



November 2, 2023

The Honourable Steven Guilbeault
Minister of Environment and Climate Change Canada
200 Sacre-Coeur
Gatineau, Quebec
K1A 0H3

Independent Electricity System Operator

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Dear: Minister Guilbeault

Re: IESO Submission on the Proposed Clean Electricity Regulations

The IESO welcomes the opportunity to provide its submission on the proposed Clean Electricity Regulations (CER). Recognizing that the scope and pace of change the electricity sector faces will be challenging, and that these decisions will be far-reaching, collaboration will be essential to achieving our shared goals.

The IESO also wishes to acknowledge the efforts taken by Environment and Climate Change Canada (ECCC) to develop a framework for eliminating the use of emitting generation and contributing to a net-zero economy by 2050, in a manner that considers system reliability and affordability.

The electricity systems that sustain many of the elements of modern life are highly complex and defined by several variables. These include the operating characteristics of generation, where generation is located, how electricity is delivered to consumers, and a myriad of factors that drive demand.

The IESO operates one of the largest and most diverse electricity systems in the country, ensuring it remains safe, reliable and affordable for Ontarians 24 hours a day, seven days a week. Ontario is also electrically interconnected with Manitoba, Michigan, Minnesota, New York and Quebec through interties. As the Reliability Coordinator for Ontario, the IESO operates the province's electricity system on a second-to-second basis, keeping supply and demand in balance at all times and maintaining compliance with North American Electricity Reliability Corporation (NERC) and the Northeast Power Coordinating Council (NPCC) reliability requirements. This reliability is what drives the confidence to support the growing provincial economy and overall decarbonization goals.

For the system operator, this is a challenging intersection - these responsibilities must be balanced with a rapidly evolving sector that is seeing significant electrification and other clean energy alternatives grow, along with major investments in the new green economy. The draft CER represents a starting point for a discussion on a Canada-wide transition to a net-zero electricity sector, but the CER must also recognize the limitations of its "one-size fits all" approach to implementation given the unique realities faced by each province.

The IESO has responsibility for determining long-term electricity system needs and develops and executes plans to meet these future needs. This includes taking the necessary actions to implement climate policy to achieve decarbonization goals. The IESO is aware that the single most important contribution the electricity system can make towards broader decarbonization efforts is to support the electrification of key sectors, such as transportation and industry, by remaining safe, reliable and cost effective. This goal is central to the IESO's mandate of ensuring electricity is available when and where Ontarians need it.

As the IESO moves further towards the transformation that decarbonization is bringing, it is clear that a balance will be needed to ensure the alignment of the many factors involved. Previous planning studies completed by the IESO concluded that natural gas generation will be needed beyond 2035. As described in this submission, the CER creates a resource shortfall by imposing severe restrictions on natural gas generation that compromises the IESO's ability to meet this need. Suitable alternatives to replace natural gas generation and build transmission infrastructure at the scale required cannot be planned, acquired and built at the rate required to comply with the draft CER.

For these reasons, the CER as drafted is unachievable in Ontario by 2035 without putting at risk the reliability of the electricity system, electrification of the broader economy and economic growth. Further, the CER could also jeopardize Ontario's ability to meet the electricity needs associated with the province's expected significant population growth.

While the CER could play an important role in guiding the future path toward the elimination of emissions from provincial grids across the country, Ontario requires the following amendments to allow the province to reach these objectives in a way that supports the orderly phase out of natural gas generation:

1. The current "Prescribed Life" provision must be extended from 20 to 30 years to ensure Ontario has a realistic timeline to replace the natural gas generation that would otherwise be restricted by the provisions of the CER in 2035. Ontario built the majority of its natural gas generators in the late 2000s as part of its leading efforts to remove coal from its resource fleet. The 20-year prescribed life provision would severely restrict the use of these natural gas generators, creating reliability risks.
2. The application of the Emergency Circumstances, to the extent they are necessary, must recognize the realities of real-time power system operations and be revised to provide confidence that natural gas generation can be relied upon for public safety by adopting the NERC definition for Energy Emergency.
3. The exception for emissions from 450 annual operating hours must be reconsidered to ensure the electricity system can continue to rely on natural gas generators for essential reliability services. The IESO is planning to complete an analysis in early 2024 to determine how the prescribed annual operating hours provision could be modified to allow for the more effective use of natural gas resources in a manner that optimizes both cost efficiencies and emissions reductions.

Recognizing that electricity system plans that look out over a decade will change, and adjust to future realities, a periodic review of the CER would ensure that it reflects the latest information, including the state of non-emitting technologies.

Ontario's Decarbonization Journey

Ontario's electricity system today is almost 90 per cent emissions-free as a result of a decarbonization journey that's been two decades in the making. The IESO has overseen this transformational change, beginning when Ontario became the first jurisdiction in North America to remove coal from its system, replacing it with nuclear, hydroelectric, natural gas, wind, solar and biofuel. Flexible natural gas supply was critical in helping the IESO comply with reliability standards.

During this period, the IESO developed its understanding of the operating characteristics of natural gas generators and how the resource could be effectively deployed to facilitate the integration of large amounts of intermittent renewable generation on Ontario's electricity system. Similar circumstances exist today as the IESO is only beginning to learn about the the operating characteristics of emerging technologies, such as hydrogen, and how the services they offer can be leveraged to effectively integrate a growing fleet of renewable generation.

Ontario's decarbonization journey continues today, as exemplified by two recent IESO studies: "[Pathways to Decarbonization](#)" (P2D) and "[Decarbonization and Ontario's Electricity Sector: Assessing the impacts of phasing out natural gas generation by 2030](#)". These studies demonstrate the IESO's efforts to assess potential approaches to decarbonizing Ontario's electricity system, and the finding of the P2D study that 8,000 MW of natural gas generation will be required in 2035 to maintain system reliability was used to inform the IESO's requested amendments to the CER, further described in latter sections. This summer, the Ontario government released its electricity sector policy in a report entitled "Powering Ontario's Growth: Ontario's Plan for a Clean Energy Future" (POG) representing the province's roadmap to facilitate a reliable, affordable, and clean energy future. Combined, these studies and policy signify Ontario's commitment to enabling a net-zero electricity system.

Recent Decarbonization Progress

Ontario's decarbonization efforts leverage many facets, in recognition of the need to integrate multiple technologies and resource types to replace the services provided by natural gas generation. An aspect of Ontario's plan includes developing a robust energy storage fleet. Contracts are in place to build almost 1,000 MW of battery storage by 2026, and the IESO is in the process of procuring a further 1,600 MW of storage capacity that will come into service in the period leading up to 2035.

The plan has also led to the province initiating work on four new small modular reactors (SMR) at Darlington Nuclear Generating Station, as well as examining the opportunity for the refurbishment of the four nuclear generating units at Pickering B and developing new nuclear generation at the Bruce site. The expected in-service dates and capacities of each of these facilities are shown in Table 1.

Table 1: Nuclear Development – Timelines and Capacities

Resource Name	IESO Expected In-service Date	Capacity (MW)
SMR G1	2029 - 2032	300
SMR G2	2034 - 2037	300
SMR G3	2035 - 2038	300
SMR G4	2036 - 2039	300
Subtotal MW		1,200
BRUCE		
BRUCE G1	2040 - 2043	1200
BRUCE G2	2042 - 2045	1200
BRUCE G3	2044 - 2047	1200
BRUCE G4	2046 – 2049	1200
Subtotal MW		4,800
PICKERING		
PICKERING G5*	2030	550
PICKERING G6*	2032	550
PICKERING G7*	2033	550
PICKERING G8*	2034	550
Subtotal MW		2,200
Total MW		8,200

*A decision to refurbish Pickering B has not been made. The expected in-service dates for Pickering B assume refurbishment is undertaken.

Further, as forecasts show a growing need for energy before the end of the decade, work has begun on the procurement of additional energy resources from renewables. In addition to providing needed capacity, renewable generation is envisioned to support the province’s new and growing storage fleet, charging batteries when power is available so they can discharge when needed.

Work is also moving forward to tap into the potential of distributed energy resources. By 2026, small scale generation, flexible load and storage located within local distribution networks will be able to participate directly in the provincial energy market – as increasing amounts of supply at the community level is expected to grow. The IESO is also investing in hydrogen and low-carbon fuels to determine how they can provide flexibility. On the demand side, incentives through Save-on-Energy conservation programs have doubled, with a focus on developing programs to promote load flexibility.

Together these resources will form the foundation of Ontario’s generation mix that will provide the reliability services the province needs over the next decade and beyond.

The Role of Natural Gas

While natural gas generation currently only supplies approximately 10 percent of the province's electricity needs, it plays a critical role in maintaining system reliability based on its ability to provide continuous energy throughout the year, under all weather conditions. Further, natural gas generation can be ramped up or down, providing reliability services that help stabilize voltages and frequencies on the transmission grid. Appendix A outlines these essential reliability services and describes why they are crucial to maintaining system reliability and operability.

As described in the P2D study, a scenario for a pathway to a decarbonized grid forecasts that 8,000 MW of natural gas generation, representing 17% of Ontario's total projected installed capacity, will need to remain available in 2035. This represents a significant reduction from today where natural gas generation represents approximately 10,500 MW, or 28% of Ontario's total installed capacity. This reduction in natural gas is enabled by nuclear refurbishments, new small modular reactors, other additional renewable generation (e.g., wind, solar) and significant conservation. The 8,000 MW of natural gas generation in 2035 is required to ensure system reliability until appropriate alternatives are identified and brought into service.

The CER, as drafted, will severely restrict the ability of the natural gas generating fleet to contribute to these reliability needs, creating a significant capacity deficit for Ontario's system. Currently, there are no like-for-like replacements, at scale and with similar operating flexibility, for natural gas generation on the system. Part of the work of the energy transformation is to learn how new forms of generation, like storage, hydrogen, flexible load and other alternative fuels, can be used to replace natural gas by providing essential reliability services; however, this will take time.

The IESO's primary concern is that CER does not provide Ontario with the necessary lead time to plan, acquire and put into service new resources and the required transmission infrastructure necessary to replace the essential reliability services natural gas generation provides.

Building New Resources and Transmission to Replace Natural Gas Will Take Time

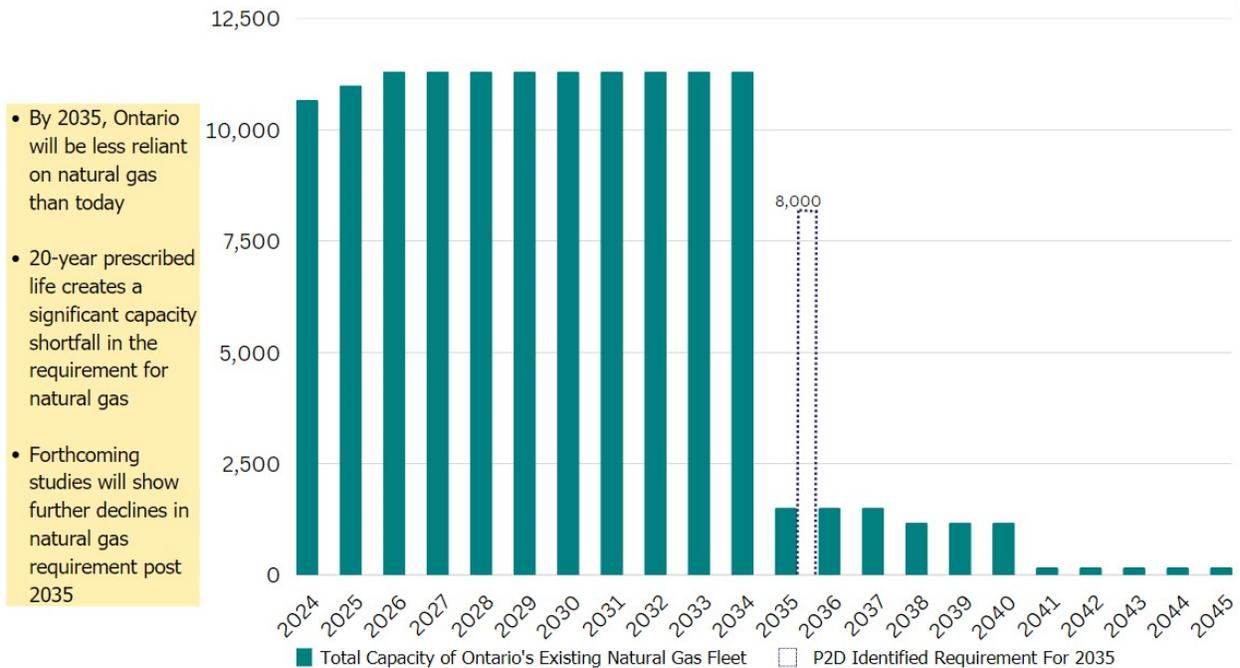
Ontario's challenges associated with replacing natural gas generation with new resources are compounded by several factors. The P2D study shows that Ontario's electricity system capacity requirement could more than double by 2050, from 42,000 MW today to 88,000 MW. This increase is driven by several factors, including economic and population growth, as well as substantial electrification. In addition, about 20,000 MW of current electricity generating capacity will remain in operation in 2050, with the remainder coming to the end of its useful life or being phased-out over the next three decades, including gas-fired resources. This means that Ontario may be required to build upwards of 69,000 MW of new generation by 2050 to ensure that a reliable and operable electricity system is maintained.

Suitable non-emitting replacement supply resources beyond those already identified cannot be planned, acquired, and put into service by 2035.

Figure 1 shows the effect of the CER, and the 20-year prescribed life, on the total capacity of Ontario's existing natural gas fleet that could be employed to meet needs. As shown, the CER places severe restrictions on the total existing capacity creating a significant deficiency compared to the amount of natural gas generation required in 2035 as identified by the P2D

study. The CER creates a resource shortfall that cannot be resolved simply through the addition of incremental non-emitting resources as they cannot be built at the rate required to comply with the draft CER.¹

Figure 1 | Resource Shortfall Created by the CER and 20-year Prescribed Life



- By 2035, Ontario will be less reliant on natural gas than today
- 20-year prescribed life creates a significant capacity shortfall in the requirement for natural gas
- Forthcoming studies will show further declines in natural gas requirement post 2035

The IESO’s concern with the draft CER is that it does not provide sufficient lead time to develop the new non-emitting generation expected to replace natural gas generation. The IESO has previously studied the expansion of non-emitting generation capacity as an element of the P2D study. As part of this capacity expansion, the IESO considered the feasibility of new resources, including the time required to bring a resource to commercial operation², annual build limits, cost and performance. Only low-emissions resources that were considered technically feasible, and that could be available within the time frame of the study, were included as potential new candidates for the future generation mix. The P2D report considered these factors, as well as the required transmission expansion, and concluded that to maintain system reliability and operability, 8,000 MW of natural gas generation will be required in 2035, as denoted in Figure 1.

Having already considered the lead time and build limits of non-emitting generation, it is not possible to further ramp up the build-out of these resources to account for the severe restrictions the CER imposes on natural gas generation starting in 2035. Moreover, when it

¹ The IESO recognizes that the available capacity from natural gas generation in the years leading up to 2035 exceeds the 2035 requirement of 8,000 MW. This excess availability provides the IESO with the opportunity to determine the optimal portfolio of natural gas resources that should remain in-service to meet the 2035 requirement based on factors such as location, cost and emissions performance.

² Including, but not limited to: procurement, detailed design, permitting, stakeholder and community engagement, and construction

comes to the reliability of the electricity system, only a portion of some non-emitting resources can be relied upon at the time of peak electricity demand due to the availability of their fuel sources. For example, during peak periods in the summer months, 1,000 MW of onshore wind resources would be expected to provide between 190 – 340 MW of capacity, and 1,000 MW of solar resources would be expected to provide between 9 – 370 MW of capacity^{3,4}. It will require more time than the draft CER allows to build a portfolio of new non-emitting resources to replace natural gas generation at the scale required for reliability identified in the P2D study.

Pursuing this phase out and replacing this lost capacity will require significant investment. As an example, and as previously noted, while a 1,000 MW natural gas generator is capable of providing nearly 1,000 MW of capacity during peak times, a 1,000 MW wind generator is only expected to provide between 190 - 340 MW of capacity during the same period. In simple terms, and without consideration of the need to construct supporting transmission infrastructure, this means that between approximately three and five new 1,000 MW wind farms would be required to replace the capacity provided by one 1,000 MW natural gas generator.

A key factor in the retirement of natural gas generation and the connection of new non-emitting resources will be the availability of sufficient transmission infrastructure. Natural gas facilities are often strategically located close to urban load centres to meet local needs as well as to contribute to overall system reliability. As such, retiring those natural gas plants will either require significant additional transmission supply to key urban areas (such as York Region and the City of Toronto) or additional local non-emitting resources, which may not be feasible given siting constraints due to the availability of land at the scale required. Further, due to congestion restrictions, new and significantly long transmission infrastructure will be needed to connect new non-emitting generation to various points of need across the province.

Building transmission infrastructure at this scale is challenging, especially in densely populated areas, where rights to land may be difficult to acquire, permitting may be more arduous and construction more expensive, especially if underground or underwater routing is required. Expanded transmission infrastructure at the scale required cannot be completed by 2035 when considering planning, construction, local engagement and building meaningful relationships with First Nations communities.

The IESO's P2D study also identified several other significant barriers to the buildout of new transmission and renewable generation. These barriers, including increasing competition for scarce resources, weakened supply chains and a limited pool of skilled labour, only intensify the challenges facing Ontario as it pursues a net-zero electricity system.

Clean Electricity Regulations (CER) Amendments

The operational challenges of managing a system with electricity needs that are ever changing and are subject to a broad range of variables are highly complex. The dynamic nature of Ontario's electricity requirements means the IESO must take a flexible and responsive approach to both planning and operating the system. Here, the key concern is timing, not the objective.

³ Note that during peak periods in the winter months, the contribution of wind resources is slightly higher than in summer, whereas the contribution of solar resources is lower.

⁴ Based on capacity contribution values provided in the IESO's P2D and Reliability Outlook studies.

The CER, as drafted, is unachievable in Ontario by 2035 without compromising reliability, and in-turn impeding ongoing efforts to decarbonize the system.

While the IESO is offering recommendations to inform regulations based on our experience with managing the Ontario grid, and current plans for a decarbonized grid, more work is needed to determine how to better align these regulations with reliability standards.

The IESO is requesting that the ECCC consider three amendments to the following provisions of the draft CER. And, in recognition that electricity system plans look out over a decade and do change, the IESO also recommends that the CER be subject to periodic review to ensure it remains reflective of future realities.

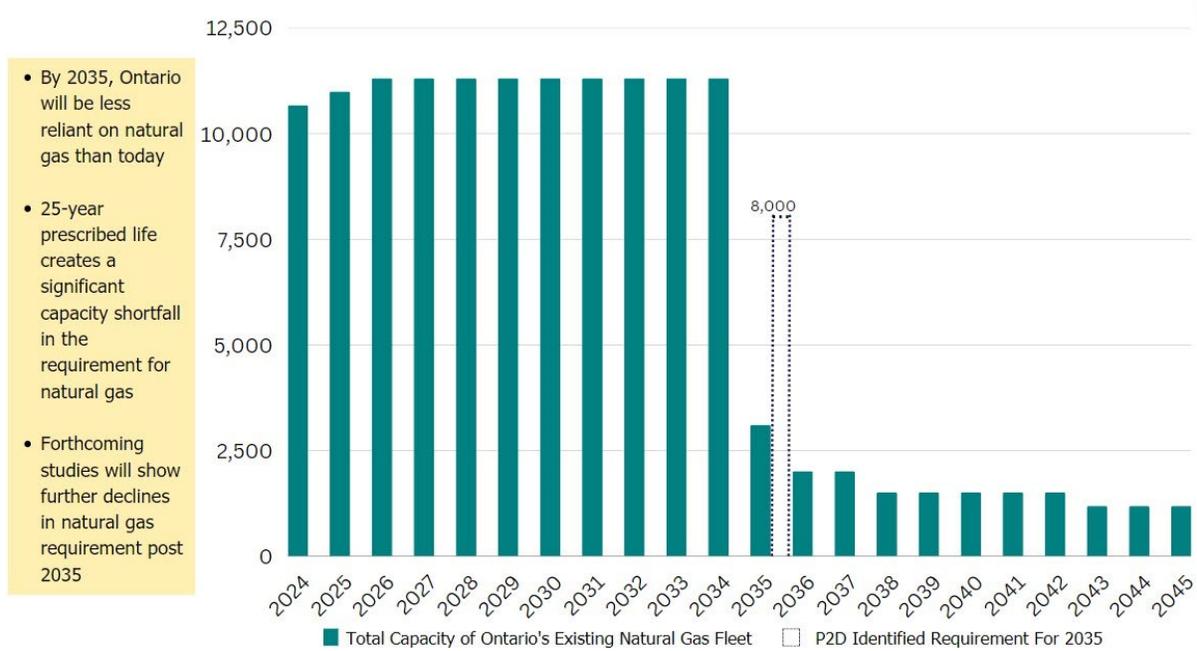
1. The Prescribed Life of Existing Units

The IESO recommends extending the “Prescribed Life” provision from 20 to 30 years, in relation to generation with a commissioning date prior to January 1, 2025, to smooth the resource shortfall the draft CER would create in 2035. Natural gas generators are needed for reliability, and though the amount they operate in the future will decline as replacement resources come online, the draft CER would severely restrict the use of Ontario’s existing natural gas generation fleet, as shown in Figure 1.

The IESO recommends extending the “Prescribed Life” to 30 years because 25 years does not mitigate the resource shortfall due to the age of Ontario’s natural gas resources, and does not allow Ontario to achieve an orderly phase out of natural gas generation. The effect of a 25-year prescribed life is shown in Figure 2 below.

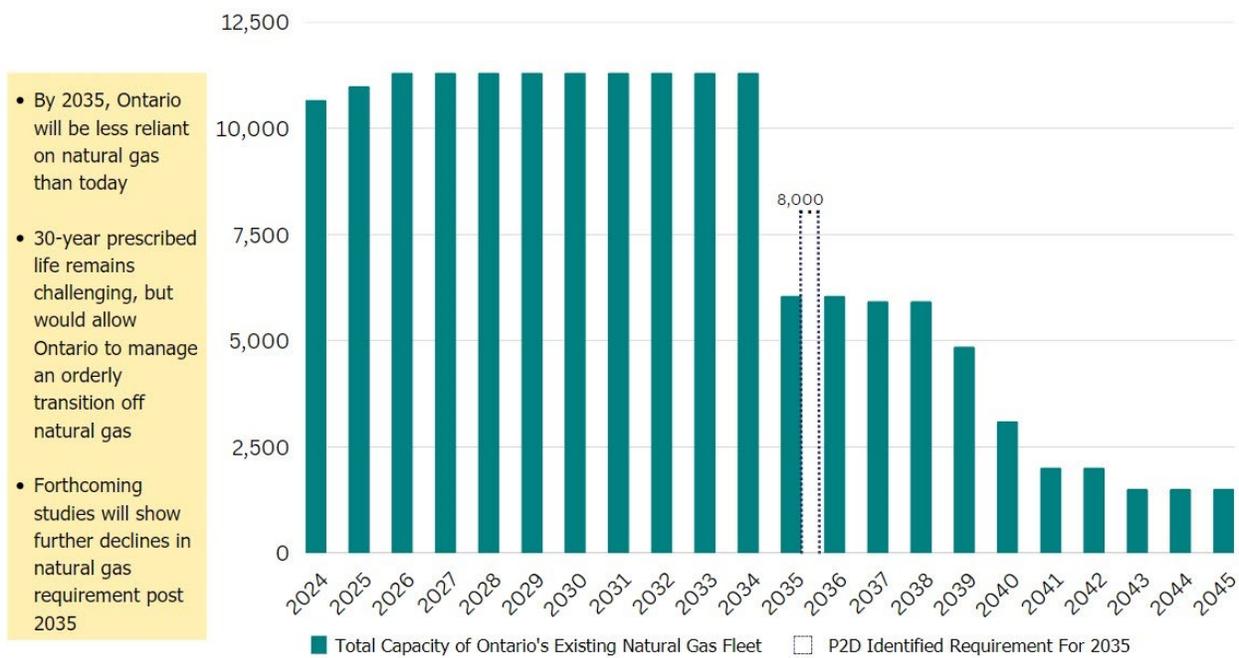
Ontario built the majority of its natural gas fleet in the late 2000s as part of its leading efforts to remove coal from its resource fleet. The 20-year asset life provision proposed in the CER would severely restrict the use of available natural gas generation, preventing access to the 8,000 MW requirement identified by the P2D study. Ontario should not be disadvantaged in the orderly phase out of natural gas generation simply because its decarbonization efforts began two decades ago and its natural gas generators are older than 20 years by association.

Figure 2 | Resource Shortfall Created by the CER and 25-year Prescribed Life



Extending the “Prescribed Life” provision from 20 to 30 years would allow Ontario’s electricity system to retain the flexibility it requires to maintain reliability and support large-scale electrification and economic growth. This is shown in Figure 3, below.

Figure 3 | CER and 30-year Prescribed Life More Closely Aligns with Ontario’s Reliability Needs



2. Definition of the Emergency Exemption

The draft CER would exempt an emitting generator from the application of the emissions restrictions during a period of emergency resulting from an “extraordinary, unforeseen and irresistible event”, provided approval is granted by the Minister of the Environment (Minister). This approval is granted on a retroactive basis, and as a result, a decision by the owner or operator of the generator to operate during an emergency carries considerable risk. A generator that operates during an emergency event, even where required by IESO direction, could face criminal penalties if the Minister does not grant approval.

As written, the emergency provisions could prevent control room operators from managing the system according to North American reliability standards. For example, natural gas generation provides reserve power should there be a sudden loss of other generation. System control room operators, much like air traffic controllers, oversee all activity on the grid, and have the authority to direct generators and other suppliers. The integrity of the system relies on a central point of authority. By putting generators in the position of being criminally liable after the fact, the IESO’s ability to make real-time decisions as it balances supply and demand would be seriously compromised.

The IESO requires certainty that operators will quickly respond to directives, especially those resulting from emergency circumstances. Lack of certainty results in unacceptable reliability risks. To provide this certainty, the IESO recommends that the ECCC consider the types of control actions that the IESO is required to take in accordance with NERC and NPCC reliability standards and emergency operating plans. Further, to provide absolute certainty, the IESO recommends that the CER adopt the following NERC definition of an Energy Emergency:

Any abnormal system condition that requires automatic or immediate manual action to prevent or limit the failure of transmission facilities or generation supply that could adversely affect the reliability of the Bulk Electric System.

Additional background on the IESO’s obligations under NERC and NPCC reliability standards regarding the development and implementation of emergency operating plans are provided in Appendix B.

Prescribed Annual Operating Hours of Emitting Generators

While the draft regulations include an exemption for emissions up to 150 annual kilotonnes of CO₂, where a generator operates up to 450 annual hours, this number of operating hours is insufficient in Ontario. Some natural gas generation operates at lower output levels, over longer durations, in order to be ready to increase output quickly to provide a variety of different reliability functions, as summarized in Appendix A. The minimal output levels are based on operating characteristics of the generator and technical limitations due to thermodynamics. The draft CER’s proposed 450 annual cap does not reflect this operating reality, restricting the ability of natural gas generation to provide the range of flexible services the IESO requires to maintain reliability in accordance with NERC and NPCC requirements.

Reliance on the electricity system is expected to increase as the economy decarbonizes. This means both increased demand and potentially more variability in demand as conventional resources retire and increasing amounts of variable renewable generation and new technologies are brought online. It also means a shift in the operational characteristics Ontario’s generation

resources have that can respond to changes on the system. Natural gas generation is the primary tool used to manage fluctuations in system demand. It does so by enabling the system to match supply and demand under all conditions, a reliability service known as flexibility. Given the increasing challenges faced by Ontario, the need for natural gas generators to provide flexibility will only continue to grow until suitable alternatives can be placed in-service.

Acknowledging that continued reliance on natural gas generation is a transitional necessity, the IESO is undertaking planning analysis to determine how the draft prescribed annual operating hours provision could be modified to allow the IESO to more effectively utilize its natural gas resources in a manner that optimizes both cost efficiencies and emissions reductions. The findings of this analysis will be presented to the ECCC in early 2024, including the IESO's recommendation for increasing the number of operating hours specified in this provision, or an alternative metric that optimizes both cost efficiencies and emission reductions.

Additional IESO Analysis

The IESO will continue to study how to plan for an orderly phase out of natural gas generation in the Ontario electricity system. As part of this work the IESO will examine the potential costs and emission profiles of phasing out natural gas generation across different implementation scenarios. The IESO would be pleased to review these results with the ECCC when the studies are complete, as they would be informative of a revised CER that decarbonizes Ontario's generation mix while maintaining a reliable and affordable electricity system.

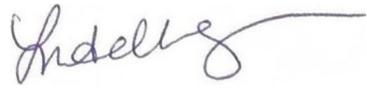
Conclusion

On average, Ontario's system accounts for just under three per cent of the province's total greenhouse gas emissions, which, as indicated in the P2D study and POG report, Ontario remains committed to further reducing. Indeed, the most important contribution the electricity system can make towards broader decarbonization efforts is to support the electrification of key sectors, such as the transportation and industrial sectors. However, the system must remain reliable and affordable to do so.

The CER must also recognize that electricity system plans that look out over a decade or more will be subject to change, and providing flexibility to adjust for future realities will be an essential design component. The CER should incorporate a periodic review to ensure it remains relevant and responsive to the most up-to-date information and trends, including the state of non-emitting technologies, as the journey towards 2035 unfolds.

As part of its commitment to achieving a zero-emissions grid that supports broader decarbonization, the IESO will be undertaking additional analysis in order to inform a CER with emissions target that are achievable while maintaining reliability. The IESO is appreciative of the ECCC's willingness to meet with and discuss the results of this technical analysis once finalized in early 2024.

Sincerely,

A handwritten signature in black ink, appearing to read "Lesley Gallinger", with a long horizontal flourish extending to the right.

Lesley Gallinger

President and Chief Executive Officer
Independent Electricity System Operator

Appendix A

The IESO operates one of the largest and one of the most diverse electricity systems in the country consisting of 13,144 MW of nuclear, 8,922 MW of hydroelectric, 5,533 MW of wind, 2,649 MW of solar, 383 MW of biofuel and 10,470 MW of natural gas generation resources. These resources transmit electricity across a transmission system over 30,000 km in length, stretching from the Manitoba border to Ottawa in the east, and Windsor in the south to serve the needs of Ontario’s 5.3 million customers.

Table 1 outlines the essential reliability services natural gas generation provides and describes why they are essential to maintaining the reliability and operability of Ontario’s diverse electricity system. A recent example is provided to illustrate the importance of these services: during the spring freshet season, hydroelectric resources typically are unable to provide operating reserve and natural gas-fired resources become the primary resource type used to satisfy IESO’s operating reserve requirements (reliability service 4 in table 1). During the 2023 spring freshet, natural gas-fired resources provided close to 70% of IESO’s operating reserve requirement, and in many hours provided over 90% of the requirement.

Table 1: Reliability Services Managed by the IESO

Reliability Service	Description
1. Capacity	Capacity is the ability of a generation resource to deliver energy. The IESO must ensure that adequate capacity is available to supply demand throughout the year, during both peak and non-peak periods. The effective capacity of a generation resource refers to the contribution that a resource can reliably make to meet peak demand, taking into account factors such as fuel availability, ambient conditions and outages.
2. Energy	Energy adequacy is a measure of a power system’s ability to satisfy electricity demand for all 8,760 hours of the year and not just peak demand hours. Evaluating a power system’s energy adequacy is becoming more important for systems with significant penetration of variable renewable energy resources, and increasing penetration of time-bound resources including storage and demand response.
3. Reactive support and voltage control	Reactive support and voltage control service is required to maintain acceptable reactive power and voltage levels on the power system. Acceptable voltage levels are required to move power through the transmission and distribution system from generators to end consumers. Maintaining adequate voltage profiles across the power system is critical to reliably operating the system, both during normal operations and following a system event. Maintaining an acceptable voltage is also essential to prevent damage to customer equipment.
4. Operating reserve	Operating reserve is standby capacity that can be called upon on short notice to restore supply-demand balance following an

	unexpected contingency. The IESO is obligated by NERC reliability standards to carry a minimum amount of operating reserve at all times.
5. Load Following/ Ramping capability	Load following is the ability of resources to follow changes in Ontario demand, and is essential to maintaining supply-demand balance in the 5-minute to hourly timeframes.
6. Frequency response	The IESO is required by NERC reliability standards to continuously match supply and demand in order to maintain power system frequency at 60 Hz. Failure to do so puts the power system at risk of losing generation and/or load, and could potentially cause local or widespread blackouts. Frequency response of generation resources is required to restore system frequency to 60 Hz after a contingency event such as loss of a large generator that causes system frequency to immediately drop. When this happens, resources that are synchronously connected to the power system will automatically respond by increasing their output within seconds to arrest the frequency drop and stabilize the frequency.
7. Regulation service	Regulation service balances normal fluctuations in supply and demand in the minute-to-minute timeframe. These fluctuations are generally caused by variations in demand and variable generation output that occur in between IESO's 5-minute energy dispatches. Regulation resources also help to restore system frequency following a contingency, after primary frequency response resources have initially responded.
8. Black start capability	Black start capability is critical to restoring the power system in a timely manner following a power system blackout. The service is provided through certified black start resources that have the ability to start without drawing power from the grid or other sources of generation. Once started, these resources can in turn support the energization of transmission elements, other generation units and critical loads in the province.

Through inertias, natural gas generation is used to assist neighbouring jurisdictions to maintain reliability during extreme events that disrupt the operation of their domestic electricity systems.

Appendix B

The IESO is obligated under NERC and NPCC reliability standards (NERC EOP-001-1 and NPCC Directory 2 Emergency Operations) to develop and implement emergency operating plans under a wide range of capacity and energy adequacy scenarios. Ontario Market Rules, including Market Manual 7.1 and 7.4, describe the conditions under which the IESO would declare an emergency operating state and the actions the IESO may take to maintain reliability. The IESO is further enabled to declare either a Conservative Operating State or Safe Posture Operating State during high-risk periods (e.g., heat waves, lightning storms, etc.) to position the power system to prevent entering an Emergency Operating State. These operating states will also be implemented when restoring the power system following emergency conditions. Under these operating states, the IESO is enabled and obligated to commit any and all available generation required to maintain the reliable operation of the power system. In all circumstances, this would include the commitment and dispatch of available natural gas resources. For the period September 2022 to September 2023, the IESO declared and operated in one of these states for approximately 300 hours.