FEBRUARY 24, 2022

Pathways to Decarbonization Study

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Agenda

- Background
- **Inform**: Modelling Approach for Gas Moratorium and Pathways to Decarbonization
- **Common Approaches** to the scenarios
- **Stakeholder Input**: Modelling Assumptions
- Next steps

Background

Background

The Minister of Energy issued a letter dated October 7, following the IESO's gas phase-out assessment, requesting the IESO to:

1. Evaluate a moratorium on the procurement of new natural gas generating stations in the next 10 years, with a focus on the latter part of the decade (reliability, cost, environmental considerations)
2. Develop an achievable pathway to phase out natural gas generation and achieve zero emissions in the electricity sector that considers; reliability/operability, cost, timelines, impact on broader electrification of the economy, low emission fuels for thermal generation, storage combined with non-emitting resources, new technologies

IESO's Role in Decarbonization

- As system operator and planner, the IESO is uniquely positioned to coordinate and address the Minister's request
  - The IESO has access to data, tools and expertise to assess resource and transmission adequacy, as well as real-time operability to provide insights to decisions makers
- The IESO recognizes and intends to leverage the experience and perspectives of sector partners and participants
  - The IESO will seek input on the availability, cost and performance of various resources and potential policy trajectories

Study Approach

- The study will address the Minister's two asks through the following scenarios:
  1. Assessment of a **moratorium** on new natural gas resource acquisitions compared to APO 2021
  2. Development of **pathways** to a decarbonized electricity system using a high demand scenario

Study Scope

- In Scope:
  - Demand, capacity, energy, operability and transmission modelling for each scenario
  - Identification of challenges and opportunities to support the ask
- Out of Scope:
  - Detailed integrated power system plan
  - Resource acquisition and project implementation

Initial Feedback on Study Approach through IESO's Engagement Channels

- The technical, system operator perspective provides value
- Cost and reliability are important considerations along with emissions
- Transparency of modelling inputs and assumptions is necessary
- Look at opportunities for greater collaboration across the northeastern electrical region
- Supply chain, labour and logistical challenges should be considered
- Consider high electrification scenario

Modelling Approach for Gas Moratorium and Pathways to Decarbonization Scenarios

Modelling Approach

- The following slides describe the modelling approach for both the Gas Moratorium and Pathways to Decarbonization scenarios
- Approaches that are common to both scenarios are presented generically. This includes the following:
  - Assessment Process
  - Transmission Analysis
  - Operability Analysis

Moratorium

Moratorium Modelling

	Details
Objective	• Assess the impact of a moratorium on new natural gas facilities compared against the 2021 APO
Study Period	• 2024 - 2035
Key Inputs and Drivers	• Adopt the 2021 APO forecasts for reference demand, resource availability (with modest updates), fuel costs and carbon pricing, and adopt related policies as they exist today (e.g. moratorium on off-shore wind) • Address resource shortfalls ("proxy resource" replacement) and attempt further natural gas generation replacement, while respecting system reliability and the availability of non-emitting resources, with comment on cost implications • Economics permitting, existing natural gas plants are assumed to be available through the duration of the study period and will run when dispatched and without limitation

Pathways

Pathways to Decarbonization Approach

- The outcome of this assessment will be illustrative of a pathway towards decarbonization. It will identify opportunities for the electricity system to enable decarbonization objectives.
- Additionally, the impact of all known and flagged policies that are currently in place to advance Ontario towards net-zero objectives will be considered
- IESO will translate the impact of polices on electricity demands, electricity resources, fuel costs and emissions and model that as reasonable upper bound pathway
- It will be assumed that carbon pricing will increase after 2030 and existing gas plants will be fully exposed to carbon taxes by 2035
- The assessment will consider **reliability and affordability**

Pathways: High Demand Scenario

	Details
Objective	• Develop a high electrification scenario
Study Period	• 2024 - 2050

Key Inputs	• Focus will be on key drivers and end uses which are impacted by electrification:
	  • Heating and cooling
	  • Transportation
	  • Industrial electrification
	• Energy Efficiency: Will consider potential identified in IESO APO study
	• Distribution Connected DER**:** Will consider potential identified in IESO DER Potential study
	• Step changes in technology adoption curves based on known and flagged policy

Pathways: Resource Modelling

	Details
Objective	• Develop a pathway to a zero-emissions electricity resource mix using a high electrification scenario
Study Period	• 2024 - 2050
Key Inputs and Drivers	• Adopt forward looking assumptions for a high electrification demand, existing non-emitting resource availability, fuel costs and carbon pricing, with openness to change in current related policies (e.g. removal of a moratorium on off-shore wind) • Address resource shortfalls, while respecting system reliability and the availability of non-emitting resources, with comment on cost implications • Economics permitting, existing natural gas plants will be considered available to end life, subject to compliance with policy and regulations

Common Approaches to Scenarios

Assessment Process

Stage	Criteria	Comment
1. Resource Selection	• Technical feasibility • GHG emissions • Availability • Cost	• Only resources that are technically feasible, likely to be available and that have low emissions will be included as an input to modelling
2. Screening	• Reliability • Operability	• Scenario resource mixes will be assessed for reliability and operability in a copper plate system, and if failed, resource selection will iterate incorporating any insights
3. Scenario Assessment	• Transmission Reinforcement and Expansion • Timeline drivers	• Once a scenario is found to be reliable and operable, it will be assessed and evaluated on additional criteria to garner further insights

Transmission Analysis Approach

	Details
Objective	• Identify the required transmission reinforcements to maintain reliability in each scenario
Study Period	• To be aligned with the demand and resource modelling approach for each scenario

Key Inputs and Drivers	• Book-end demand and resource assumptions will be used initially to determine transmission transfer capability requirements and evaluate reinforcement options
	• The required transmission reinforcements to maintain reliability will be informed by:
	  • The technical evaluation of the transmission options using book-end assumptions;
	  • Hourly operating points, extracted from energy modelling using the final demand and resource assumptions;
	  • The cost of transmission reinforcements, based on cost benchmarks to be provided by a consultant; and,
	  • Lead-time for development and construction of the reinforcements

Operability Analysis Overview

Operability refers to the ability to manage a variety of conditions on the power system as they occur in real-time. Operability is essential for a system to be **reliable;** for a Pathway to be viable, it must be operable and reliable. This year's assessment will focus on three key elements to ensure a reliable system:

- Flexibility: The ability of the system to easily respond to intra-hour circumstances or conditions that arise in real-time, depending on the supply and demand balance that materializes
- Ramping: The ability of the system to follow changes in Ontario demand from hour to hour and during periods of large demand increases
- Event Management: The ability of the system to maintain operations during disruptive events, such as sustained severe weather, and return to normal operations as quickly and efficiently as possible

Stakeholder Input: Modelling Assumptions

Assumptions Feedback Requested

- The IESO is seeking input on the assumptions for the scenarios
- Detailed assumption tables will be posted on the engagement website and stakeholders will have the opportunity to provide evidence-based feedback for up to two weeks following the posting of documents

Assumption and Data Categories

- Following this engagement, the IESO will release assumptions and questions following this engagement, as they pertain to the following categories and invite stakeholders for feedback:

Policy	Demand	Resources
• Carbon price and policy • Clean fuel standard • Codes & standards	• Heating & cooling • Transportation • Industrial electrification • Conservation programs • DER potential	• Technical: energy, capacity, lead time and project life • Financial: capital, operating and fuel cost

- To ensure transparency, the list of financial and technical data resources to be referenced in the assessments will be provided
- Stakeholders are welcome to provide feedback on the following: the reasonableness of the assumptions, data sources, timing and any apparent gaps

Next steps

Engagement: Next Steps

- Presentation on approach to reliability and operability analysis – March Engagement Days
- Project update – Q3 Engagement Days
- Discuss study results and insight – Q4 Engagement Days