Jurisdictional Scan: Summary Report

Prepared for:
Independent Electricity System Operator

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1. BACKGROUND AND CONTEXT

The Independent Electricity System Operator (IESO) oversees Ontario's wholesale electricity market, operates its power system in real time, and is responsible for planning for Ontario's future energy needs. The Long-Term Energy Plan (LTEP)[1] serves as Ontario's vision for the electricity and energy sectors and endeavors to balance dual priorities of affordability and greenhouse gas (GHG) reduction. The IESO developed an Implementation Plan for the 2017 LTEP[2] outlining how it will achieve certain objectives in the 2017 LTEP. As part of the IESO's LTEP Implementation Plan, the IESO is reviewing and reporting on system planning processes and proposing adjustments or recommendations to improve the processes.

The IESO is presently in the process of redesigning Ontario's wholesale electricity market through the Market Renewal Program (MRP). MRP includes the most ambitious enhancements to Ontario's wholesale electricity market design since market opened in 2002, addressing known issues with market design. As part of MRP and their broader system planning mandate, the IESO is considering changes to its system planning processes. Under MRP, the IESO will be moving toward more market-based mechanisms to procure resources, specifically through the proposal of Incremental Capacity Auctions that operate in a similar fashion to capacity markets in other jurisdictions. Implementing such mechanisms will require more long-term planning studies to ensure that system needs can be met effectively to maintain the reliability of the system.

In particular, the IESO has identified five core initiatives:

(1) Develop a formal, integrated bulk system planning process;

(2) Review and report on the existing regional planning process (local area planning) and provide options and recommendations. This includes identifying barriers to the implementation of non-wires solutions as alternatives to traditional network investment and options to address any such barriers;

(3) Develop a coordinated, cost-effective, long-term approach to replacing transmission assets at end of life;

(4) Develop a competitive transmitter selection or transmission procurement process; and

(5) Review and report on its technical criteria used to assess customer reliability.

[1] The 2017 LTEP can be found here - https://files.ontario.ca/books/ltep2017_0.pdf

[2] The IESO Implementation Plan for the 2017 LTEP, *Putting Ontario's Long-Term Energy Plan Into Action*, can be found here - http://www.ieso.ca/-/media/Files/IESO/Document-Library/ltep/IESO-ltep-implementation-plan.pdf?la=en

The IESO engaged Power Advisory LLC (Power Advisory) to perform a jurisdictional scan of electricity planning processes and associated frameworks in order to support these identified initiatives.[3] As part of this jurisdictional scan, Power Advisory conducted initiative specific surveys of other jurisdictions that were organized around a set of questions that provided a deeper understanding of the identified topic. Power Advisory summarized and delivered research notes and findings to the IESO staff. The results of this research were summarized in various public reports. This summary report provide background and context about the jurisdictional scans and lists the lessons learned from Power Advisory's viewpoint that are applicable to the IESO.

[3] Power Advisory is an electricity sector focused management consulting firm, specializing in electricity market analysis and strategy, power procurement, policy development, regulatory and litigation support, market design, and project development and feasibility assessment, in North American electricity markets. www.poweradvisoryllc.com

2. GUIDANCE ON JURISDICTION SELECTION

The following table highlights the initial guidance Power Advisory received on jurisdiction selection for each topic. Power Advisory has also included the ultimate list of jurisdictions that were selected to interview. Jurisdictions that Power Advisory completed desktop research on are also included.

Research Topics	Jurisdiction Selection Constraints	Ultimate Jurisdiction Selection
Topic #1: *Design of the Bulk Planning Process*	• At least 4 jurisdictions with competitive energy markets	• CAISO • ISO-NE • NYISO • PJM
Topic #2: *Design of the Local/Regional Planning Process*	• At least 2 US, 1 Canadian and 1 outside of North America • Focus on jurisdictions that have similar context/characteristics as the Ontario's electricity sector and have some experience in Integrated Resources Planning for a Local Area (i.e. community and sub-regional level)	• AEMO • FortisBC • Green Mountain Power
Topic #3: *Stakeholder and Community Engagement in Bulk and Local/Regional Planning Processes*	• At least 2 US, 1 Canadian and 1 outside of North America • At least 4 jurisdictions with competitive energy markets • Have similar context/characteristics as the Ontario's electricity sector and have some experience in Integrated Resources Planning for a Local Area (i.e. community and sub-regional level)	• AEMO • CAISO • ISO-NE • National Grid Electricity Transmission • NYISO • PJM

Research Topics	Jurisdiction Selection Constraints	Ultimate Jurisdiction Selection
Topic #4: *Bulk and Local/Regional System Planning Processes and Electricity Market Activity Coordination*	• At least 4 jurisdictions with competitive energy markets	• CAISO • ISO-NE • National Grid Electricity Transmission • NYISO • PJM
Topic #5: *Adapting Bulk and Local/Regional Planning Processes for Evolving Policy Context*	• At least 2 US, 1 Canadian and 1 outside of North America • Have similar context/characteristics as the Ontario's electricity sector and have some experience in Integrated Resources Planning for a Local Area (i.e. community and sub-regional level)	• AEMO • CAISO • ISO-NE

Topic #6:
Framework for Consideration of Non-Wires Alternatives in Bulk and Local/Regional Planning
	• At least 2 US, 1 Canadian and 1 outside of North America
	• Focus on jurisdictions that have similar context/characteristics as the Ontario's electricity sector and have some experience in Integrated Resources Planning for a Local Area (i.e. community and sub-regional level)
		• Australia (AER and Ausgrid)
		• Additional desktop research on:
		  • Rhode Island (National Grid)
		  • California (CPUC)

Topic #7:
Roles and Responsibilities of Implementation of Non-Wires Alternatives in Bulk and Local/Regional Planning
	• At least 2 US, 1 Canadian and 1 outside of North America
	• Focus on jurisdictions that have similar context/characteristics as the Ontario's electricity sector and have some experience in
		• Australia (AER and Ausgrid)
		• Additional desktop research on:
		  • Rhode Island (National Grid)
		  • California (CPUC)

Research Topics	Jurisdiction Selection Constraints	Ultimate Jurisdiction Selection
	Integrated Resources Planning for a Local Area (i.e. community and sub-regional level)	

Topic #9:
Transmitter's Process for End-of-Life Assets
	• At least 5 large transmission owners
	• At least 2 US, 1 Canadian and 1 outside of North America
	• Has an aging asset base and be a well-developed country, preferably with similar load growth characteristics to Ontario
		• New York (National Grid)
		• Additional desktop research on:
		  • BC Hydro
		  • Bonneville Power Administration
		  • CAISO
		  • European Union's Generally Accepted Reliability Principle with Uncertainty Modelling and through Probabilistic Risk Assessment
		  • Japan
		  • Manitoba Hydro
		  • PJM

Topic #11:
Regulatory Barriers for Non-Like-for-Like Asset Replacement Options
	• At least 5 transmission or system operators or their regulator
	• At least 2 US, 1 Canadian and 1 outside of North America
	• Has an aging asset base and be a well-developed country, preferably with similar load growth characteristics to Ontario
		• Great Britain (Ofgem)
		• New York (National Grid)
		• Additional desktop research on:
		  • BC Hydro
		  • Bonneville Power Administration
		  • CAISO
		  • European Union's Generally Accepted Reliability Principle with Uncertainty Modelling and through Probabilistic Risk Assessment
		  • Japan
		  • Manitoba Hydro
		  • PJM

Research Topics	Jurisdiction Selection Constraints	Ultimate Jurisdiction Selection
Topic #12: *Framework for Customer Reliability*	• At least 1 US, 1 Canadian, 1 outside of North America and 1 Australia • Multiple types of customers including urban, rural, commercial and large industry • Separate transmission and generation operation and ownership • Reliability criteria that are established and enforced by an independent entity or entities • At least 3 with interconnected systems (connected to other jurisdictions) • At least 2 with multiple transmitters	• Alberta (AESO) • Australia (AEMC, AEMO) • Great Britain (Ofgem) • New York (Con Edison)
Topic #13: *Customer Reliability Standards*	• At least 1 US, 1 Canadian and 1 outside of North America • Multiple types of customers including urban, rural, commercial and large industry • Separate transmission and generation operation and ownership • Reliability criteria that are established and enforced by an independent entity or entities • At least 3 with interconnected systems (connected to other jurisdictions) • At least 2 with multiple transmitters	• Alberta (AESO) • Australia (AEMC) • Great Britain (Ofgem) • New York (Con Edison) • Texas (Texas Reliability Entity)

Research Topics	Jurisdiction Selection Constraints	Ultimate Jurisdiction Selection
<u>Topic #14</u> *Criteria for Determining When Competitive Procurement for Transmission is Employed*	• At least 3 jurisdictions that have developed a competitive process to procure electricity transmission facilities	• MISO • NYISO • PJM • SPP
<u>Topic #15</u> *Different Approaches for Conducting the Procurement of Transmission Facilities*	• At least 3 jurisdictions that have developed a competitive process to procure electricity transmission facilities • At least two of these jurisdictions should have developed a solicitation-based approach to seek solutions to identified power system needs, or a hybrid approach that contains elements of a solicitation (either instead of or in addition to a bid-based process for constructing transmission facilities)	• AESO • MISO • NYISO • PJM • SPP

3. LESSONS LEARNED

The following section highlights the main takeaways from the survey process for each of the five core initiatives. Additional details are available in each of the final reports.

3.1 Bulk System Planning

The primary lessons learned can be distilled into five main areas:

1. Stakeholder engagement: Significant stakeholder engagement is needed to ensure solutions to identified system needs are viable, cost-effective, and supported by market participants and other key stakeholders. However, stakeholder engagement can be resource intensive and potentially lead to delays in the planning process if not managed properly. Jurisdictions have deployed a number of action plans to manage engagement, including adopting standard reports and standardized assumption documents. In addition, while all entities interviewed expressed the requirement to perform stakeholder engagement activities throughout the planning process, there was a common conclusion that a majority of the stakeholder engagement efforts are focused on reviewing input assumptions. Finally, stakeholder engagement occurs consistently in each jurisdiction interviewed (i.e., planning completed in phases with stakeholder engagement occurring after each phase). Not doing so was seen as a recipe for disaster or delays since not seeking stakeholder feedback throughout the process would lead to redoing analyses and conclusions at a later date.
2. Process consistency: All entities, except for ISO-NE, use a consistent planning cycle. For PJM and CAISO, the bulk planning cycle for one cycle to the next overlap, which provides the benefit of easily carrying forward previous assumptions and inputs. The overlap also allows any changes to inputs/assumptions identified late in the planning process to be transferred to the next planning cycle with limited push-back from stakeholders. An additional benefit of repetitive planning cycles is that they provide a natural process for bulk planning to re-assess previous conclusions and ensure identified solutions are still appropriate for the system, thus limiting rate-payers from unjustified investments. All entities indicated that bulk system planning is performed by a consistent and committed team. Power system planners' knowledge and experience is needed to manage stakeholder expectations, perform system analysis and maintain timelines.
3. Policy impacts: All entities interviewed identified public policy that supports energy efficiency and renewable generation development as having the most significant impact on planning. Distribution-connected renewables and energy efficiency programs directly impact demand forecasts; all entities clearly stated that demand forecasting has become more uncertain due to policy support. Transmission system planning in particular has been difficult since the transmission system model must estimate both quantity of impact on demand (e.g., MW/year in peak demand reduction) and the location of the impact (i.e., where in the transmission system will the impacts from policy support be greatest). Without adequate system models incorporating public policy impacts, it is

extremely difficult to determine if planning solutions are required, or if solutions will continue to be needed after development has begun.

4. Market inputs: PJM, ISO-NE and NYISO all have capacity markets which provide direct inputs into resource availability for planning process activities. If a generator clears the capacity market, the capacity is included in system models. On the other hand, if the generator does not clear the capacity market, the system planners assume that the generator's capacity is not available for reliability assessments. Economic efficiency (i.e., cost-benefit analysis of resolving system congestion) relies on market inputs to assess appropriateness of solutions. Bulk system planning processes are trending towards assessing operational needs more due to greater variability of generation output (i.e., due to higher percentages of renewable generation in the supply mix) and higher uncertainty of demand due to energy efficiency and distributed energy resources.
5. IESO Considerations: The potential shift to more market-based mechanisms (e.g., Incremental Capacity Auctions) will lead to the need to release publicly more planning activities (e.g., assumptions, models, draft conclusions, final conclusions, etc.). There will also be a need to increase the stakeholder engagement activities throughout the planning process to ensure robust stakeholder participation and support for planning process conclusions. As Ontario potentially embarks on the expansion of market-based mechanisms for power system needs (e.g., incremental capacity auctions for supply adequacy, competitive procurement for transmission), the entities interviewed recommended that IESO will need to have a firm hand on the planning process to ensure independence and provide confidence to market participants that have to depend on its analysis and work. Further, Power Advisory recommends that the IESO be open-minded to using new tools and considering alternative solutions to system constraints. Generally, the IESO will be able to achieve its planning objectives (e.g., maintaining reliability standards in the most cost-effective manner) when market participants have confidence in the IESO's capabilities and believe that the IESO will apply those capabilities fairly to any and all recommendations from stakeholders.

3.2 Regional Planning and Non-Wires Alternatives

The primary lessons learned can be separated into two broad topics, one being regional planning and the other being non-wires alternatives.

Regional Planning Lessons Learned

All entities interviewed align their regional planning process with other processes (e.g., demand forecasting, regulatory processes, etc.) Alignment ensures that key inputs, such as supply-side resources, are the same in all planning documents. While local/regional plans are primarily focused on a specific geographic area, alignment with broader planning activities is required to avoid errors and ensure plans are cost-effective.

Each jurisdiction interviewed has its own guiding principles for its integrated resource planning process based upon the current issues it faces. Regional planning will need to fully understand the trends and issues arising in the system to ensure that the planning process takes these into account. Experience in other jurisdictions show that the planning process will be constantly evolving and must adapt to new influences.

All entities identified the importance of stakeholder relations as part of the regional planning process. Informed and engaged stakeholders can help ensure plans are assessed from different view points and ultimately leads to greater buy-in from customers and higher probability of success. Overall, all entities indicated that stakeholder engagement helped keep the planning process focused on objectives and key principles when assessing options and considering new technologies/emerging trends.

Non-Wires Alternatives Lessons Learned

Each jurisdiction surveyed uses similar criteria to screen identified needs in the planning process that can be addressed by non-wires solutions. The three main criteria are: viability, cost, and timing. The viability screen generally evaluates whether the service offered by the non-wires solution can meet the grid need. The timing screen tests whether the solution can be deployed by the need date. The cost screen compares the cost of the non-wires solution versus the traditional solution. A cost screen can also be used as a threshold above which a traditional solution will be evaluated for non-wires alternative solutions.

Each entity scanned (Ausgrid, National Grid RI, and CPUC) are either currently utilizing RFPs or will be utilizing RFPs to provide non-wires solutions to identified grid needs. An RFP-based approach can provide numerous benefits over utility supplied solutions, such as: getting best market information available, less internal resources required, and a more favourable risk allocation.

Incentives for utility implementation of NWAs ensure efficient outcomes and ensure that laws that mandate procurement of distributed generation are adhered to. Each entity has an incentive, but implementation differs.

All entities we surveyed had significant data requirements to implement non-wires solutions. For example, US jurisdictions are implementing maps that show: 1) the amount of capacity available to connect DERs to each part of the utility’s system, and 2) the total net benefits that a DER could provide at each grid location. Given the amount of data necessary for the multiple steps within the planning process, significant time and effort is needed to ensure the data used is high quality and an accurate representation of the current state of the technology and the distribution system.

All of the entities interviewed had steps in place to ensure that no technology was given preference. For Ausgrid, as an example, all technology types are considered as potential solutions. In addition, stakeholders are heavily involved in suggesting solutions to identified needs, so many possible ideas can be considered. Emerging technologies and rapid innovation are motivating entities to be open to new products and service offerings to meet changing system needs.

3.3 End-of-Life Assets

From the interviews and desktop analysis of EOL asset process and barriers, a key finding emerged: determining EOL asset replacement priorities should rely on probabilistic analysis about the health of the assets and their future failure rates (i.e., the probability the assets may fail in the future). Combining the failure rate with the potential impact to the power system provides the asset owners the ability to determine a risk-cost for the assets[4]. Risk cost can be used to prioritize EOL asset replacement plans. There were three primary lessons learned for EOL assets and risk-cost analysis.

1. Planning and optimizing EOL asset replacements requires a detailed power system planning outlook. The power system is adapting to new electricity sector policies (i.e., climate change) and emerging technologies (e.g., distributed energy resources) that are changing how the system will be used in the future. The future requirements on EOL assets will influence the appropriate replacement plan (e.g., like-for-like, upgrade, retirement). To assess the future system needs, a detailed system planning outlook is required and needs coordination between asset owners, system operators and other key stakeholders.

2. To accurately estimate failure rates and predict potential failure impacts, National Grid (NYISO) and AEMO stated that robust data management systems are required. Data management systems and data analytics provide information used to determine an asset's health (i.e., the probability of failure) and to assess an asset owner's EOL replacement needs as a whole. Further, data management systems can be used to provide guidance for system planners assisting in EOL asset failure impact analysis and the prioritization of EOL asset replacement plans. Data management systems are key in providing greater visibility to the electricity sector stakeholders on the needs of the system into the medium-term (i.e., 5 to 10 years) and in determining the appropriate EOL replacement process.

3. EOL asset replacement requires the management of both internal constraints (e.g., available equipment, labour force, engineering) and external constraints (e.g., weather, outage windows, etc.) that restrict the ability to complete EOL asset replacement plans.

[4] Risk-cost is an estimation of the probability that the asset may fail and the potential cost/impact of that failure

EOL assets are components of the operating power system and therefore replacement plans require coordination between system operators, asset owners, and customers to plan outages of those assets and replace with appropriate new assets. In addition, available capital constraints and regulatory priorities (e.g., mandates for timelines to connect new customers) need to emphasize the need for flexibility in EOL asset replacement plans.

3.4 Customer Reliability

From the interviews on customer reliability, there were four primary lessons learned.

1. Certain jurisdictions have more stringent reliability standards as load density increases and/or to compensate for existing system constraints (e.g., over reliance on transmission network). Two of the jurisdictions interviewed (Con Ed and Australia) have higher standards for urban areas. Higher standards reflect the importance of load density in these areas, and reflect the expectation that outages in these areas will have a higher impact compared to other areas in their service territory.

2. Penalty/incentive frameworks for customer reliability standards have resulted in higher customer reliability at a reasonable cost to customers. Great Britain and Australia have a penalty/incentive framework in place for distributors that is overseen by the regulator in each jurisdiction. In Australia, distribution has voltages below 132 kV. In most of Great Britain, distribution is 132 kV and below. In Scotland, 132 kV lines are considered transmission. In both jurisdictions, the regulator sets a target for customer reliability for each distributor. If reliability increases above the target, there is a monetary award, but delivering reliability levels below the target results in a penalty. Empirical results in these jurisdictions show that interruption incentive schemes can improve customer reliability; however, there are concerns that targets and rewards were not appropriately set due to larger than expected returns for distributors (i.e., distributors are receiving high returns for modestly higher customer reliability, so targets will need to be stricter to ensure rate-payer value).

3. Distributed Energy Resources (DERs) influence on reliability, both positively and negatively, is being considered. Two of the jurisdictions interviewed are now reviewing standards for renewable DERs. In Alberta, the AESO is now considering the inclusion of two types of DERs into reliability standards: i) industrial application, and ii) solar/wind connection to the distribution system In Great Britain, recent amendments to the national security standards considers DERs. As the growth of DERs is expected to rapidly increase, reviewing customer reliability standards to reflect the growth in DERs is prudent and appropriate to ensure the continued operation of a safe, reliable and cost-effective grid.

4. Only Great Britain has load restoration timeline requirements that are similar to the requirements in the ORTAC. The National Electricity Transmission System Security and Quality of Supply Standard outlines system restoration criteria under secured events. While customer reliability standards in Great Britain and Australia are deterministic, utilities have the ability to build beyond the standard based on a probabilistic cost-benefit analysis. The probabilistic cost-benefit analysis achieves a similar objective of the load restoration timelines, ensuring contingencies are minimized through system investments.

3.5 Competitive Transmission Procurement

From the interviews on competitive transmission procurement, there were seven primary lessons learned, which are summarized below:

1. Importance of stakeholder engagement - Each of the jurisdictions interviewed (AESO, PJM, NYISO, SPP, and MISO) involve stakeholders throughout the competitive transmission procurement process. Stakeholder feedback is especially important during the design of the process for bid-based approaches as well as lessons learned phase of the procurement process to make continual improvements. This is also important in solicitation-based approaches where a common understanding of the need and system conditions is essential for stakeholders to develop workable, creative solutions.
2. Significant internal and external resources required – Each jurisdiction highlighted the need to properly allocate internal resources from the beginning. The competitive procurement process is complex, and can take significant time in the early stages to develop the procurement model. In addition, there can be significant requirements for external resources.
3. Evaluation criteria are process and jurisdiction specific - Each jurisdiction's criteria for selecting a transmission proposal is different, not only depending on the procurement model but also the need drivers as well. For example, for bid-based approaches, evaluation criteria do not focus on meeting needs, but focus on costs and cost containment.
4. Sponsorship model has demonstrated the ability to deliver creative solutions - Both PJM and NYISO use the solicitation-based approach in competitive transmission procurements. They selected this model because it can allow for more creativity in the solutions to the specific need. This was believed to be more important in producing savings to customers. The ability to be creative also extends to the participation of non-wires alternatives in these procurements.
5. Cost containment is becoming more important - PJM in particular notes the increasing importance of cost containment provisions particularly where the proposed solutions are similar. However, there can be significant challenges in assessing the relative risks and respective value of cost containment proposals.

6. Significant benefits from competitive procurement - Each jurisdiction interviewed stated that the competitive procurement process (for both approaches) yields substantial benefits for customers even after consideration of the significant resources required to conduct these processes.
7. Difficulty in comparing processes - Each jurisdiction is different with respect to its planning process, what types of projects can be competitively procured, and the procurement method. Therefore, comparing jurisdictions to determine which is the most successful or which works best is difficult. Each jurisdiction's process reflects its unique market attributes and planning contexts. However, the IESO can move forward with its own method knowing that adjustments can be made to the process along the way.