GE VERNOVA

Ministry of Energy and Electrification
77 Grenville Street, 10th Floor
Toronto, ON M7A 2C1

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RE: Integrated Energy Resource Plan Consultation (019-9285)

GE Vernova is pleased to provide the enclosed responses to the Ministry of Energy and Electrification's Integrated Energy Resource Plan Consultation (019-9285).

In comments we previously submitted in response to the Provincial Government's consultation on the IESO's *Pathways to Decarbonization* report[1], our team expressed enthusiasm for the development of an integrated plan that aligns generation and transmission with forecasted commercial and household demand by location within the province. Our organization believes that medium- and long-term siting of generation and dedicated transmission assets must be done with a holistic understanding of the grid system's demands.

We are pleased to see the Provincial Government taking this important step and look forward to supporting efforts to foster a reliable, affordable, and sustainable electricity system for Ontarians.

About GE Vernova

GE Vernova, which spun off from GE in April 2024, is a purpose-built company delivering innovative technologies that facilitate decarbonization of the energy sector and support electrification of the world. We design and manufacture industry-leading wind, gas, steam, and hydro-powered turbines, nuclear power generation technologies, power quality equipment, and hybrid power solutions, while incorporating the latest digital innovation. GE Vernova leads grid modernization efforts with a defense-in-depth approach to the design, development, deployment, and service of the world's most critical power systems.

Across Canada, we have an installed base of power generation capacity of more than 60 Gigawatts (GW), and more than 90% of Canadian transmission utilities have been equipped with our solutions. Our technology is used to power nearly 40% of Canada's electricity.

We are also supporting Ontario's energy sector in several exciting ways, including:

- A $1B refurbishment of Ontario Power Generation's (OPG) Sir Adam Beck Hydroelectric Generating Stations in Niagara Falls to extend the life of these stations by 30 years, and secure up to 1,700 megawatts (MW) of clean electricity[2];
- Deployment of the first of four planned commercial, grid-scale Small Modular Reactors (SMR) in the Western world at Darlington[3];
- Supporting the on-time and on-budget refurbishments of the Darlington and Bruce Nuclear Generating Stations across multiple business lines;

[1] https://prod-environmental-registry.s3.amazonaws.com/public_uploads/2023-05/IESO%20Pathways%20to%20Decarbonization%20Study_General%20Electric_Comments.pdf
[2] https://news.ontario.ca/en/release/1004449/ontario-refurbishing-hydroelectric-stations-in-niagara
[3] https://news.ontario.ca/en/release/1003248/ontario-building-more-small-modular-reactors-to-power-provinces-growth

- Building the grid of the future in Markham, where we manufacture grid automation technology in addition to hosting a global testing and simulation laboratory;
- Developing grid orchestration software, which enables utilities to navigate the complexity of the sustainable energy grid while driving reliability and resilience, following our acquisition of Richmond Hill-based Opus One Solutions;
- Servicing Ontario's fleet of gas-fired power plants to maintain reliability and affordability of the grid; and
- Working with Ontario startup Next Hydrogen to integrate their electrolysis technology into our power systems offerings to produce green hydrogen.

Planning for Growth

1. **Building on the recommendations of the EETP's final report, what actions should be prioritized to enhance planning across natural gas, electricity, and other fuels?**

   To build on the recommendations from the Electrification and Energy Transition Panel's (EETP) final report, GE Vernova would restate our recommendation from our May 2023 submission[4]: that non-emitting technologies, gas-fired generation in line with federal Clean Electricity Regulations, and transmission lines connecting generation assets to load centres should receive expedited permitting.

   We also recommend that brownfield projects to retrofit, refurbish, or repower existing clean electricity infrastructure should also have streamlined permitting processes. Brownfield projects typically have shorter conception-to execution timelines versus greenfield clean generation or storage projects, enabling Ontario to accelerate its energy transition while increasing productivity. Additionally, brownfield projects can benefit from existing permits and environmental and/or impact assessments that have already evaluated and addressed effects for local communities and wildlife.

2. **The Government's priority is to ensure Ontario has the energy resources it needs to support growth. Are there opportunities to enhance the province's approach to procuring electricity generation supply to better serve this priority?**

   GE Vernova applauds the Ministry and the IESO for continuing to support a competitive, transparent, and technology-agnostic procurement process for energy generation resources in Ontario.

   Amid a difficult global macroeconomic environment with supply chain constraints, more concerted cooperation will be required between the province, IESO, power producers, utilities, and Original Equipment Manufacturers (OEM) and technology developers, such as GE Vernova. As an OEM, GE Vernova has typically been involved at later stages of the project development or procurement cycles.

   Earlier engagement can enable supply chain partners to appropriately scale operations and obligations to power producers and utilities. The investment required by OEMs into increasing factors of production and resource allocation for domestic manufacturing are strategic decisions. Tools such as "frame agreements" with mid to long term timelines, can help all parties manage grid affordability and reliability while accelerating the buildout of energy infrastructure.

[4] https://prod-environmental-registry.s3.amazonaws.com/public_uploads/2023-05/IESO%20Pathways%20to%20Decarbonization%20Study_General%20Electric_Comments.pdf

The surety of volume provided through a framework agreement gives companies like GE Vernova the ability to invest in our supply chain and human resources in order to serve Ontario. Although framework agreements may not be possible in many cases, the province should explore more shared risk/ reward contracting models where possible to incentivize problem solving and collaboration in light of the aforementioned volatile and uncertain macroeconomic environment.

3. **What actions should the government consider promoting greater access to electricity and accelerate grid-connections that will support economic growth, connecting new homes, and electrifying transportation and heating?**

GE Vernova's Grid Solutions business electrifies the world with advanced grid technologies and systems. We enable power transmission and distribution from the point of generation to the point of consumption and support a decarbonized and secured energy transition.

We anticipate that significant grid investment in Ontario will be required to meet growing energy demands, improve system resilience, integrate variable renewables, and upgrade the digitization of infrastructure.

The future of the Ontario grid infrastructure is one that is data-driven and autonomous.

Such grid solutions are ready to meet the moment and needs of the Ontario grid. There are available intelligent solutions to enhance electric network visibility, ensuring reliability and resilience. With increasing extreme weather and unpredictability, to be managing complex grids under adverse conditions will be imperative and artificial intelligence/machine learning solutions can improve availability while reducing operation and maintenance costs.

Modernization requires digitization to take advantage of the benefits available through necessary investment in the proper resources. To build a safer, more advanced grid that accelerates the energy transition by enabling utilities, industries, and system operators to generate, collect, process, analyze, and act upon a rapidly expanding range of grid data. GE Vernova offers a full range of solutions for digitizing grid operations, from converting analog data into digital data (e.g., Digital Substation) to orchestrating a more sustainable grid that's built for change (e.g., our GridOS software portfolio).

Grid software-defined automation solutions are crucial for grid modernization and supporting the growth of electricity demand. These innovations will empower grid operators to manage an increasingly complex grid, that will integrate more intermittent renewable energy sources and other variable generation or storage supply that can impact the operation of the grid network.

Further long-term support for innovative grid solutions will enable GE Vernova and other industry stakeholders to provide cost-effective and impactful innovative technologies to support the reliability,

growth, security, and efficiency of the Ontario grid. Supporting such innovation will strengthen the grid and support the development of industry and economic growth across the province.

GE Vernova recognizes technology is not sufficient to accelerating grid connectivity. Change management is an important component of ensuring that utilities are able to use innovative technological solutions to drive outcomes benefitting Ontarians. This is particularly salient given an aging workforce in the utility sector and challenges in hiring/ retaining the workforce needed to build the grid of the future.

4. **As the need for new transmission infrastructure continues to grow, what steps can the government take to ensure that transmitters have the certainty they require to move forward with development work as soon as possible, while also ensuring that competitive pressures keep costs as low as possible?**

   To ensure continued and improved reliability with adequate resources to meet load and growth while optimizing the cost of production, it is essential to establish a policy context that supports and incentivizes a supporting ecosystem of stakeholders to accelerate the significant investments required to develop and build the necessary low-carbon infrastructure, including the grid network that will enable the energy transition.

   Provincial Government considerations for first-ready-first-served resource queue evaluations will provide the transmitters an accelerated understanding of potential transmission requirements while expediting development work. Collaboration between the Province and transmitters is necessary to understanding speed of load growth, organic or due to electrification, while ensuring policy alignment.

5. **What policy guidance should the Government provide to the Ontario Energy Board (OEB) with respect to the long-term role of natural gas in Ontario's economy and opportunities for low-carbon alternatives in the gas system?**

   There is a role for natural gas development in the long-term that can maintain a clean electricity grid whilst enabling economic growth. This is particularly true when considering the development and incorporation of hydrogen production and carbon capture technologies. The Government should ask the OEB to consider further development of natural gas generation sources in conjunction with opportunities to develop said assets with carbon capture or low-carbon fuel solutions to limit emissions significantly.

   It is possible to operate new natural gas units and upgrade existing units for operation on low-carbon fuels with relatively minor changes to gas turbines and plant auxiliary equipment. For existing units, these upgrades can be scheduled with planned outages to minimize the time the plant is not generating power, and for new units these capabilities can be part of the initial plant configuration or phased in over time as hydrogen becomes available.

   The decision to build a gas-fired power plant today does not necessarily lock in CO_2 emissions at the original level for the entire life of the power plant. Future cost and technology breakthroughs may make hydrogen competitive as a zero-carbon dispatchable fuel source to complement renewables. Policies and incentives, such as the Federal Government's Clean Hydrogen Investment Tax Credit, are expected to foster development of hydrogen infrastructure and drive down costs.

   These have the potential to significantly increase the availability and affordability of hydrogen, similar to what the wind and solar photovoltaic industries experienced through targeted policies and

incentives. Another pathway to net-zero carbon emissions for a gas turbine is through the use of either liquid or gaseous biofuels. Gas turbines are capable today of burning a wide variety of these carbon-neutral fuels.

With regards to hydrogen production, Ontario should enable all forms of low-carbon hydrogen production and could encourage co-location of production and end use through hubs to minimize transportation costs. In previous IESO models, hydrogen has been assumed to have been produced outside Ontario and would have no demand impact. In the short- and-medium terms, there is a high likelihood that Ontario's primary methods of low-carbon hydrogen production will be through electrolysis powered by nuclear or renewables and will need to be produced within the province.

Previous IESO models have not included carbon capture, utilization and storage (CCUS) as an option to abate emissions from gas-fired generation. This potentially disregards CCUS on cogeneration assets used by the oil and gas and petrochemical industries in the Sarnia and Windsor areas, where Ontario has the best (albeit limited) potential to sequester CO2. It also potentially disregards emerging CO2 utilization technology that could provide alternatives to permanent sequestration. Although widespread carbon sequestration in Ontario is unlikely, the province is embarking on a process to create a CO2 resource management framework and decarbonization planning should be aligned with regulatory changes.

With these considerations in mind, GE Vernova recommends that the Government of Ontario and the IESO work to develop policy to accelerate new and clean gas-powered generation. This can be done by developing IESO procurement paths for new sites, which take stakeholder acceptance into consideration at the outset of the procurement process, so that independent power producers (IPPs) do not frivolously engage and needlessly invest in a site if that site's feasibility or community acceptance is not present or has not manifested.

6. How can the Government best support Indigenous leadership and participation in energy planning and projects?

GE Hitachi and GE Vernova are committed to participating in meaningful and informed engagement with Indigenous communities, with the goal of creating lasting benefits to Indigenous communities. We are also continuously exploring opportunities for partnerships with Indigenous business where feasible, and we have long collaborated with the Canadian Council of Aboriginal Business (CCAB), the First Nations Power Authority (FNPA), local Indigenous communities, and Indigenous post-secondary partners to ensure engagement and inclusion of Indigenous perspectives in our work and projects in the near- and long-terms.

With plans for several new nuclear builds and refurbishments on the horizon, demand for skilled workers in the nuclear sector is anticipated to significantly increase. A report commissioned by the Organization of Canadian Nuclear Industries (OCNI) and published in September 2024 found that several companies are expecting to grow their workforce by as much as 20% over the next three years[5]. However, a 2019 report commissioned by the Canadian Nuclear Association (CNA) and OCNI found that only 3% of the entire Canadian nuclear workforce was Indigenous[6].

[5] https://www.world-nuclear-news.org/articles/successful-projects-lead-to-canadian-nuclear-job-surge
[6] https://cna.ca/wp-content/uploads/2019/11/MZ-Consulting-Benefits-of-Nuclear-Energy-for-Canadians.pdf

While this anticipated job creation and workforce growth is an encouraging sign for the industry, work must begin now to ensure the province has the talent ready to fill these roles as they become available. To achieve this, we encourage the Government to make the necessary investments now to support training for Indigenous youth and workers to pursue a career in the nuclear sector.

7. How can provincial planning processes be enhanced to support high growth regions, ensure greater coordination between energy resources, and better integrate municipal, distributor and regional planning processes?

A holistic integrated approach breaks down barriers to identifying system needs and risks across physics, operations, economics and decarbonization and innovating systems-specific solutions to address them. GE Vernova's Consulting Services provides a comprehensive portfolio of software and services to evaluate the needs and craft solutions for the power system undergoing transition by delivering power systems engineering and economic analyses, providing solutions to the electric power industry's most pressing challenges, and advancing and enhancing electric power systems to perform with greater affordability, reliability, and efficiency.

GE Vernova has frequently been called upon by system operators and regulators globally to provide a comprehensive view of grid reliability, operability, and resiliency through holistic integrated system planning evaluations, spanning the physics, operations, economics, and resource adequacy of the grid. This includes in-depth techno-economic solutions for energy portfolio management and the reliable operation of power systems amid evolving energy demands and increasing renewable integration. Using PlanOS, which includes a transmission-based production cost, steady state power flow, and resource adequacy modules, we conduct detailed analyses that help forecast unit-by-unit electricity production to evaluate the costs of generation, emissions, fuel consumption, and assess the reliability impact of variable renewable energy sources on the power system.

Energy Portfolio Audits (Gaps Study) by GE Vernova, includes the evaluation of the current state of the power system and identify gaps and trends in technology, processes, grid codes, technical regulatory requirements, and energy trading mechanisms. This helps drive informed policy decisions and ensures that the energy system remains resilient and adaptable to changing conditions, such as increasing loads and the integration of distributed resources.

Grid Integration and Stability evaluations by GE Vernova, provide solutions to integrating high penetration of inverter-based resources technology into challenging weak grid areas with declining inertia. Utilizing state-of-the-art power flow, stability, and electromagnetic transient modeling and software, system stability gaps are resolved on new and existing inverter-based resources and HVDC interconnections. Grid code compliance evaluations, power plant testing, and model validation are also performed to qualify modeling and installed equipment performance to support integrated system planning analyses.

8. What cooperation opportunities exist across other jurisdictions to support energy trade, construction of transmission infrastructure (ex. pipelines and interties), and transportation electrification?

To support collaboration with other national and sub-national jurisdictions, particularly on nuclear energy development, we recommend the Government of Ontario work with the federal government and Canadian Nuclear Safety Commission (CNSC) to establish cross-jurisdictional working groups with regulators, governments, and utilities in foreign nations which have signed agreements with the Province to utilize the Ontario nuclear supply chain to further and develop their domestic nuclear energy projects. This will help facilitate improved knowledge transfers and technology exchanges, streamlining

deployment processes and allowing Ontario to capitalize on its expertise at a more rapid pace than its competitors.

9. What types of technical information and forecasts would best support sector participants and energy consumers as the system is built out for growth and the economy increasingly electrifies?

Cross-sector technical information and forecasts should include but not be limited to detailed load forecasting, grid capacity analysis, insights on inverter-based resources penetration, advanced weather data for renewable generation planning, integration insights, energy efficiency potential assessments, infrastructure development, and energy consumption management.

Load forecasting should include, at a minimum, medium-term for understanding of seasonal forecasts to plan for expected demand fluctuations. Additionally, long-term projections will provide sector participants projections of future electricity demand based on economic growth, population changes, and electrification trends.

As inverter-based or other carbon neutral resources continue to increase in volume, high-resolution weather data (historical and projected) is necessary to predict variability and effectiveness of integrations while correlated to grid capacity analysis.

Identifying opportunities for energy savings in buildings through retrofits and design improvements with consumer behaviour insights will continue to encourage energy-efficient practices.

Affordable and Reliable Energy

10. What further actions could the Government take to maintain an affordable energy system for Ontarians throughout the energy transition?

GE Vernova commends the province for its efforts to continue to reduce electricity costs through investments in the energy grid, implementation of energy efficiency measures, and the implementation of the ultra-low overnight electricity price plan.

Additional opportunities we recommend the province pursue to further mitigate costs include:

- Standardization on critical technologies, which can help drive productivity, and reduce costs. Subsequent projects take advantage of early technology development work as well as the experiences of supply chain partners to “rinse and repeat” for additional sites.

- Retrofits, refurbishments, and repowering of existing electricity infrastructure. From an economic perspective, it makes sense to employ new capital to upgrade these projects to extend their useful lives and increase their efficiency, while also reusing certain attributes of the original facility. For example, retrofits can use existing civil and electrical works as well as critical infrastructure such as wind turbine generator (WTG) foundations and towers, canals/dams/dykes, or transmission equipment.

- Prioritize investments in technology areas where there are opportunities for project developers to share costs with the Federal Government. To support this pursuit, federal investment tax credits include technologies such as renewables, storage, nuclear, abated gas, and inter-provincial transmission.

- Grid modernization is a key enabler for increasing the capacity factor and providing operator and regulatory oversight of the demands placed on the system with digital. The transmission

build-out forecast for Ontario and the integration of additional capacity would benefit from a dedicated digital planning focus.

- **Transmission:** Increased grid stability, forecasting, security with advanced energy management systems, wide area monitoring systems, and market management systems can help improve grid capacity by 25%.
- **Distribution:** Improved grid reliability and efficiency with distributed energy resource aware advanced distribution management solutions can reduce system interruption frequency and duration by up to 30%.
- **Asset Management & Analytics:** Increased geospatial network accuracy, office to field mobility, and artificial intelligence/machine learning insights can provide up to 20% plan, design as-built time savings.

- Continue to utilize proceeds from the provincial industrial carbon pricing system to support emissions reductions projects in the power sector.

Becoming an Energy Superpower

11. What opportunities exist to further capitalize on Ontario's leadership and expertise in nuclear technology and nuclear innovation?

Ontario is set to benefit from its first-mover advantage on SMR deployment thanks to the Provincial Government's early leadership and adoption of this innovative technology.

By moving first, Ontario businesses will be some of the first in the world to gain experience building, operating, and maintaining an SMR, and will be well-positioned to export their knowledge and products to other national and sub-national jurisdictions seeking to duplicate Ontario's success.

Here we would like to restate our recommendation from Q8. To help facilitate this knowledge and capabilities exchange with countries such as the Unites States, the United Kingdom, Poland, Estonia, and Sweden— all of whom have announced intentions to build their own SMRs—the Ontario Government work with the Federal Government and Canadian Nuclear Safety Commission (CNSC) to establish cross-jurisdictional working groups with regulators, governments, and utilities in foreign nations which have signed agreements with the Province to utilize the Ontario nuclear supply chain to further and develop their domestic nuclear energy projects. This will help facilitate improved knowledge transfers and technology exchanges, streamlining deployment processes and allowing Ontario to capitalize on its expertise at a more rapid pace than its competitors.

We also recommend the Ontario Government take the following actions:

- Provide and adhere to a reliable and technology agnostic procurement and policy framework over the long-term through the Integrated Energy Resource Plan, similar to the IESO's approach to LT2, which can provide OEMs further certainty and confidence in developing solutions, including SMRs and new nuclear energy developments to power Ontario's future.
- Continue to work with OEMs and supply chain partners to identify and secure export opportunities for nuclear energy development abroad, leveraging the Ontario nuclear sector's workforce and expertise.

12. What opportunities should Ontario consider to leverage its position as a clean energy leader?

GE Vernova supports investing in large-scale hydroelectric assets because they are sustainable, reliable, and dispatchable technology. With long permitting and regulatory lead times for hydroelectric projects, there needs to be a sense of urgency to accelerate approvals and early involvement by supply chain partners is critical to success. Ontario should seriously explore the construction of large-scale hydroelectric assets in all parts of the province where it is feasible to do so. For potential sites in Northern Ontario, this advanced feasibility analysis should extend to the transmission required to connect generating stations to load centres in Southern Ontario. We are encouraged to see new large hydro included in both the ministry and IESO's planning, but this could be an underestimation of potential capacity additions through 2050 as it discounts the role of refurbishments of existing hydro facilities in unlocking additional capacity.

Modernization programs often encompass the rehabilitation or replacement of key equipment such as the turbine, stator, rotor, shaft, wicket gates, and other major components. Due to the age of some existing hydro assets, replacing components with modern equipment leverages advancements in technology. For older facilities, using newer, more efficient and powerful equipment increases both MW capacity and the efficiency of hydro units, increasing annual energy production by 5%-10% or higher, depending on the facility.

OPG in 2021 began embarking on a 22-year turbine/generator overhaul program to repair or replace key components of ~75% of its hydro units. It would be beneficial to further understand the potential of refurbishments to increase capacity and annual energy production elsewhere within OPG's fleet and among private and Indigenous-owned stations.

To further develop clean and affordable energy, the Government of Ontario ought to continue to develop hydropower and the hydropower supply chain to power the province's clean energy future for decades to come by maximizing the value of its renewable natural resources. To do so, Ontario can look to its neighbouring comparators.

Since 2023, the United States Department of Energy (DOE) has concentrated on thoroughly examining the hydropower supply chain and formulating strategies to address its challenges. The challenges outlined in the research and studies are most acute for large (greater than 100 megawatts [MW]) hydropower systems, i.e. large power systems. The studies seek to identify strategies to secure and encourage domestic manufacturing, with three focus areas:

- Define the market for rehabilitations and new construction of the US hydropower fleet.
- Provide insights for policies, incentives, loan programs, and technology investments to encourage domestic content.
- Define the existing and required domestic hydropower manufacturing capabilities and workforce.

The strategies address five key critical gaps identified in the U.S. domestic hydropower supply chain. These gaps are highly relevant and should be considered in the context of the hydropower supply chain for large hydro in Ontario and Canada.

Gaps in the domestic hydropower supply chain that are relevant for the Ontario context and should factor in the Government's future policy frameworks include:

1. **Unpredictable and variable demand signals:** The development of a domestic hydropower supply chain is hampered by an unpredictable and highly variable demand for materials and

components. In general, hydropower systems have exceptionally long lives (e.g., 30–50 years), so replacements and refurbishment schedules have cycles that are years or decades.

2. **Severely limited or nonexistent domestic suppliers for hydropower materials and components:** No domestic facility for large forgings nor domestic facilities for large castings, critical components to the hydropower builds.

3. **Contracting procedures:** Practices in procurement, inherent in the gap identified in point 1, that inhibit the development of the domestic hydropower supply chain, including, specifying precontract design work, all-inclusive contracts, and focusing exclusively on the initial capital outlay rather than the total project life cycle cost. The contracting procedures do not currently reflect the global supply chain impact and do not recognize the costs of resource, labour, and inflationary pressures.

4. **Shortage of skilled workers:** Hydropower manufacturing and upstream support industries suffer from a significant lack of workers with requisite expertise. Seasoned and experienced technologists and engineers in the hydropower sector are largely close to retirement age and the forecast for replacement is not optimal. This potential labour gap is critical and will have a negative impact on ability for attaining the targets we need for climate and economy.

In seeking to leverage its position as a clean energy leader, Ontario should consider further deployment of the BWRX-300 SMR at Darlington and future sites in order to continue the development of nuclear energy on time and on budget while contributing significantly to the province's economy.

GE Vernova is encouraged to see the continued important role for nuclear power, both SMRs and large-scale reactors, in Ontario's future electricity mix. We believe SMRs will play a critical role in Ontario's clean energy future. The BWRX-300 is projected to have up to 60% less capital cost per MW when compared with the typical water-cooled SMR. Using a combination of modular and open-top construction techniques, the BWRX-300 can be constructed in 24-36 months while achieving an approximate 90 percent volume reduction in plant layout. In addition, reducing the building volume by about 50 percent per MW should also account for 50 percent less concrete per MW. Investing in additional SMRs at other sites in the province can result in productivity benefits by leveraging standardization, common design, and supply chain experience. SMRs can also be built in succession at the same site to increase overall capacity.

GE Vernova is encouraged to see the Government of Ontario's continued commitment to the development of new wind energy resources as a part of the province's non-emitting energy mix. In previous years, procurements in Ontario have not included wind power, a trend that needs to continue to be reversed to support decarbonization of Ontario's grid beyond LT2.

Future procurements should also include a pathway for wind farm repowering. Wind farm owners can retrofit existing wind turbine generators of a wind farm to increase the life of the asset, while improving its generation and reliability profile. They can exchange components of the WTG drive train and/or full nacelle, swapping and increasing the rotor size. This is done while maintaining the wind turbine's tower foundation and with minimal needed alterations to the wind farm's balance of plant. RePower extends the life of an existing wind farm asset by an additional 20 years or more, enabling the asset to continue providing zero-carbon electricity for longer. This also grows annual energy output by 5-45% through increased nameplate capacity and/or increased swept area, higher availability and less downtime, rotor expansions that enable the WTG to capture and create energy from lower wind speeds, effectively increasing the capacity of the wind farm, making energy when otherwise it would have made little or

none. Through RePowering, WTGs also receive upgrades to their digital and controls systems, improving load management and cybersecurity.

Furthermore, in the *Pathways to Decarbonization Report*'s scenario, the model capped onshore wind at 15.8 GW, leaving a role for 1.8 GW of offshore wind. Canada currently does not have a regulatory regime for offshore wind and although one has been developed, it is focused on Atlantic Canada. If Ontario is considering offshore wind as a technology beyond 2035, it should begin laying the groundwork for projects as there would be considerable logistical challenges with siting offshore wind on the Great Lakes.

From a grid perspective, GE Vernova continues to be encouraged to see the role of demand response and recognition that transmission buildout would be required. In addition to these initiatives, Ontario should look to decarbonize the grid itself by replacing SF_6 as an insulating gas for electrical transmission equipment. In 2020, for example, Hydro One Networks emitted 64,250 tonnes of CO_2 equivalent in the form of SF_6, which would have made it the 90th-largest emitter in the province according to Environment Canada's Greenhouse Gas Reporting Program.