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Input Item: Natural Gas Phase-Out Report Next Steps

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Purpose

IESO is seeking input on the next steps requested by the Minister of Energy to evaluate a moratorium on procurements of new natural gas generating stations in Ontario and to develop a pathway to zero emissions in the electricity sector.

Context

Natural Gas Phase-out Study

IESO undertook a study to assess the feasibility of phasing-out natural gas generation by 2030, including what would be required, the associated costs and the system impact.*

*See appendix for more information on the results of the study

Report Highlights:

- Phasing out natural gas generation by 2030 would lead to blackouts and the system changes required would increase residential electricity bills by 60 per cent.
- Ontario's electricity grid is only responsible for roughly 3 per cent of the province's total GHG emissions and is well positioned to support the electrification of other sectors.
- Ontario's electricity system is constantly evolving and the IESO is actively integrating emerging technologies that have the potential to meet Ontario's long-term needs.

Decarbonization and the future of Ontario's grid

Decarbonization – What's Next?

- The IESO's recent study found that Ontario's electricity system can support decarbonization within the sector – and in the broader economy.
- The 2021 Annual Planning Outlook (APO) will incorporate new demand forecasts to reflect the latest developments in electrification.
- 2021 APO will provide a deeper dive into the potential for electrification to increase demand forecasts, taking into account the many variables that influence its growth.

Decarbonization – What's Next?

The recent study relied heavily on increasing amounts of storage, demand response and energy efficiency. Given more time, the following options would also be available to further reduce emissions from the system:

- Building new hydro and nuclear generation would be feasible
- Siting of new wind/solar facilities would be more likely
- Emerging technologies would mature
- A staged retirement of gas facilities would enable a managed transition

The Ongoing Shift To A Cleaner Grid

While currently dependent on gas generation for reliability, Ontario's electricity system is evolving, shifting toward more flexible, non-carbon and localized supply sources.

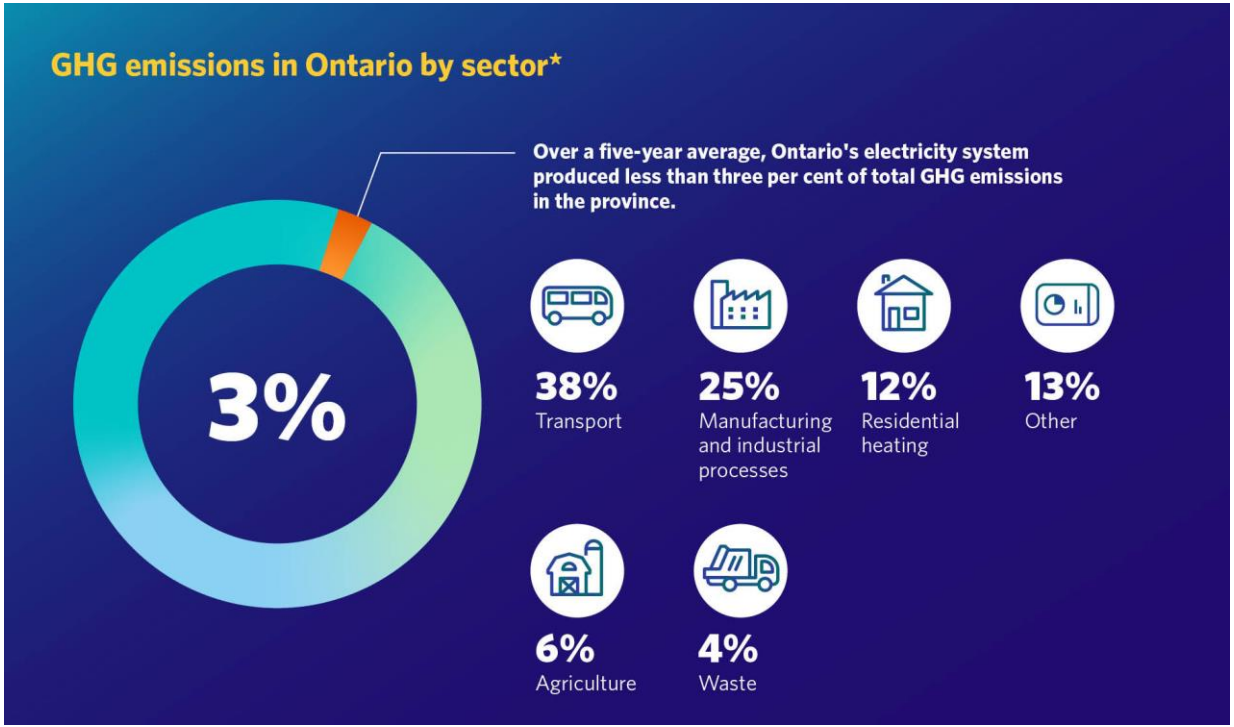
- Demand response competing with traditional sources of generation through capacity auctions
- Enabling participation of new resources through the Hybrid Integration Project and Distributed Energy Resources (DER) Roadmap
- New forms of storage, like batteries, are being tested on the bulk system

The Ongoing Shift To A Cleaner Grid (2)

While currently dependent on gas generation for reliability, Ontario's electricity system is evolving, shifting toward more flexible, non-carbon and localized supply sources.

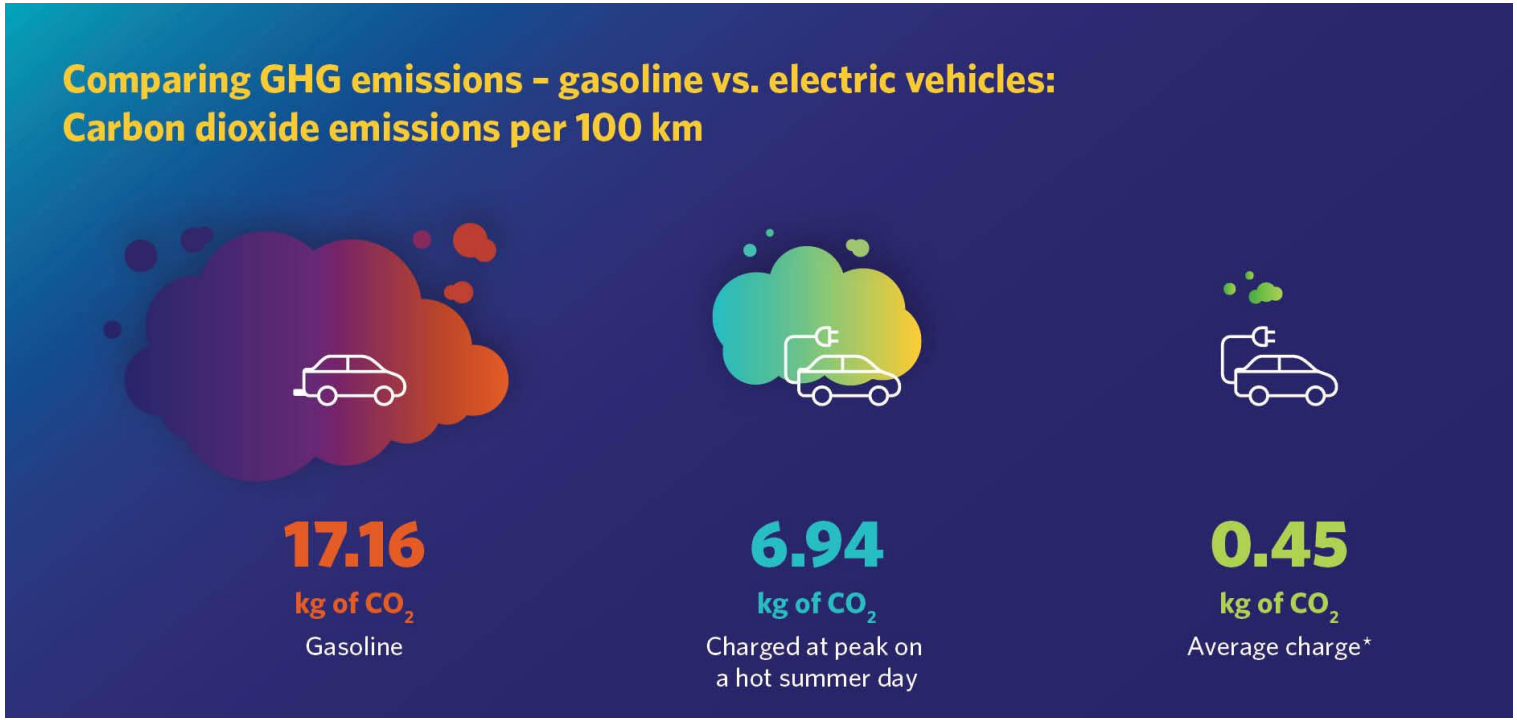
- Pilot projects are demonstrating how local power projects contribute to overall reliability
- Save on Energy conservation programs are evolving to support overall system and regional needs
- Technologies such as hydrogen and renewable gas represent future possibilities

A grid well-positioned to support electrification



* Percentages have been rounded and as a result will not add to 100.

Supporting decarbonization of other sectors



* For 2019

The Work Ahead

The Work Ahead

In response to the IESO study, the Minister of Energy's letter has requested additional work:

1. Evaluate a moratorium on the procurement of new natural gas generating stations in Ontario.
2. Develop an achievable pathway to phase-out natural gas generation and achieve zero emissions in the electricity system.

The Work Ahead (2)

With respect to the pathway, the IESO's work should consider:

- First and foremost, the reliability of the electricity system
- Cost to electricity ratepayers
- Timeline on which this is achievable
- Effect on electrification of the broader Ontario economy (i.e. industry, transportation, etc.) and reaching the province's overall climate goals

The Work Ahead (3)

With respect to the pathway, the IESO's work should consider:

- The possibility of maintaining the generating facilities but replacing natural gas with green fuels
- The role of technologies like pumped storage, battery storage combined with non-emitting resources, hydro, nuclear, and demand response to eliminate emissions in the electricity system

Seeking Input from SAC Members

General Considerations:

- Thoughts on how the energy sector's pathway to zero emissions can be achieved and the specific role for the electricity sector in supporting decarbonization in other sectors
- IESO's role in facilitating the evolution of new technologies (carbon capture, green fuels, small modular reactors, etc.) and considerations around cost and timeline

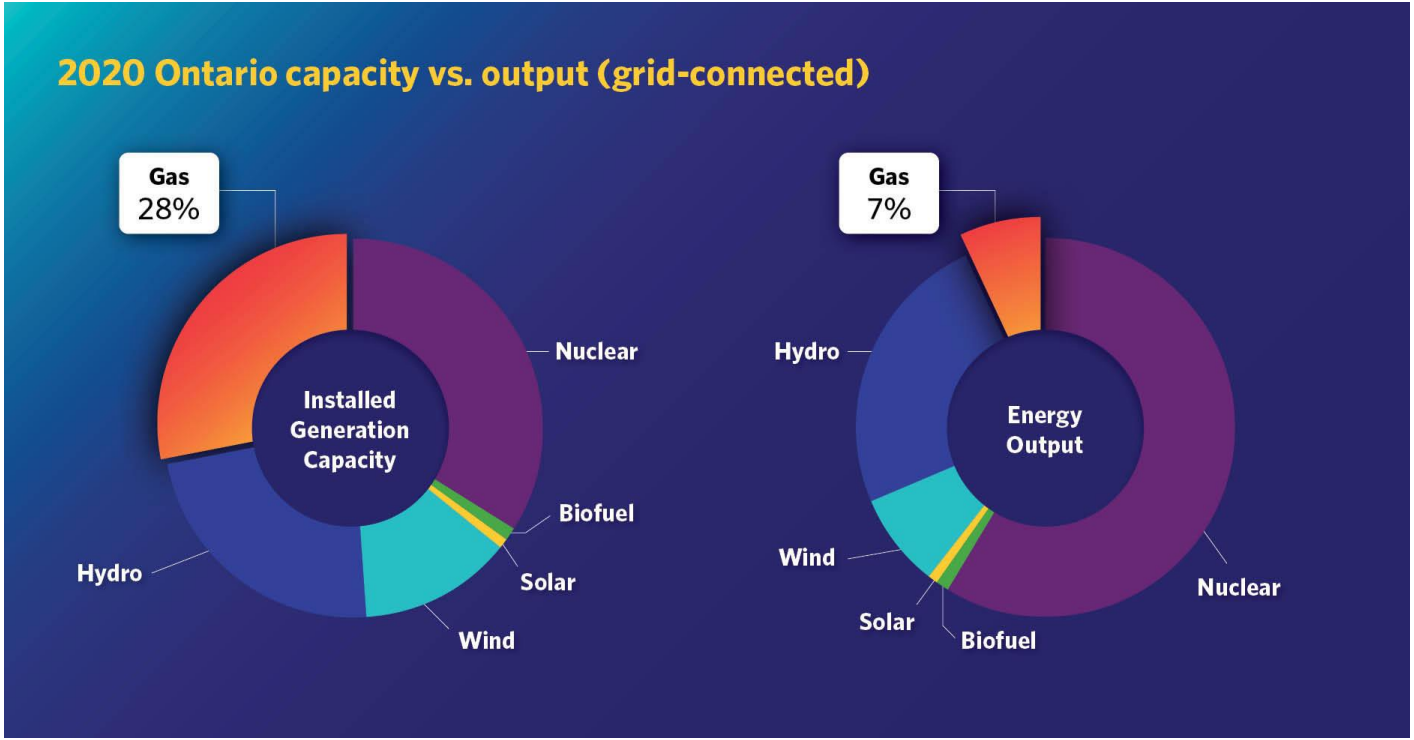
Outreach and Engagement Considerations:

- Role for municipalities, communities and sector stakeholders in achieving the outcome
- How engagement on this work impacts the IESO's future acquisition of resources

Appendix:

Decarbonization and Ontario's Electricity Sector: Assessing the impacts of phasing out natural gas generation by 2030

Natural Gas Generation – Available and Responsive Supply



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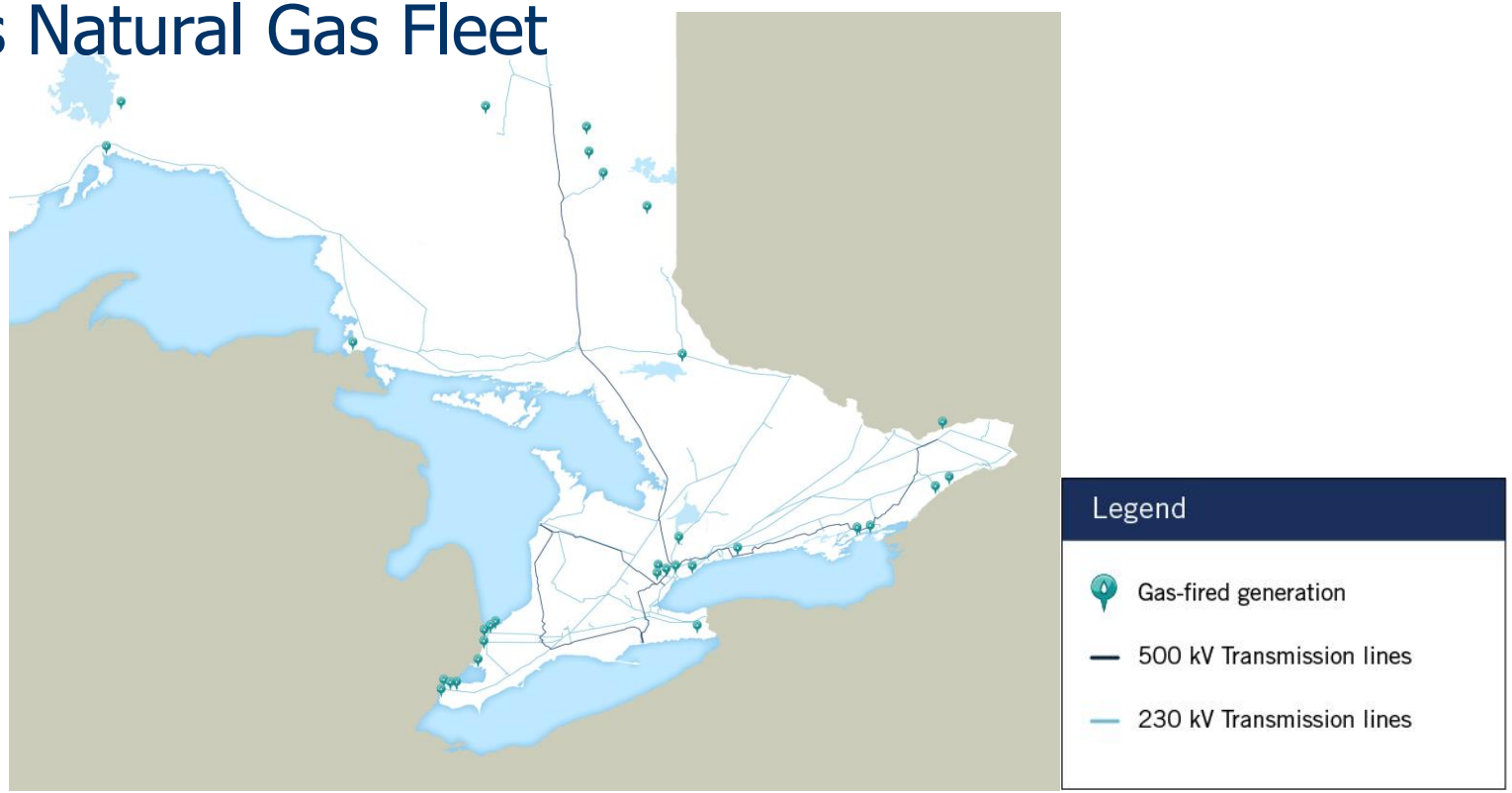
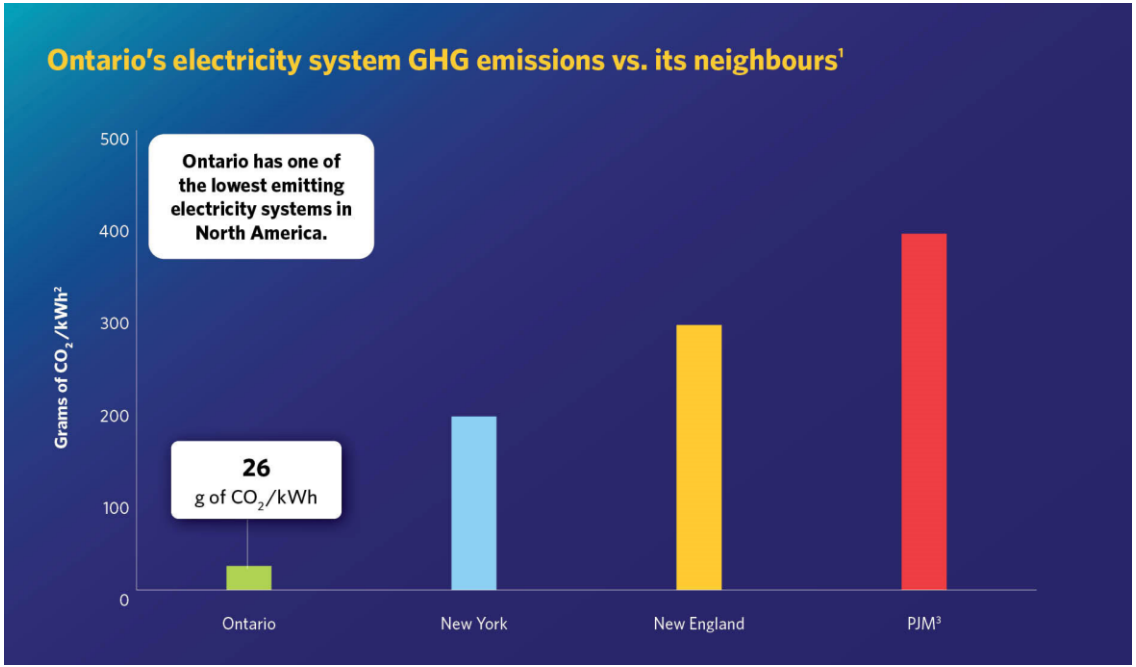
Ontario's Natural Gas Fleet



Map of generation facilities >20 MW.

Ontario electricity system emissions low vs. neighbours



[1] This graph shows the amount of Co_2 emitted per kWh of electricity produced. This value is often referred to as the Carbon Intensity (CI)
[2] Based on 2019 data all regions.
[3] PJM is a regional electricity transmission organization serving parts of the American Midwest and East Coast.

Lessons learned from Ontario's coal phase out

- The effort represents the largest GHG reduction initiative in North America - sector emissions reduced from 21 to 3 per cent of total provincial emissions.
- Gas generation was available and provided a mature technology with similar but slightly less flexible operating characteristics.
- Planned for 4 years, it took 12 years to complete.
- It meant adding new nuclear, gas, wind and solar generation for supply, transmission expansion, and the launch of an ambitious energy-efficiency program.
- Reliability was assured throughout, but added $4 billion in system costs.

The Question: Can Ontario Phase Out Gas Generation by 2030?

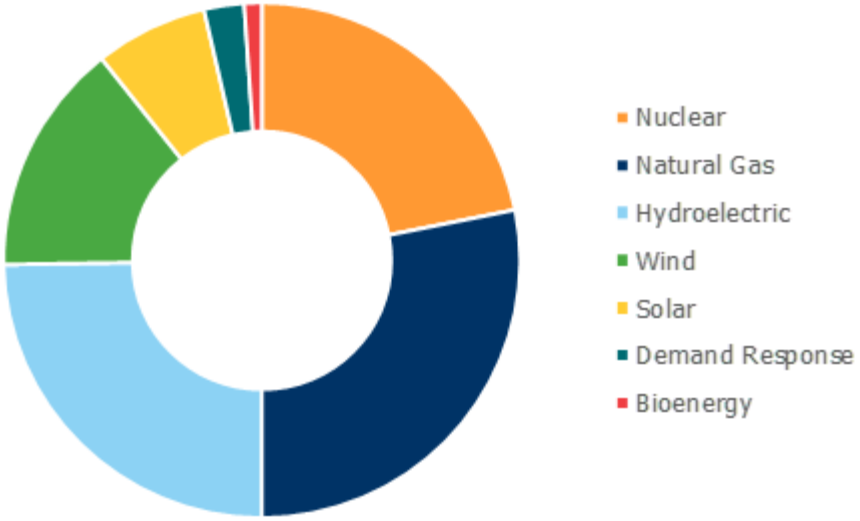
- More than 30 Ontario city councils and organizations have called to phase out Ontario's gas-fired generation fleet by 2030.
- As the power system operator and planner, the IESO is uniquely positioned to inform this discussion, focusing on electricity system reliability and affordability.

Study Overview

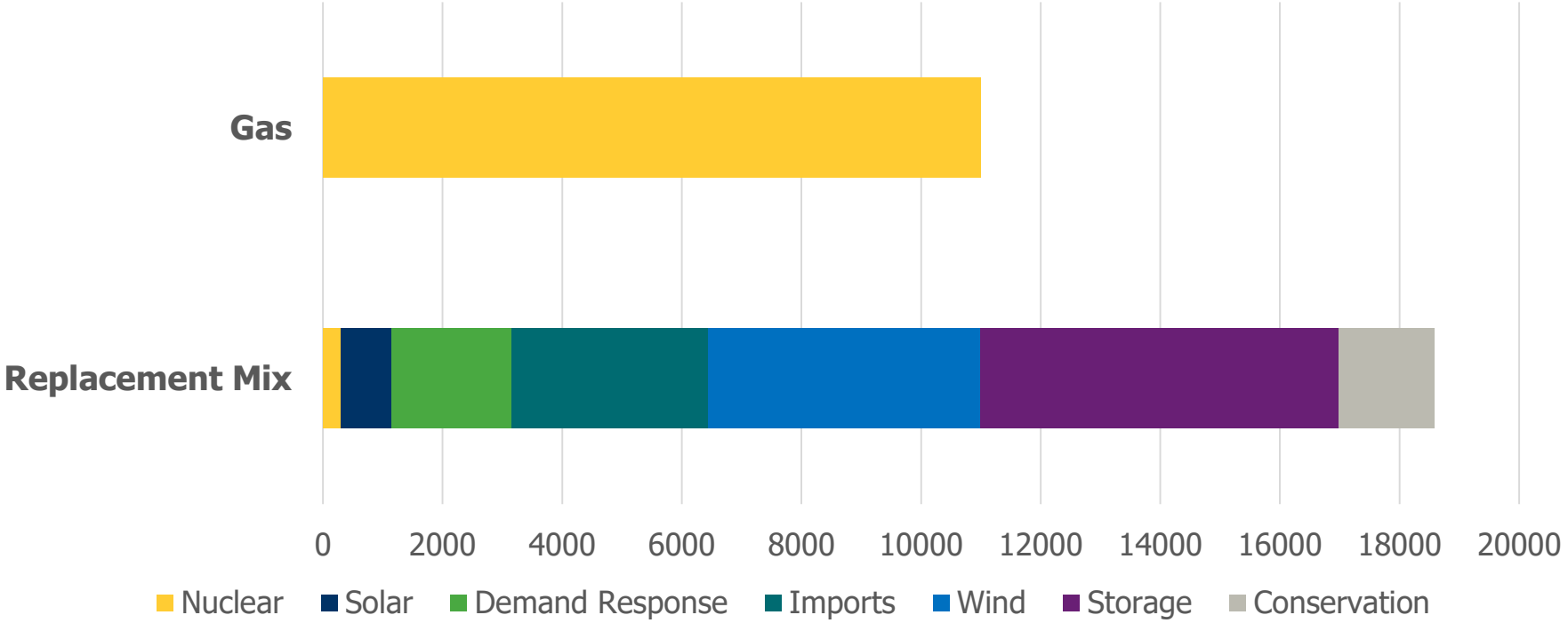
- The study aimed to find a rough range of costs and identify implementation challenges for meeting 2030. It used a model resource mix of reasonable, least-cost, available and commercially feasible technologies to replace gas generation.
- The resource mix portfolio meets some basic power system requirements (capacity and energy), but makes optimistic assumptions to achieve the 2030 timeline.
- The resource mix was not intended to be the definitive solution, but allows the assessment of reliability and cost impacts of eliminating gas generation in Ontario by 2030.

Base Case – 2020 Annual Planning Outlook, Scenario 1

- 2030 Forecast
  - Total Net Demand: 159 TWh
  - Summer Peak: 25.5 GW
  - Winter Peak: 24.6 GW
  - Installed Capacity: 38 GW
- Reflects continued availability of existing resources following contract expiry, as applicable.



Model Supply Mix: No Like-for-Like Replacement



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Key Findings

- A complete phase-out of gas generation by 2030 would lead to blackouts, as electricity would not always be available where and when needed.
- The IESO's modelling of how to replace gas by 2030 would require more than $27 billion to install new sources of supply and upgrade transmission infrastructure.
- There are significant practical reasons why it would not be possible to build substantial amounts of new supply and reorient the system by 2030.
- While the study highlights the complexity of change within the electricity system, it also reveals the broader possibilities.

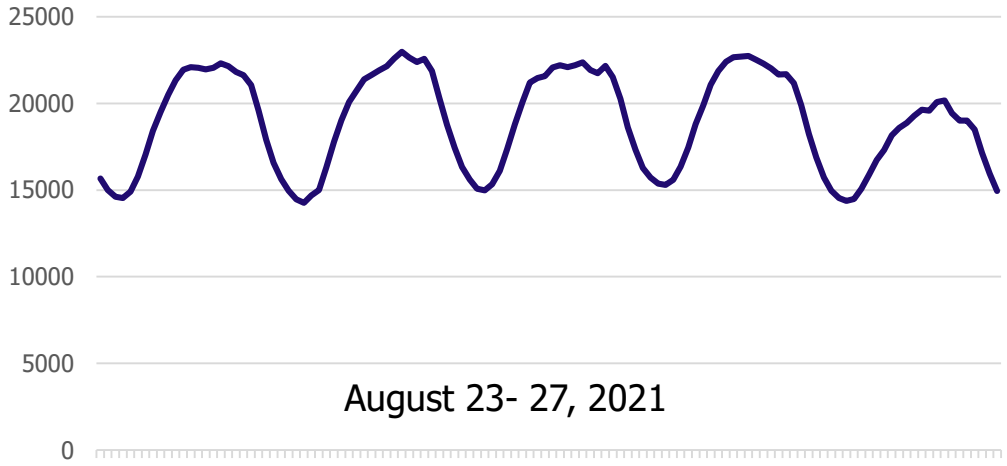
Assumptions

A number of assumptions were required in order to create a supply mix that did not include gas generation:

- Storage and demand response would function in quantities much higher than current experience suggests would be possible.
- Quebec could supply energy all year, though today it requires winter imports.
- Integrating large amounts of supply wouldn't result in operability challenges.
- Major transmission projects could be planned and built simultaneously and more quickly than in the past.

Still, the Supply Mix Fell Short at Peak

- During successive days of high demand, there would be insufficient supply at peak.
- Generation would reach maximum output, imports would be maxed out and storage would no longer have enough charge left after days of supplying the system.



- Shortages would be managed through rotating voltage reductions, conservation appeals and rotating blackouts, affecting most areas of the province.

Transmission Challenges

- Phasing out gas has significant implications for transmission – given the highly integrated nature of the system.
- Major transmission upgrades and expansions would be needed to bring supply from Quebec to population centres.
- Upgrades might also be needed to support centres like the GTA if replacement supply can’t be located there.

Costs

- The capital investment required for the replacement resource mix is at least $27 billion – an annual electricity service increase of $5.7 billion, due to:
  - Building new generation
  - Upgrades/expansion of transmission lines
  - Additional ongoing operating costs
- Unknown costs include additional transmission, compensation to asset owners if generators are retired before end of contract, and stranded investments in a number of relatively new facilities
- High electricity costs would deter consumers from investing in carbon reduction