methods other than cross-subsidization to ensure customers in underprivileged communities have access to affordable and reliable service.
    - The best overall value for the price that is paid, while maintaining appropriate standards of system security and reliability, and ensuring cost-effective integration of DERs and other emerging solutions.

Guiding Questions

A. How does this choice impact customer rates, bills and ability to pay for all customers?
B. How does this choice provide customers with the best value for their money?
C. What are the costs (e.g. financing, payments, support) and benefits associated with this choice? How are they impacting different stakeholders (customers, utilities, etc.)? Who is responsible for the costs?

Principle # 2: Customer Focused (Customer)

Definition

- Customer focused is defined as decision making that is oriented towards evolving customer experience, customer communication and customer control (e.g. through flexibility of payment methods, increased customer choice etc.).
    - Decisions are made that demonstrate the best value to customers based on their evolving needs, and includes processes for understanding these needs in real-time.
- Customer focus encourages transparency and engagement with customers, to enhance their understanding of the energy system, and to incorporate their voice in decision making.

Guiding Questions

A. What outcomes does this choice deliver to customers?
B. How is the information about the decisions shared with the customer? How has the customer been engaged in considering this choice?
C. How does this choice balance and respond to different customer needs, now and in the future?

D. How are the trade-offs between customer value and utility returns balanced?

Principle # 3: Accessible and Transparent (Energy Network)

Definition

- Accessible and transparent is defined as ensuring and encouraging fair and equitable access to markets for all customers and resource types. This includes managing undue market participation requirements to increase accessibility.
- Accessible refers to predictable and equitable access to energy across all customer types and locations.
- Access to data and supporting infrastructure is made available in a secure, accurate and timely manner, to all energy system stakeholders, while protecting their privacy.
    - In data collection and sharing, interoperability of standards across different vendors as well as stakeholders is considered, and privacy and cybersecurity requirements are addressed.
    - See ETNO's previous *Recommendations for Improving Access to Data* report (2020) for more precedent on this topic.
- Transparent refers to open sharing of information and increasing awareness. This includes data, market signals and other communication that enables equitable access to the energy network and market. It also includes opportunities for providing new services regardless of stakeholder type (e.g. traditional vs. non-traditional players).

Guiding Questions

A. How does this choice provide equitable access to the energy network, markets, and/or funding (innovation or other) opportunities?

B. How does this choice enable transparency and interoperability as it relates to data collection, access and use?

C. How does this choice enable and enhance equitable access to energy for all customer types?

Principle # 4: Optimized and Efficient (Energy Network)

Definition

- Optimized and efficient is defined as the most cost-effective use of energy resources on a life-cycle basis.
    - Viable innovative solutions are leveraged, where feasible, to provide energy network and economic efficiencies.

    - Different DER technology types having different characteristics are considered. These considerations are technical or socio-economical, and may impact adoption and implementation.
- Grid efficiency includes the seamless integration and operation of electricity grid assets (traditional and non-traditional), regardless of ownership, in order to achieve the desired system objectives.
- Short- and long-term impacts are considered in every choice to enable adaptive response to changing circumstances. This includes awareness of how short-term decisions lock in or preclude the opportunity for future decisions. For example, not being able to procure a new and cheaper/less carbon-intensive solution for power generation in the future that did not previously exist.

Guiding Questions

A. How does this choice impact system costs and revenues in the short- and long-term? How does the choice impact future decisions (e.g. is the current choice locking us into future long-term decisions that will impact cost and benefits)?
B. How does this choice balance trade-offs between short- and long-term costs/benefits as they relate to enhancing grid efficiency optimization, and adequacy?
C. How does this choice optimize the use of existing and new assets (traditional and non-traditional) immediately and over the asset life cycle?

Principle # 5: Reliable and Resilient (Energy Network)

Definition

- Reliability is ensuring that resources are available and deployable to provide customers with a continuous supply of energy.
    - Reliability and resiliency are a fundamental expectation of Ontario's energy system, at the transmission and distribution level.
    - Reliable supply accounts for any sudden disturbances, while ensuring sufficient power quality and safety, based on customer needs.
    - Customer expectations and needs are heterogeneous, some may have a higher willingness to pay for reliability and power quality, than others.
    - Interconnections to neighbouring jurisdictions are considered to support resiliency, and accounted for in the planning process.
- Reliable and resilient choices account for the increasing extreme weather events (heat, cold, extreme precipitation, drought, storms, wildfires, hurricanes) and their impacts on the energy network and service.
- Resilience is not just about lessening the likelihood that these outages will occur. It is also about limiting the scope and impact of outages when they do occur, restoring power rapidly

afterwards, and learning from these experiences to better deal with events in the future (Source: Enhancing the Resilience of the Nation's Electricity System in The National Academies Press).

Guiding Questions

A. How does this choice affect reliability, resiliency and safety across the entire system?
B. How does this choice help improve cybersecurity across the entire system?
C. How does this choice consider contingencies for disruptive events to the energy network (like extreme weather, pandemics, or black swan events)?

Principle # 6: Competitive (Governance)

Definition

- Competitive is defined as the provision of an open, transparent, fair, and predictable market which is essential for attracting new capital for financing options.
    - An open, transparent, fair and predictable market is essential to attracting cost-effective or lowest costs for capital (to ensure that decisions result in financeable options), which is needed to ensure lower costs to end consumers.
    - Competitive market enables meeting evolving system need, improving customer outcomes and enhancing Ontario's competitiveness at a global scale.
    - Increased participation in the energy market is an indicator for success.
    - System includes both the transmission and distribution system.
    - Currently, not all stakeholders and resources have equal opportunities to participate in the market (e.g. due to differences in generation capacity, stakeholder type, traditional vs. non-traditional assets etc.). A competitive market enables equal access and participation.
    - Competitiveness is enabled through an open market construct that is resource and technology agnostic, and offers a level playing field for all participants.

Guiding Questions

A. How does this choice promote or inhibit open, transparent, fair, and predictable competitive opportunities?
B. How does this choice create and promote an enabling environment for investment?
C. How does this choice promote Ontario's competitive advantage in a global context?
D. How does this choice enable implementation of "technology agnostic" solutions?
E. What industry structure will best promote consumer welfare (lower prices, better service, and reduced carbon emissions) given changes in technology?

Principle # 7: Collaborative and Innovative (Governance)

Definition

- A collaborative framework encourages an integrated approach to planning and developing the energy system.
    - Integrated planning accounts for: gas, electricity, transmission and distribution system, traditional and non-traditional players, and aligning across jurisdictions.
- As the energy network modernizes, stakeholders' roles (both traditional and non-traditional) are evolving. Purpose-led innovation and collaboration that serves customers and the energy network is incentivized amongst different stakeholders.
    - Proof-of-concept projects consider a pathway for scaling from the onset.
    - Collaboration amongst stakeholders on proof-of-concept projects enables resources to be utilized more efficiently, and allows development of solutions with consistent standards and interoperability requirements.

Guiding Questions

A. How does this choice incentivize collaboration between different stakeholders? What structures will enable this collaboration? Is there alignment between innovation efforts, to ensure a common, coordinated, and efficient allocation of research & development and commercialization efforts without duplicating those efforts?
B. How does this choice encourage open innovation (in hardware, software, systems, processes, services, standards, pricing, etc.)?
C. What is the value proposition of the proposed innovation for stakeholders across the value chain? Is the value proposition well understood?
D. Does this choice enable/consider a pathway to scale beyond proof-of-concept (e.g. piloting)? What structures will enable implementation of the pathway to scale solutions?
E. Do government decisions account for all aspects, and not just the bulk component of the system?

Principle # 8: Regulatory Evolution (Governance)

Definition

- Regulatory evolution is defined as the process by which the rules that govern the energy system are modernized in a timely manner to serve the public interest and attract capital/investment.
    - Regulatory evolution is aimed at upholding the public interest, meet energy system needs and attract investment in the face of transformative change
    - Regulatory evolution is pragmatic, collaborative, focused on customer outcomes, and void of unnecessary red tape.

    - Regulatory evolution balances the needs of innovation with other competing considerations such as affordability, as well as the trade-offs associated with short- and long-term costs and benefits.
    - Regulatory evolution considers the emergence of business models of traditional and non-traditional players, while only establishing rules and policies to the extent necessary.
    - Regulatory evolution is informed by democratic imperatives, such as the decarbonization of the energy system.
- Regulatory evolution includes closing the existing gap between policy and regulations, while recognizing that policy changes are inevitable with changing political landscape.

Guiding Questions

A. How does this choice respond to changing needs and demands from stakeholders (customers, energy network service providers including traditional and non-traditional players) and the market? Is this regulatory process transparent and participatory?
B. How is this choice able to withstand changing political landscapes?
C. How does this choice align with public policy commitments in order to close the gap between policy and regulations? Have the appropriate regulatory frameworks been considered for implementing this choice?
D. How does this choice promote policy and regulatory predictability to enable longer-term decision making?

Principle # 9: Just, Equitable, Diverse, & Inclusive (JEDI) (Society)

Definition

- JEDI is defined as organizations and systems that reflect the diversity of Ontario's society.
    - This includes diversity in the industry at all levels from decision-makers to the front-line workforce.
    - This includes enabling frameworks that enable the diverse workforce to be successful in their respective roles.
    - Improved outcomes include equitable access to energy as well as associated societal benefits that come with it.
- Justice is included in this definition to acknowledge the opportunity to leverage the capacity of all government and regulatory agencies to make a meaningful contribution as it pertains to meeting the needs of all communities, including those identifying as black, Indigenous and people of color (BIPOC).
- Decisions factor in equality of outcomes, enable collaboration and operation across jurisdictions and municipalities in Canada, and acknowledge changing global norms for JEDI.

- Choices consider the Gender and Diversity Analysis frameworks that have been implemented by the Ontario Public Service and Canadian Federal government.

Guiding Questions

A. How does this choice promote equitable access, and opportunity (e.g. for front-line workforces, or for those participating in the market)?
B. How does this choice address challenges and systemic barriers, and enable participation from underprivileged communities?
C. How does this choice enable representation from diverse stakeholders?
D. How does this choice uphold the justice and equity goals set out in public policy (including with regards to the Indigenous community)?
E. Are there specific targets in place (for ratepayer-based and other regulated organizations) to ensure that responsibility is properly distributed to ensure accountability?

Principle # 10: Decarbonize (Society)

Definition

- Decarbonize is defined as achieving Canada's commitment to achieve net-zero emissions by 2050, and reducing emissions by 40-45% by 2030 compared to 2005 emission level.
- Decarbonization goals are at the forefront of decision-making in the energy sector, and all decisions align with municipal, provincial/regional, and federal targets.
  - Includes decisions affecting the environment.
  - Decarbonization goals are achievable and account for all necessary trade-offs.
  - Decarbonization goals account for Canada's commitment and role in reducing emissions in the global context.
  - Currently the provincial and federal goals and commitments do not fully align, causing uncertainty for decision makers in Ontario to make long-term choices.
  - Furthermore, the energy sector may have to respond quickly to policy decisions made at municipal, provincial, and federal levels.
- Decisions associated with implementing decarbonization goals factor immediate and long-term (including intergenerational) costs of inaction on climate change, and balance that with feasibility of implementing these targets over a defined period of time.
- Capabilities in decarbonization generate economic opportunities that leverage the economy in Ontario.

Guiding Questions

A. How does this choice incentivize or help achieve reduction of carbon emissions?
B. How does this choice align with broader climate targets (community, provincial, federal, global) around net zero emissions?

C. How does this choice balance short-term and long-term (including intergenerational) costs associated with climate change? Does this choice consider the cost and opportunities of the energy network as a whole (i.e. the net benefit for the net cost in the network)?
D. How do emission reduction targets (at all levels of government) align with customers' aspirations?

3. Next Steps

This report will be presented to the CEO of the OEB, the CEO of the IESO, and the Deputy Minister of the ENDM for their review and consideration. ETNO will incorporate feedback from these stakeholders as it embarks on the work for Sprint 2.

The intended focus of Sprint 2 is on addressing the energy network challenge of *"need for a robust market structure(s) and supporting regulatory framework, at a distribution and transmission level, that aligns with the 10 principles, and enables energy network modernization and enhancing customer outcomes*". Addressing this challenge area will build upon the work done by ETNO in 2020. This challenge has also been identified as a key area that if addressed, will enable development of Ontario's energy system in accordance with the principles identified in this report.

In Sprint 1 ETNO discussed multiple energy network challenges that need to be addressed. These include, but are not limited to:

- Clarifying Ontario's ambitions on climate change and the future of energy
- Increasing transparency and inclusion on processes for all decisions impacting the future of energy in Ontario
- Enhancing the clarity as it relates to the roles and responsibilities of decision-makers and stakeholders in Ontario's energy sector
- Increasing collaboration amongst stakeholders in Ontario to develop and utilize common technical standards

While the above-mentioned challenges will be considered during Sprint 2, they will not be the key focus. The above is not an exhaustive list of energy network challenges, rather an overview of some of the key ones that were discussed by ETNO.

4. Appendix

Appendix A: ETNO and Working Group Membership

ETNO's membership includes:

- David McFadden, President & CEO, Generation 4 Capital Corporation *(Chair)*
- Ron Dizy, Co-Founder & Managing Director, Red Jar Capital *(Vice-chair)*
- Alexandre Prieur, Director, Renewable Energy Integration, CanmetENERGY
- Anthony Haines, President & CEO, Toronto Hydro
- Brad Carr, President, Canada, Mattamy Homes
- Brian Hewson, Vice-President, Consumer Protection and Industry Performance, Ontario Energy Board
- Carlyle Coutinho, President & COO, Enwave
- Chris Carradine, Executive Vice President, Business Development, Ecobee
- Chris Ireland, Managing Director, Infrastructure and Natural Resources, Greenfield Investments and Renewables, Ontario Teachers' Pension Plan
- Cynthia Hansen, Executive Vice President & President, Gas Distribution & Storage, Enbridge Gas Distribution
- David Collie, President & CEO, Electrical Safety Authority
- David Lebeter, Chief Operating Officer, Hydro One Inc.
- Dr. Jatin Nathwani, Executive Director, Waterloo Institute for Sustainable Energy, University of Waterloo
- Jeff Lehman, Mayor, City of Barrie
- John Avdoulos, President and CEO, Essex Power Corporation
- Katherine Sparkes, Director, Innovation, Research & Development, IESO
- Linda Wainewright, Vice-Chair, Corporate Partners Committee, ETNO
- Mark Fernandes, Chief Information & Technology Officer, Hydro Ottawa Limited
- Matthew Sachs, Chief Operating Officer, Peak Power
- Mike Smith, Director, Distribution and Agency Policy Branch, Strategic Network and Agency Policy Division, Ministry of Energy, Northern Development and Mines
- Nicholas Pender, Vice President of Energy Markets, Ontario Power Generation

- Paul Grod, President & CEO, Rodan Energy Solutions
- Steven Muzzo, Chairman, President & CEO, Ozz Clean Energy, Ozz Electric
- Tyler Hamilton, Director, Cleantech Ecosystem and Capital, MaRS Discovery District
- Neetika Sathe, Vice-President, GRE&T Centre, Alectra Inc.
- William Milroy, Vice-President, Engineering & Operations, London Hydro

ETNO's Working Group for Sprint 1 includes:

- Alex DeLange, Advisor, Operations & Reporting, Enbridge
- Ammar Nawaz, VP, Distributed Energy Solutions (DES), Alectra Inc.
- Andrew Yang, Director, Market Strategy & Innovation, Bullfrog Power
- Anjali Wadhera, Smart Grid Research Officer, NRCan
- Charles Berndt, Manager, Grid Technology, Hydro Ottawa
- Charles Layton, Director, Corporate Business Development & Strategy, OPG
- Chris Carradine, Executive Vice President, Business Development, Ecobee
- Dervla Murphy, Senior Policy Advisor, Ministry of Energy, Northern Development and Mines
- Estefan Apablaza-arancibia, Research Officer, NRCan
- Geri Yin, Head, Grid Innovation, GRE&T Centre, Alectra Inc
- Greg Van Dusen, Director of Regulatory Affairs, Hydro Ottawa
- Ian McCarter, Manager, Business Development, MaRS Discovery District
- Imran Noorani, Chief Strategy Operator & Late Founder, Peak Power
- Justin Ngomsi, Senior Manager, Operating Engineering & Performance Reporting, Hydro One
- Kaleb Ruch, Manager of Government Relations, Toronto Hydro
- Mario Chiarelli, Chief Technology Officer, Cricket Energy
- Moeen Salibe, Senior Director, Smart Operations & Optimization, Enwave
- Rachele Levin, Innovation Sandbox Lead, OEB
- Ryan Boudreau, Manager, Protection and Automation, Hydro One
- Raubia Elahi, Regional Sales Director, Bullfrog Power
- Ryan Zade, Team Lead, Ministry of Energy, Northern Development and Mines
- Shawn Peterson, Senior Account Manager, Ecobee

- Zoran Stojanovic, Director, Information Services, London Hydro

Appendix B: Jurisdiction Scan

This appendix provides an overview of DER deployment and associated principles in the following jurisdictions:

- Australia
- United States – California
- United States – Massachusetts
- United States – Department of Energy
- United Kingdom

A. Australia

Australia is a world leader in DER deployment. Figure 2 below shows the decentralized ratio of Australia compared to other jurisdictions.

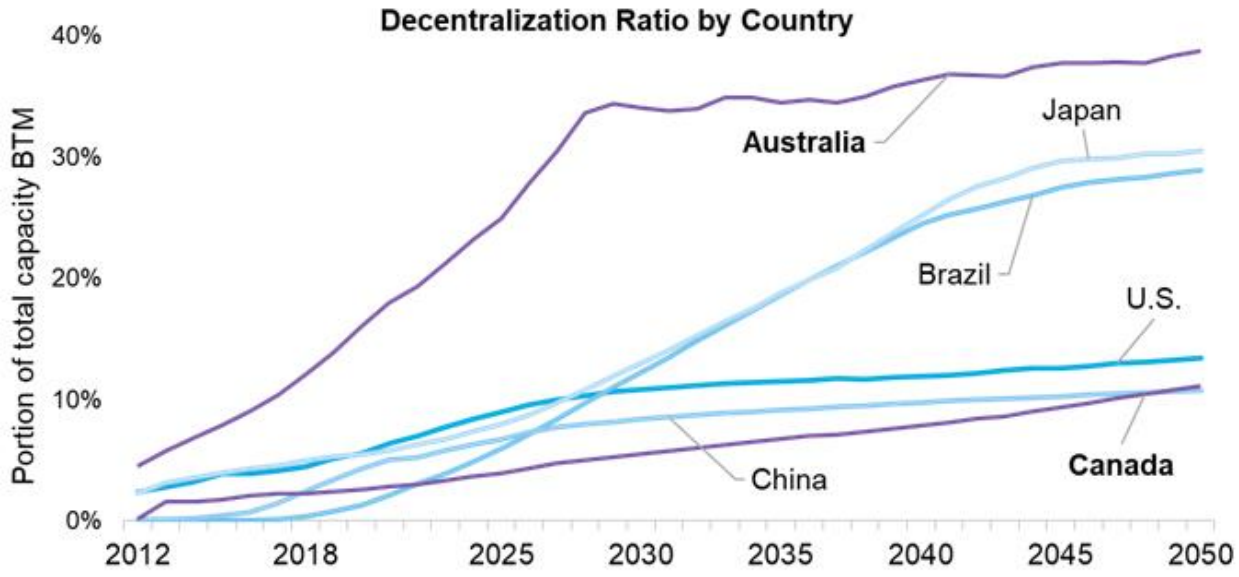

Figure 2. DER deployment in Australia compared to other jurisdictions Source: Bloomberg New Energy Finance

**Note: Decentralization ratio is the ratio of non-grid-scale capacity (small-scale PV, batteries and demand response) to total installed capacity.*

By 2030, the Australian Energy Market Operator (AEMO) expects 50% of consumers to have either solar Photo Voltaic (PV) or controllable load; and at times distributed generation may constitute up to 90 per cent of load across the National Electricity Market (NEM).

The Energy Security Board (ESB), created by the Ministers of Energy, has been proactive in facilitating DER adoption through unified objectives and planning with the AEMO, Australian Energy Market Commission (AEMC), and Australian Energy Regulator (AER). ESB published a 'DER Integration Roadmap', outlining a three-pronged approach:

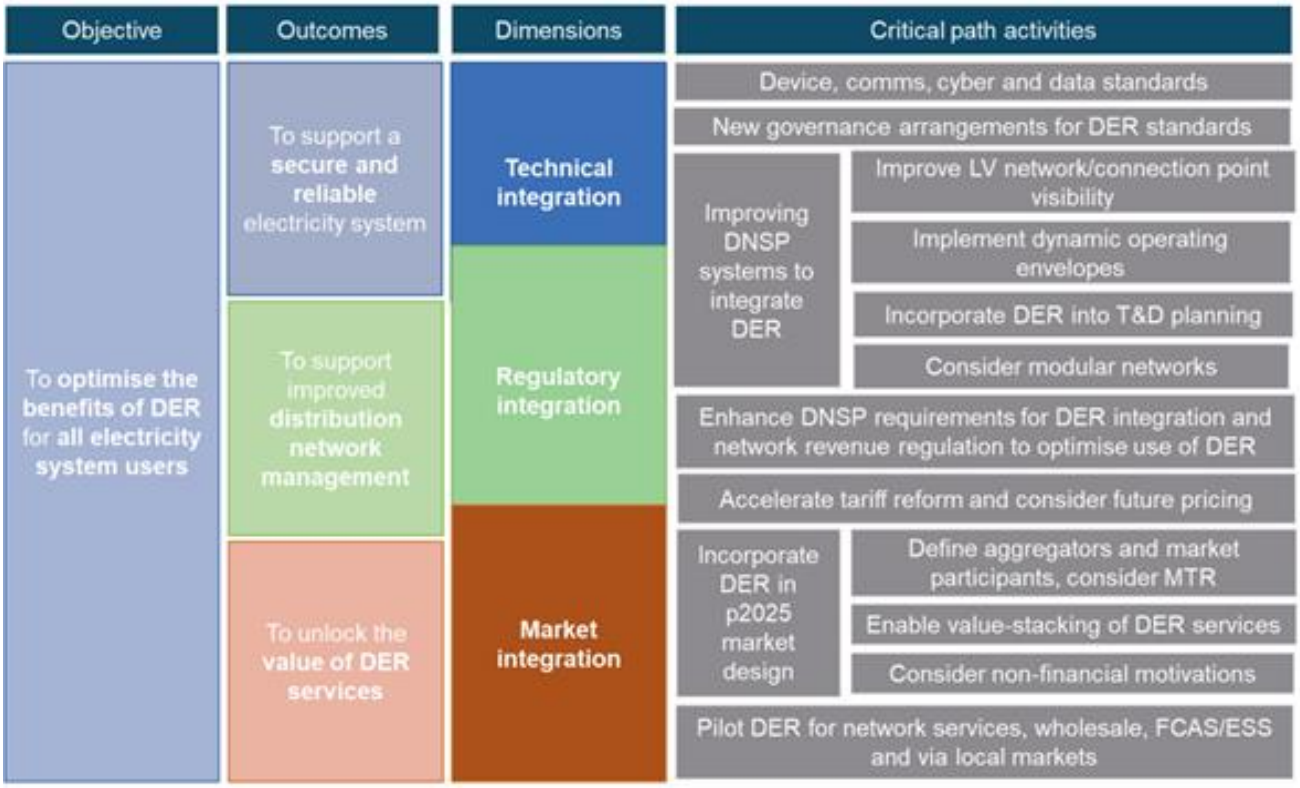

Figure 3 DER Integration Roadmap

Principles used to inform the development of the Australian electricity system:

1. Market Integration

- Determined DERs will be valued and regulated equivalently with conventional resources.
- Designing rules to enable aggregators to participate in various markets
- Enabling the value-stacking of DER services
- Integrating non-financial incentives to provide DER services
- Using DERs to provide network services, such as DNSPs in AER's DMIS

2. Technological Integration

- Created a DER Standards Governance Committee
- Improved device interoperability
- Higher temporal data resolution and system control
- Incorporate DER into T&D planning

3. Regulatory Integration

- Rule changes are enabled through a versatile rule change process administered by the AEMC, allowing any stakeholder to request rule changes at any time, with a prescribed timeline for response.
- Enabling inclusivity of the DNSPs as the dispatch authority
- Exploring a remuneration framework based on the quality of services delivered in lieu of TOTEX.

The applicability of the Australian Energy System for Ontario:

- Australia's grid, relative to Canada's, is considerably less fragmented by coming together under collective entities overseeing the country as a whole; whereas much of Canada's energy policy is addressed on a provincial level.
- Key lessons:
    - Prescribed timelines for Rule Change processes are approachable by any stakeholder in the system (in contrast to the Rule Change process currently set up through the IESO, which is reportedly technically costly and time consuming to pursue).
    - All Australian entities share the same objectives and outcomes of the system, allowing alignment for all stakeholders involved.
    - Australia's roadmap for DER integration provides a comparable framework to consider for Ontario's planning purposes.

Reference:

- Energy Security Board DER Integration Roadmap and Workplan

B. United States - California

California has nearly 5 GW of DERs, with projections showing they may have 13.5 GW by 2025.[1] The ability to use embedded metering - via telemetry / runtime data - from DER's in the residential space helps to eliminate key barriers for accessibility and scale participation. This data helps to verify and reliably estimate load reduction for applicable programs and bidding capacity into wholesale markets.

An example of this is highlighted in California where as of April 2021, the Public Utilities Commission of the State of California (CPUC) accepted[2]San Diego Gas and Electric's (SDG&E's) proposal to:

- Pursue emergency agreements with device manufacturers to signal existing installed thermostats that are not in an existing DR program to secure additional load reduction.
- Offer a reasonable incentive, consistent with the guidelines described by SDG&E, to these manufacturers for increasing the number of participating thermostats, will result in

[1] https://www.greentechmedia.com/articles/read/unlocking-californias-gigawatt-scale-distributed-energy-potential
[2] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M369/K286/369286360.PDF

increased participation and lead to decreased peak and net peak load during times when this program is triggered.[3]

The proposal highlights that SDG&E will use a pre-approved list of device manufacturers participating in their Demand Response (DR) program where load reduction has been effectively demonstrated. Beyond this, SDG&E will accept aggregated device data (i.e. telemetry / runtime) to demonstrate that load reduction has occurred during California Independent System Operator (CAISO) stage 2 or 3 alerts or a SDG&E local emergency.

C. United States - Massachusetts

The Massachusetts Clean Peak Energy Portfolio Standard (CPS) is designed to provide incentives to clean energy technologies that can supply electricity or reduce demand during seasonal peak demand periods established by the Massachusetts Department of Energy Resource (DOER). As per the Standard:

> *"A Clean Peak Resource shall meter and report fifteen (15) minute interval performance in compliance with standards and protocols as established by a third-party Program Administrator designated by the Department."*
>
> *"Demand Response Resources must demonstrate that changes to electric usage from their normal consumption patterns are measurable and verifiable"*[4]

This is another example of allowing residential resources to utilize embedded metering to demonstrate quantifiable load reduction. This rule reduces participation barriers and provides residential customers with an accessible avenue to participate in the Clean Peak Energy Standard using load management tools such as smart thermostats.

D. United States - Department of Energy

The U.S Department of Energy (DoE) is currently establishing a national standardized Measurement and Verification (M&V) protocol for energy efficiency and demand response program evaluation, named the Uniform Methods Project (UMP). Thermostat telemetry data is being viewed as acceptable for M&V purposes in this standard. Specifically, in section 4 of the draft protocol[5], the DoE supports the use of runtime data as appropriate for M&V by stating:

[3] https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/R2011003/3373/363790630.pdf
[4] https://www.mass.gov/doc/clean-peak-demand-response-resource-guideline/download
[5] Protocol available upon request via National Renewable Energy Laboratory (NREL) https://www.nrel.gov/ump/

> *"As residential electricity demand for space heating and cooling often contributes significantly to peak demand, administrators of smart thermostat programs may want to estimate the peak energy savings from smart thermostats. To estimate accurately the energy savings for the utility's peak hour(s), evaluators should collect and analyze hourly or sub-hourly electricity consumption or thermostat runtime data using the methods for thermostat replacement programs or optimization programs described previously in this chapter." (pg. 14)*

A standard protocol for M&V established by the DoE should help to provide clear, accessible, step-by-step methods to determine savings and evaluate performance of demand side resources across programs in the United States. This has a direct impact on reducing participation barriers across markets and encouraging equitable participation from residential, behind the meter resources.

E. United Kingdom (UK)

Background

The Energy Networks Association's (ENA) Open Networks Project (ONP) is a major energy industry initiative that is helping the UK meet its 2050 goal of net zero emissions by enabling a smart and flexible grid through the development of policies and implementation plans around opening up new markets for customers to provide services with their DERs, and building an inclusive energy system, while reducing costs for consumers through more cost-effective planning.

A five "Future Worlds" have been developed, representing different market, organizational and operational structures to access and utilize flexible DERs to operate the transmission and distribution systems; the Worlds were also differentiated by the respective responsibilities of the Distribution System Operator (DSO), Electricity System Operator (ESO) and other participants, the role of reformed network access rights and price signals, and the possibility of greater independence in certain system operation functions.

UK Future Grid

World B is the future grid scenario the UK is currently transitioning into. World B market structure and participant roles and responsibilities as follows:

- World B Description: The ESO directly procures flexibility resources connected to the distribution network for electricity transmission system balancing purposes in active collaboration and coordination with the DSO. The DSO procures flexibility resources connected to the distribution network for distribution networks constraint management in active collaboration and coordination with the ESO. The DSO and ESO cooperate to perform a coordinated dispatch of the distributed flexibility resources, procured by the DSO and ESO

during their respective procurement activities, ensuring that concurrent transmission and distribution network service requirements are met.

- Market Design: There is a central ancillary services market for flexibility resources connected at the transmission and distribution networks that is organized and operated by the ESO. There is a regional market for flexibility resources connected at the distribution network that is facilitated by the DSO of the respective geographical region. This market arrangement seeks to provide and coordinate parallel routes to market for distributed flexibility resources.
- ESO Role: The ESO organizes and operates the central market for ancillary services and is responsible for balancing the electricity transmission system. Thus, the ESO directly procures and activates flexibility resources connected to the transmission network for balancing the electricity transmission system. The ESO directly procures flexibility resources connected to the distribution network for transmission system management and for energy balancing in collaboration and coordination with the DSO. The ESO actively collaborates with the DSO to facilitate a coordinated procurement and activation of distributed flexibility resources through the active exchange of information in order to maximize synergies between transmission and distribution network service requirements and minimize potential conflicts associated with the delivery of concurrent flexibility services. The ESO (i.e. via the TO) offers flexibility services to the DSO from its portfolio of smart grid network solutions (i.e. network asset-based solutions).
- DSO Role: The DSO is responsible for the development and operation of the electricity distribution network following an active network management approach. The DSO facilitates a regional flexibility services market for flexibility resources connected to the distribution network. The DSO directly procures flexibility resources connected to the distribution network for distribution network management, in active collaboration and coordination with the ESO, via the regional market for flexibility resources. The DSO cooperates with the ESO to perform a coordinated dispatch of the distributed flexibility resources that have been procured by the ESO and DSO during their respective procurement activities. Hence, the DSO actively collaborates with the ESO to deliver a coordinated procurement and activation process of distributed flexibility resources that identifies synergies between transmission and distribution network service requirements and meets concurrent transmission and distribution network service needs, respectively. The DSO offers flexibility services to the ESO from its portfolio of smart grid network solutions (i.e. network asset-based solutions).
- Aggregator/supplier/local energy system role: The aggregator / supplier combines different flexibility resources connected at the distribution network and offer their aggregated output as a flexibility service to the ESO and the DSO.
- Customers: Customers provide behind-the-meter flexibility resources that can be directly offered to the ESO and the DSO or indirectly via an Aggregator of choice.

DER uptake largely influences whether the UK will continue on the World B path. If high DER adoption occurs, UK may move to World A (see graphic below), which is similar to a 'Total DSO' model whereby the DSO takes a central role for all distribution connected parties

acting as the neutral market facilitator for all DER and provides services on a locational basis to the ESO. All contracts and services with DERs go through the DSO because the DSO needs to be a technical gatekeeper around DERs connected to the distribution system to ensure the distribution network performance remains stable.

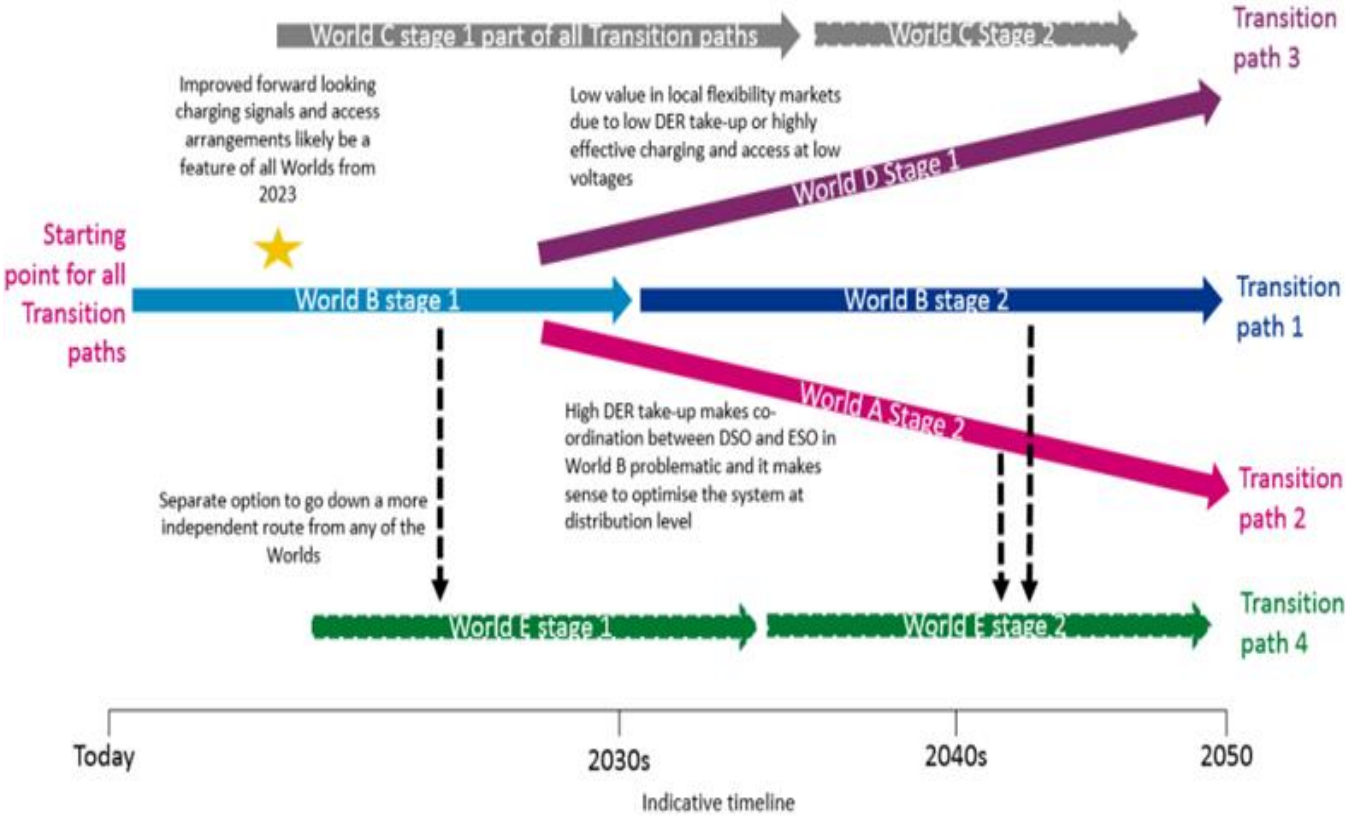

Figure 4. World A

Reference:

- Future World Impact Assessment

Appendix C: Overview Of Recent DER Engagements, Initiatives, and Publications

#	ENGAGEMENTS, INITIATIVES AND PUBLICATIONS	LEAD	PURPOSE OF ENGAGEMENT, INITIATIVE OR PUBLICATION	ISSUES TO BE ADDRESSED OR RESOLVED
1	Framework for Energy Innovation (FEI) (EB-2021-0118) *Note: Formerly Utility Remuneration (EB-2018-0287) and Responding to DERs (EB-2018-0288)*	OEB	To facilitate the deployment and adoption of innovative and cost-effective solutions, including distributed resources, in ways that enhance value for energy consumers. It also aims to increase regulatory clarity in the treatment of innovative technologies and approaches.	• DER usage - intended to investigate and support utilities' use of DERs they do not own as alternatives to traditional wires solutions to meet distribution needs. • DER definition - intended to establish a working definition for DERs. • DER integration - intended to ensure that utilities' planning is appropriately informed by DER penetration and forecasts. • DER value - Developing a number of high-value, non-utility-owned DER use cases as non-wires alternatives to meet distribution system needs, based on relevant players' knowledge of needs and alternative solutions. Further, defining an approach to measure the benefits of these DER use cases relative to costs and assess the value of DERs relative to traditional distribution investments.

2	OEB Innovation Sandbox	OEB	To provide a streamlined, accessible way for the OEB to support innovators to test new ideas, products, services, and business models in the electricity and natural gas sectors.	Providing direct access to OEB staff for innovators to bring questions related to their innovations where OEB may provide customized regulatory guidance as well as temporary relief from a regulatory requirement.
3	DER Connections Review (EB-2019-0207)	OEB	Identify barriers to DER connection and standardize the connection process.	• Review of OEB's requirements regarding DER connections by licensed distributors, specific to electricity generator or storage. facilities (front of or behind meter) • Identify barriers to the connection of DERs. • Identify areas of the connection process that could be standardized.
4	Community Net Metering Pilots (ERO 019-2531)	MENDM	Proposal to allow community net metering pilot projects.	• Proposal to allow community net metering arrangements which permit the transfer or sharing of credits from generation facilities within a community across multiple metered accounts. A lead customer would enter an agreement with the utility for account management. • Limited number of demonstration projects proposed. • Includes behind the meter renewable generation and energy storage projects.

5	Enbridge Gas Integrated Resource Planning Proposal (EB-2020-0091)	OEB	Provide guidance to Enbridge Gas on the consideration of supply-side and demand-side alternatives to facilities projects within natural gas system planning, through the establishment of an Integrated Resource Planning (IRP) Framework.	• Definition of IRP. • Integration of IRP into system planning. • Types of supply-side and demand-side IRP alternatives that Enbridge Gas can pursue. • Evaluation and comparison of IRP alternatives with traditional facilities projects. • Regulatory approval process. • Approach to cost recovery.

6	Examination of Alternative Price Designs for the Recovery of Global Adjustment Costs from Class B Consumers in Ontario	OEB Staff *(Part of RPP Roadmap, EB-2016-0201)*	Contemplates alternative, more uniform methods of distributing Global Adjustment charges to non-RPP Class B customers.	• Examination of the way Global Adjustment (GA) costs are collected, specifically for non-RPP Class B customers exposed to the uniform GA cost.
				• RPP customers are incentivized to limit demand during peak times with lower GA rates; a consistent approach to the recovery of GA costs from all Class B consumers would be more equitable. Study considers alternative pricing options:
				  ◦ Flat Price – Same price for all hours in a year, for all customers.
				  ◦ TOU price – Consistent with current practice for TOU customers, but would apply to all Class B consumers.
				  ◦ Demand Shaped Price – Class B GA costs correlate to total Ontario Demand on hourly basis.
				  ◦ Supply Shaped Price – GA costs applicable to a particular generator are recovered through consumers using energy in the hours that the generator is operational.

				• High-N Price - GA costs based on electricity consumption during *N* highest electricity demand hours within a cost recovery period.
7	DER Survey	IESO for MENDM	Understanding the relationship between DERs and the Industrial Conservation Initiative (ICI). Results to be used to inform other consultations.	• Voluntary survey related to impacts of large customer peak load curtailment/shifting capabilities in Ontario, to better understand the role DER play in the Industrial Conservation Initiative (ICI), and the DER capacity available in Ontario. • Focuses on load control capabilities associated with behind the meter strategies. • Borne of 2020 ICI peak-hiatus with respect to pandemic-recovery efforts, when Class A customers were returning to full levels of operation.
8	Storage Design Project Engagement	Energy Storage Advisory Group	Contemplates how energy storage resources can participate in current and future markets.	• Completed engagement that led to the Interim Market Rules and Manuals for Energy Storage. • Supports the IESO in the integration and treatment of storage resources within the current structure of the IESO administered markets. • Review of current and potential obstacles to fair competition for energy storage resources. • Review and stakeholder engagement of market rule/manual changes.

9	Exploring Expanded DER Participation in the IESO-Administered Markets	IESO – Innovation & Sector Evolution White Paper Series	Identify high-level options for integrating DERs into the IESO-administered markets by setting out participation models that exist for DERs currently and identify the range of options that exist for expanded future participation.	• Sets out the participation models that exist for DERs in wholesale markets. • Identify the range of options that exist for expanded future participation.

10	Non-Wires Alternatives Using Energy and Capacity Markets	IESO – Innovation & Sector Evolution White Paper Series	Support need characterization and options development, explore market mechanisms; investigate potential energy and capacity market processes that coordinate DERs, Distribution System Operators (DSO) and Transmission System Operators (TSO).	• Exploring procurement options for securing NWAs
				  • Pricing structures (based on varied times, location, etc.).
				  • Program offering type (standard offers, or targeted by customer class).
				  • Procurement type (RFP or alternate).
				• Coordinated market approach between TSO and DSO is needed to meet complexity of DER future where electricity services are transacted at the distribution and wholesale levels, accomplished by one of:
				  • Total TSO – central system operator handles market and system operation at all levels, including forecasting, mapping DERs, managing bids, producing dispatch signals and market prices.
				  • Hybrid DSO – DERs may interface with the TSO or DSO or both. DSO dispatches DERs based on distribution level needs. TSO dispatches DERs based on transmission level needs.

				• Total DSO – DERs submit bids to their DSO, which aggregates bids before providing to the TSO. TSO selects DSOs/DERs for dispatch.

11	Tx-Dx Interoperability	IESO – Innovation & Sector Evolution White Paper Series	Provide readers with a practical understanding of how interoperability between the transmission and distribution systems could evolve to support a system with growing numbers of DERs.	• Examines traditional roles of transmitters and distributors, assesses potential for incrementally building on existing capabilities to meet future system needs.
				• Objectives for Ontario's electricity grid will help determine the most suitable T-D interoperability model. Flexibility is key with expected variability of DER adoption levels amongst LDCs.
				  ○ Centralized approach – IESO assumes larger share of roles and responsibilities.
				  ○ Layered approach involves greater share of distribution-level roles.

12	The Power to Connect: Advancing Customer-Driven Electricity Solutions for Ontario	Electricity Distributors Association	Present the role of LDCs as leaders in integrating and enabling new technology in transition to a cleaner, decentralized grid.	• Presentation of the EDA's vision for the future role of LDCs. • Remarks on LDC role for a DER future within existing regulatory framework, and advocates for a more flexible regulatory framework where the LDC acts as a Fully Integrated Network Orchestrator (FINO). A FINO would potentially enable, control, and integrate DER within its distribution service territory. • Three key differences between an LDC's role for a DER integrated future with the existing regulatory framework vs. a more flexible regulatory framework include: *1) The extent to which an LDC provides a DER enabling platform* *2) The degree of DER ownership by an LDC, and* *3) The degree of control and operation of DER*

				• Each LDC will evolve to a FINO at a different pace and to a different degree and there will need to be significant collaboration amongst LDCs related to DER enablement, control and integration as they evolve to become FINOs over the next ten to fifteen years and beyond. • Documents the EDAs intention to investigate alternative regulatory frameworks to incentivize LDCs to integrate DER, where doing so brings economic and system efficiencies, and develop a cost-benefit analysis framework for DER evaluation and DER enabling technologies.
13	Connecting Devices: Best Practice Guide for Standardized Distributed Energy Resource Connections	Electricity Distributors Association	Understanding drivers to customer adoptions of DERs, and issues related to the DER connection process.	• Identify drivers for customer adoption of DERs and related impacts on both local and upstream distribution and transmission systems. • Identify necessary amendments to distributor's connection standards and processes. • Identify changes to regulatory framework and DSC to support multiple connection process streams, define DERs and related terminology.
14	Structural Options for Ontario's Electricity System in a High-DER Future	ETNO	Examination of options for the allocation of roles and responsibilities for DERs in Ontario.	• Examines options for allocation of roles and responsibilities for DERs in Ontario amongst sector players. • Assessment of potential conflicts of interest and synergies to be found within the sector as it transforms with respect to DERs. • Allow for appropriate valuation of DER services to maximize reliability, value, and efficiency for the greater good of consumers and the broader grid.

15	Distributed Energy Resources: The Role of Regional Planning, New Benefit-Cost Methodologies and the Competitive Landscape	Mowat Centre	Summary of the role of regional planning, new benefit-cost methodologies, and the competitive landscape in Ontario.	• Broadly suggests component costs to be factored into a benefit-cost analysis in assessing the value of DERs in a particular region. • Review of the LDC role in relation to competitive processes and potential issues of cross-subsidization.
16	FERC Order No. 2222: Enabling DERs to participate alongside traditional resources within US wholesale markets through aggregations	Federal Energy Regulatory Commission (FERC)	Rule enabling DER participation in US wholesale markets.	• Rule enabling DERs to participate alongside traditional resources in regional organized wholesale markets through aggregations (in USA). • Enables DERs who would not satisfy minimum size and performance requirements individually to participate in the market. • Regional grid operators must allow DER aggregators to register resources under one or more participation models and prohibits retail regulatory authorities from broadly excluding DERs from participation in regional markets. • Retail regulators maintain their ability to prohibit customer level demand response from being bid into regional markets by aggregators.

17	Distributed Energy Resources Action Plan: Aligning Vision and Action	California Public Utilities Commission	Long-term vision for DER and supporting policies in California.	• Development of a long-term vision and committee for coordination of DER activities including:
				  • Rate options and tariffs
				  • Planning and procurement processes to allow for distribution grid infrastructure and interconnection.
				  • Wholesale market integration by establishing market rules and policies around DERs and demand response.

18	DER Research Roadmap and DER Integration Technical Assessment	Navigant for California Energy Commission	Identify key needs to transform California's electric system to enable high penetration of DER.	• Identify and prioritize key needs to transform electricity system to enable high penetrations of DER. • Plan for deployment of funding in short, medium, and long term. • Plan for overcoming barriers (development of operational capability, high capital costs, complexity of coordination). • Technology and strategy review for specific technologies: storage, EVs, load management, smart inverters, communications.

19	Roadmap and pilot projects	New York ISO	Present vision for integrating DERs in the NY wholesale markets and develop a framework to enable and test pilot projects.	• Market enhancements to integrate DERs into existing markets and the introduction of three pilot projects to inform market design efforts, and test viability and valuation of operational processes:
				  • Front-of-Meter batteries – demonstrating coordination of multiple DERs for dispatch when required by system needs or conditions.
				  • Front-of-Meter batteries co-located with solar – evaluate the ability of aggregate resources to provide wholesale and retail services.
				  • High rise buildings with curtailable/adjustable energy load – evaluate capability of building management systems to provide ancillary services.