



Resource Eligibility Interim Report

October 7, 2022



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This interim report has been prepared for the Ontario Minister of Energy to inform policy decisions about the eligibility of carbon-emitting generation in upcoming procurements to meet future energy and capacity needs. This analysis complements an ongoing assessment of potential pathways to decarbonize the grid to be released later this year.

The IESO recommends that a diverse set of resources, which would include a significant investment in battery storage, balanced by natural gas capacity and other forms of non-emitting generation, be included in these procurements to ensure reliability and affordability.

The IESO is confident that a maximum target of 1,500 megawatts (MW) of new natural gas capacity will address short-term energy needs and contribute to the province's longer-term energy transition. Without a limited amount of new natural gas in the near term, the IESO would be reliant on emergency actions such as conservation appeals and rotating blackouts to stabilize the grid. Recommendations on the future role of natural gas will be included in the Pathways to Decarbonization report to be released later this year.

Executive Summary

Ontario currently has one of the cleanest electricity systems in North America. Greenhouse gas emissions from the electricity sector comprise roughly three per cent of all emissions in the economy. This low-carbon supply mix is highly attractive for business development and creates opportunities for significant emissions reductions in other sectors to support the energy transition.

The Independent Electricity System Operator (IESO) has identified capacity needs in the 2025-2027 period, as well as energy and capacity needs later in the decade and beyond. As the province's system planner, the IESO is implementing plans to secure supply, much of it non-emitting, to meet these needs, including: executing new contracts for existing natural gas and wind facilities; increasing targets and enabling imports in the annual capacity auction; and, rescheduling generator outages and refurbishments.

In 2023, at the direction of the Minister of Energy, the IESO will launch new Save on Energy conservation programs to further reduce demand. In addition, the IESO expects to exercise an import capacity agreement with Quebec in 2026 or 2027. The Minister has also asked Ontario Power Generation to seek regulatory approval for an extension of the Pickering Nuclear Generating Station's operating licence until fall 2026.

Earlier this year, the IESO launched three competitive procurements, which are expected to result in one of the largest storage procurements in North America. The IESO, however, has identified significant reliability risks associated with supply chain disruptions, tight market conditions which could be particularly impactful for battery storage projects, and new technology integration.

To mitigate these risks, the IESO recommends pursuing a diverse portfolio of supply options. The procurement will target 4,000 MW of new capacity from a variety of resources including approximately 2,500 MW of storage, contributions from other non-emitting resources such as hybrids and biofuel resources, and up to 1,500 MW of natural gas. Without a limited amount of new natural gas in the near term, the IESO would be reliant on emergency actions such as conservation appeals and rotating blackouts to stabilize the grid. Failure to mitigate these risks, if combined with extreme weather, could create conditions similar to those seen in California where shortfalls resulted in rotating blackouts.

Over time, the IESO expects that natural gas generation will be replaced by a portfolio approach that includes new non-emitting generation, storage, as well as demand-side and transmission solutions. As this transition occurs, natural gas can continue to provide stability to the system as new forms of flexible supply are built, tested and connected to the grid.

By using natural gas in a limited way, Ontario's communities, businesses and consumers will be able to continue with their electrification plans, while at the same time, decarbonization of the electricity system can continue in a carefully coordinated manner without risking reliability or economic growth.

Purpose

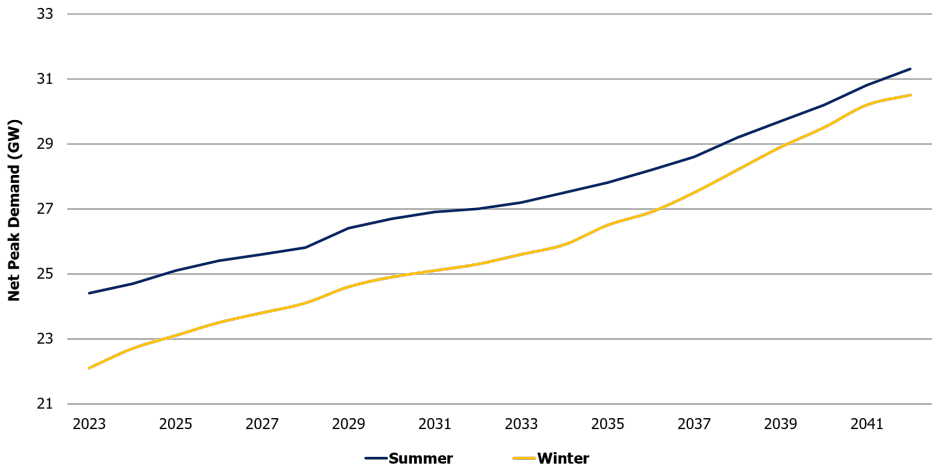
This interim report has been prepared for the Ontario Ministry of Energy to inform future policy decisions about the eligibility of carbon-emitting generation in procurements to secure new supply to meet future energy and capacity needs. The IESO recommends to the Minister of Energy that a diverse set of resources, including natural gas, should be included in the Long-Term 1 procurements to ensure that Ontario’s electricity system is reliable in 2025 and beyond and can enable economic growth and electrification. This analysis is a complement to an ongoing assessment of potential pathways to decarbonization for Ontario’s electricity sector to be released later this year.

Ontario’s Energy Future

Ontario currently has one of the cleanest electricity systems in North America. Greenhouse gas emissions from the electricity sector comprise roughly three per cent of all emissions in the economy. This relatively low-carbon supply mix is highly attractive for business development and creates opportunities for significant emissions reductions in other sectors through electrification.

However, after years of declining demand for electricity, the trend is reversing, with economic growth and electrification shaping a very different long-term outlook for Ontario’s electricity system. Based on existing policies and trends captured in its 2021 Annual Planning Outlook (APO), the IESO forecasts that overall annual energy demand will grow at an average rate of 1.7 per cent a year over the 20-year Annual Planning Outlook Period (2023-2042). Summer peak demand is forecasted to rise at an average annual rate of 1.3 per cent.

Ontario Forecast Seasonal Peak Demand (2023-2041)



The IESO’s planning forecasts include the estimated impact of electric vehicle charging, rail transit electrification, and industrial electrification. Electrification is poised to continue increasing due to

proposed new EV battery cell factories and processing facilities, and hydrogen electrolysis plants on the system.

A transformation is also taking place on the supply side. Contracts for many existing generators are expiring, and refurbishments and retirements at nuclear facilities are contributing to reliability needs in 2025-2027 and into the next decade.

The IESO has plans for meeting these needs, which are set out in the 2022 Annual Acquisition Report (AAR). In particular, capacity shortfalls have increased over the 2025-2027 period in comparison to previous forecasts – a reflection of accelerating electrification and economic growth. Increasing demand due to industrial expansions, revised federal EV targets, and municipal policy decisions are expected to continue this upward trend. This electrification and economic growth, however, can not happen if consumers and businesses don't have confidence that they can count on the grid to provide a reliable and affordable electricity service.

The IESO has made good progress in acting on these plans, including:

- Higher capacity auction targets, which can now include imports;
- Contracts with five existing suppliers (natural gas and wind) under the medium-term RFP to continue operations with end dates ranging from 2029 to 2031;
- Negotiating five-year contract extensions for a number of existing biomass facilities; and
- Contract extensions for existing natural gas facilities with Lennox and Brighton Beach to support reliability in specific areas of the province.

In addition, in response to a directive from the Minister of Energy, the IESO will launch a suite of new Save on Energy energy-efficiency programs in 2023 to reduce demand by an additional 285 MW. A capacity agreement is also in place with Hydro-Quebec that could provide 500 MW of import capacity in 2026 or 2027.

Pickering Extension

The Ontario Minister of Energy has asked Ontario Power Generation (OPG) to seek regulatory approval for an extension of the Pickering Nuclear Generating Station's operating license until fall 2026. A decision on this request is not expected until 2024. If approved, this extension will make an important contribution to the overall reliability picture in 2026, as well as reduce overall emissions.

Ontario's Long-Term Procurements

The 2022 AAR identified the need for 2,500 MW of capacity starting in 2025 and continuing beyond. To address this need, the IESO has developed three procurements (Same Technology Upgrades, Expedited LT 1 and LT 1) with a target of approximately 4,000 MW of capacity.

The IESO has identified significant reliability risks as a result of potential project delays, given current global supply chain and project development issues. This higher procurement target mitigates against

this risk of not having enough resources to meet planning standards and ensure that the system is ready for future growth. This target will also help the IESO manage operability risks stemming from integrating new technologies onto the system.

The importance of taking a more proactive approach is confirmed by recent experiences from other system operators. In California, for example, rotating blackouts in 2020 highlighted the need to carefully plan for the energy transition.

The procurement amounts and timelines are expected as follows:

Procurement Mechanism	Capacity Target (MW)	Eligibility	Final Procurement Materials Posted	Proposals Due	Contract Award
Same Technology Upgrades	300	Facility improvements managed through contract amendments	Nov 1, 2022	Dec 20, 2022	Q1 2023
Expedited Long-Term 1	1,500	On-site expansions and new greenfield resources	Nov 1, 2022	Dec 20, 2022	Feb 2023
Long-Term 1	2,200	On-site expansions and new greenfield resources	Jan 31, 2023	Q2 2023	No later than Oct 2023
Total	4,000	-	-	-	-

The Same Technology Upgrades stream is a solicitation for upgrades and efficiency improvements to existing contracted facilities that will provide for the timeliest and most cost-effective capacity increases to the electricity system. The Expedited and LT1 RFPs will target resource expansions in addition to new build generation, while providing incentives for the early delivery of new resources.

This structure of the procurement design is rooted in the 2021 APO, which found that assuming continued availability of existing resources in the near term, adequacy needs are primarily for dispatchable capacity that must be able to run for a minimum of four continuous hours. They do not include energy, as enough energy production capability exists for most periods of time. Energy needs become more prominent in the latter years of the planning horizon.

In order to manage costs to ratepayers, the IESO is using open, competitive mechanisms to acquire the new capacity. In June 2022, the IESO issued a request for qualifications for both the Expedited LT1 and LT1 RFPs, which qualified 55 applicants to participate in the procurements. This level of interest from the developer community provides the IESO with confidence in the success of this approach; interest has been expressed by developers of storage (both battery and other forms), hybrids, biofuels and natural gas providers.

In particular, storage project proponents – especially in the form of lithium batteries – have submitted a significant number of proposals for deliverability assessments. A successful and robust storage fleet would contribute to the reliable decarbonization of the electricity system.

Storage can be a new form of non-emitting capacity to meet peak needs, as well as firm up variable generation, a service currently provided by natural gas. Battery storage is also of interest to the IESO as it is a flexible, modular resource that can be placed where it has the most value.

As a result, these procurements are expected to secure up to 2,500 MW of battery storage capacity, which could make it one of the largest fleets in North America. These procurements will also give the IESO an opportunity to learn how to integrate and operate storage at scale and support future growth.

Capacity vs. Energy

Capacity is a measure of the maximum amount of electricity the province's system can supply at any given time. To plan a reliable electricity system, the IESO must ensure that adequate capacity is available to supply the peak demand, taking into account sufficient margins in reserve. While capacity represents the maximum amount of electricity that the system can supply at any given time, the actual amount of energy produced varies. The IESO's current long-term procurements are seeking dispatchable capacity – forms of supply that can ramp up and down in response to system needs.

Energy Efficiency: A Cost-Effective Resource

Programs that help consumers reduce or control their energy use continue to be important contributors to the reliability of the electricity grid. Over the past 15 years, Save on Energy programs have helped Ontario homeowners and business reduce provincial demand by 12 per cent. Conservation and demand management (CDM) measures are quicker and easier to implement and can be counted on to achieve significant savings.

The Ontario government announced four new Save on Energy (SOE) programs to be implemented by the IESO for 2023 that will reduce demand by 285 MW for a minimum of eight years. These programs build on the current suite of SOE offerings.

Two of the programs – a program for greenhouses as well as one for local initiatives – are designed to help relieve constraints in local areas of need, including southwest Ontario. A residential demand response program will provide incentives to participating homeowners with smart thermostats by reducing air conditional load during the hottest summer days. New Retrofit incentives for custom projects will not only lower electricity demand, they will offer the added benefit of helping business reduce overall GHG emissions across their operations.

Resource Eligibility

The IESO recommends that the three procurements be open to a diverse portfolio of supply options. As outlined in the table below, the procurements should target approximately 2,500 MW for storage (battery and other), contributions from non-emitting resources such as hybrids and biofuels, and up to 1,500 MW of natural gas. In setting the target of 2,500 MW of storage, which could make Ontario one of the largest battery storage jurisdictions in North America, the IESO considered of operability challenges, as well as the risks associated with the integration of new technology.

Procurement Mechanism	Procurement Target (MW)	Storage (MW)	Natural Gas (MW)	Other**
Same Technology Upgrades	300	No limit	Up to 300	No limit
Expedited Long-Term 1	1,500	~900	Up to 600	No limit
Long-Term 1*	2,200	~1,600	Up to 600	No limit
Total by 2027	4,000	~2,500	Up to 1,500	-

* Exact targets to be confirmed

** Non-emitting resources including hybrids and biofuels

The Same Technology Upgrades and Expedited LT 1 are expected to be launched fall 2022, with LT1 to follow in 2023. As part of its regular annual planning process, the IESO will review the scope for the LT 1 procurement after the completion of the 2022 APO and the Pathways to Decarbonization report later this year to ensure that it addresses evolving needs.

Storage offers tremendous promise for Ontario’s electricity system. A small amount of storage is already in service – withdrawing energy from the grid during periods of low demand and injecting it when it is needed most. A successful and robust storage community will be critical to the decarbonization of the electricity system and reliability as it has the potential to offer much of the flexibility that is currently provided by natural gas.

Yet it cannot be counted on alone to meet Ontario’s needs. Based on the IESO’s experience, supplemented by feedback from stakeholders and other research, the IESO has identified significant reliability risks associated with potential project delays, supply chain disruptions and tight market conditions, that must be carefully managed and mitigated against. Each of these factors is discussed in more detail below.

Development Risk

All projects face development risk. As the IESO experienced in the transition from coal generation to replacement supply, only 30 per cent of projects were in operation on schedule, with 60 per cent falling behind by an average of 10 months, and the remainder failing to reach completion. Knowing this, the IESO is looking to secure diverse technologies from a range of suppliers to hedge against

delay risks. The IESO will also work with suppliers where appropriate to support timely project delivery and include additional incentives for commissioning early.

Supply Chain Risk

The IESO commissioned an independent report to review supply chain disruptions across the global economy that have arisen since the onset of COVID-19 and the challenges associated with sourcing batteries, photovoltaic cells and other critical components. Shortages of ships, containers and labour, increases in the cost of steel and oil, as well as geopolitical events such as the Russian invasion of Ukraine, have all exacerbated these delays.

Although new battery manufacturing facilities can be constructed in two or three years, it will take close to a decade to bring raw material suppliers on-line. Various alternative battery technologies are being developed, yet all remain several years away from mass commercialization.

As the demand for batteries is forecast to exceed supply, battery costs are continuing to rise. In particular, price increases for lithium, cobalt and nickel are pronounced, which will have cost impacts for customers. The IESO is mitigating the risk of delays and cost increases caused by supply chain challenges by diversifying the procurement portfolio.

Integration Risk

With less than 100 MW of storage currently operating on the system, the IESO, like most other system operators, has only recently begun to build the necessary experience to integrate and operate grid-scale batteries. California's recent experience highlights the potential of grid scale storage and the challenges of integrating a new resource type into the supply mix. For its part, the IESO's first-hand experience with integrating natural gas and wind into the electricity market underscores the need for time to ensure the systems worked reliably.

The IESO is off to a good start; it is working closely with storage providers and others to build a process and market rules for storage resources. However, it can reasonably be expected that time will be needed to fully test and integrate grid scale batteries into the system. This large deployment of storage will provide valuable and practical experience further unlocking its potential for Ontario.

Adequacy Risk

The capacity needs identified will require a mix of resources that can meet needs for a minimum of four hours, as well as longer durations. Relying on storage alone would not address all adequacy needs. Battery storage is an energy-limited resource, which can typically only be discharged once a day for up to four hours and, as such, would not be available to provide energy over long durations or for multiple times over a day. When the system falls below reliability standards and is not considered adequate, there is considerable operational risk – with a greater reliance on conservation appeals and rotating blackouts to stabilize the provincial grid.

Natural Gas as a Transitional Fuel

While natural gas comprised 28 per cent of installed generation capacity in Ontario, in 2021, it only produced 8.6 per cent of actual energy. It provides flexibility to the system by quickly ramping up and down to meet changes in demand and augmenting the availability of other forms of generation.

Natural gas generation can also support longer periods of need during extreme weather events and, as of yet, there is no like-for-like replacement. Operating a system without it requires a careful analysis of how a combination of other forms of supply can provide this level of flexibility.

Given the considerable development and supply chain risk, the uncertainties around building and operating new facilities, and the potential for faster than forecasted growth in demand, natural gas generation will help ensure reliability over this period. Based on the IESO's assessments through the qualification process, it is anticipated that the majority of this capacity will come from upgrades and expansions at existing natural gas facilities. In addition to being a cost-effective solution, it also offers a high level of certainty in terms of deliverability and operability.

While additional natural gas capacity will be needed to hedge against risks to reliability, it will also support economic development, as well as changing consumer preferences and electrification, beyond what is currently considered in the IESO demand forecasts.

Impact on Emissions

The IESO is recommending up to 1,500 MW of incremental natural gas generation be procured to be used during periods of peak demand. Based on expected usage of gas as a peaking resource, incremental carbon emissions would be in the range of 0.2 to 0.4 MT or a 2 to 4 per cent increase over 2021 APO projections. As such, it is not expected to significantly increase emissions from the system – with overall emissions still remaining far below pre-2005 levels.

Moreover, this expansion will contribute to the electrification of technologies across all sectors, particularly transportation, manufacturing and industry, and contribute to emissions reductions in the broader economy.

As the risks of climate change are gaining prominence at home and abroad, Ontario is also participating in the global conversation about how electricity systems can support electrification while also transitioning to net zero emissions. In response to a request from the Minister of Energy, the IESO is assessing how to fully decarbonize Ontario's grid to eliminate the remaining emissions from the system.

In its analysis of pathways to decarbonization, the IESO is considering how to replace the flexibility and fuel security currently provided by natural gas facilities and eliminate remaining sector emissions. As part of this process, we are considering known technologies, including demand response and pumped storage, as well as emerging technologies like hydrogen turbines and fuel cells.

As with the phase-out of coal generation, if the province were to eliminate emissions from the electricity system, it will need to be done in a carefully coordinated manner, to maintain reliability and affordability while facilitating carbon reductions across the broader economy. The results of this analysis will be available by the end of the year.

Conclusions & Next Steps

Without a limited amount of new natural gas in the near term, the IESO would be reliant on emergency actions such as conservation appeals and rotating blackouts to stabilize the grid.

As such, the IESO recommends that 4,000 MW of new supply capacity be procured to meet capacity needs in 2025-2027 across the three procurement processes: Same Technology Upgrades, Expedited LT1 and LT1. The IESO further recommends that this need be addressed by securing approximately 2,500 MW of storage capacity, contributions from non-emitting resources such as hybrids and biofuels, and up to 1,500 MW of natural gas.

The IESO is confident that a maximum target of 1,500 MW of new natural gas capacity will address short term energy needs and contribute to the province's longer term energy transition. Recommendations on the future role of natural gas will be included in the Pathways to Decarbonization report to be released later this year.

Following receipt of an Order in Council, the IESO will issue the final Expedited LT1 Contract and RFP, as well as the solicitation for the Same Technology Upgrades. Proposals will be due by December 20 of this year. The IESO expects to conclude both processes by spring 2023. The LT1 RFP Contract and RFP are expected to be posted in January 2023 and conclude by October that year.

Together, these recommendations will enable Ontario's electricity grid to remain reliable and affordable through a period of significant change. They will allow the IESO to manage development and supply chain risks, prepare for potentially faster than forecasted demand growth from economic development and electrification, and support the transition to a low-carbon grid.

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