Ontario's Energy Future

Sector Analysis

Report Commissioned by

ECAO

ELECTRICAL CONTRACTORS ASSOCIATION OF ONTARIO

FEBRUARY 2023

Contents

Acknowledgement

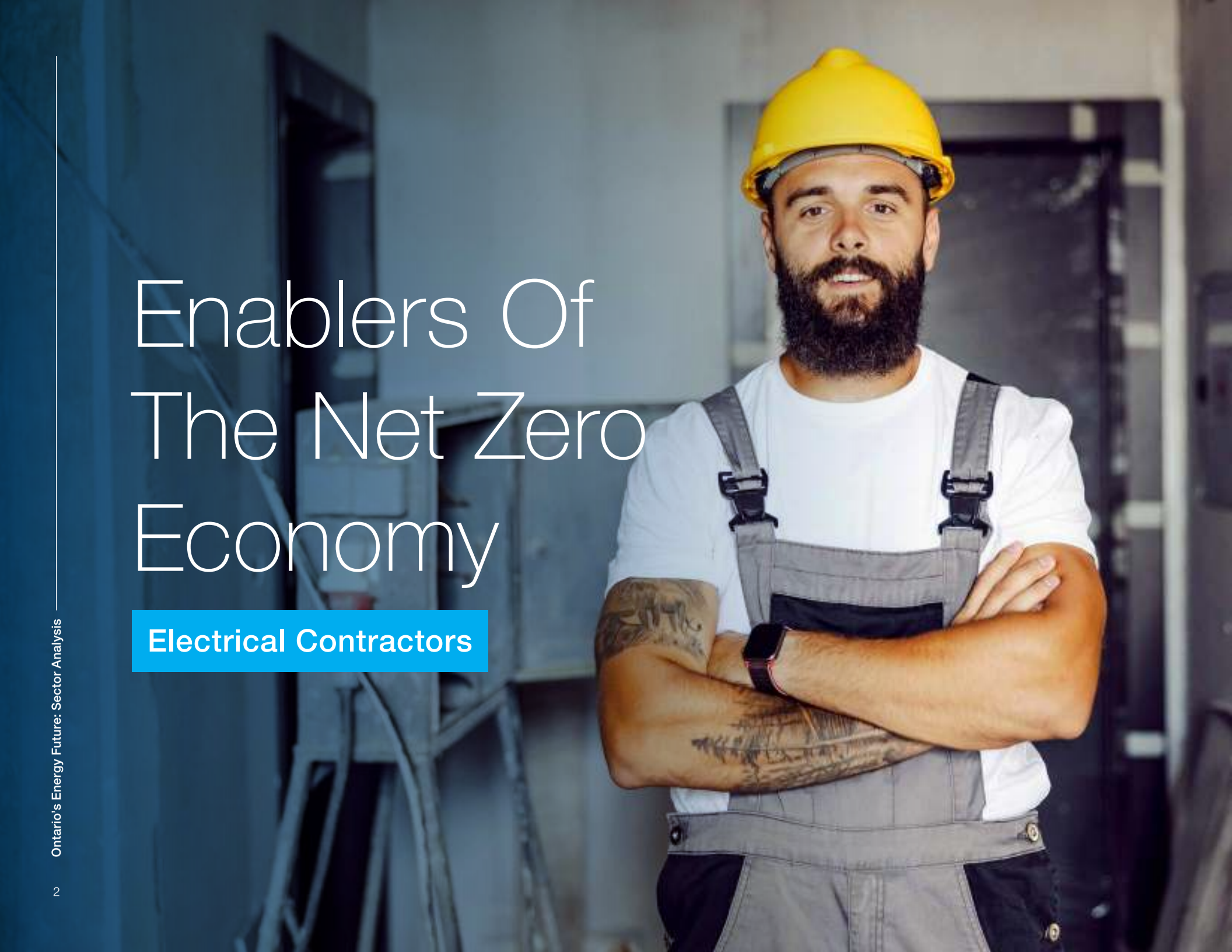
This report was commissioned by the Electrical Contractors Association of Ontario (ECAO) for its members and was written by and in cooperation with Rubicon Strategy and Power Advisory. Insights provided are meant to summarize critical trends in Ontario's electricity sector and provide recommendations to ensure the labour readiness of the electrical contracting industry

Rubicon Strategy is a top-tier Canadian public affairs and strategic communications firm with unparalleled knowledge, experience and government relations expertise.

The firm's political strategists and communication experts successfully navigated some of Canada's toughest public affairs challenges, providing advice and creating opportunity solutions for clients across industries such as energy, transportation and public infrastructure.

Power Advisory LLC is a leading North American management consulting firm specializing in electricity sector matters and solutions.

The company's highly qualified and focused team provides market-tested and value-driven consulting support. Their advice is based on a deep understanding of fundamental economic drivers shaped by electricity market structures, generation technologies, regulatory frameworks, government policies and market behaviour.



Enablers Of The Net Zero Economy

Electrical Contractors

Ontario's electricity system is in transition. Driven by economy-wide decarbonization efforts in response to the global climate crisis, Ontario's electricity sector is rapidly evolving to enable the shift from fossil-based energy sources to clean energy sources. Whether it is the installation of a new electric vehicle charging station, the development of a local microgrid system or the upkeep of a large-scale transmission line, electrical contractors and their skilled workforce are essential to powering Ontario's economy, especially now as the need for new electricity supply grows.

Representing electrical contractors across Ontario, the Electrical Contractors Association of Ontario (ECAO) has a mandate to advocate for the interests of electrical contractors and works with key stakeholders to advance business objectives in the electrical contracting industry. This includes building relationships with federal, provincial and municipal governments, training colleges and universities, and system providers to ensure ECAO members have the resources and skills required for a net-zero future.

Given the shift to cleaner and distributed technologies, it is essential to identify future service needs, recognize potential labour shortages, and fill gaps through training and education. Securing funding for these programs will require continued advocacy and engagement with government stakeholders.

This report reviews the main drivers for change in Ontario's electricity system, summarizes critical trends in the province's electricity sector, and provides recommendations to ensure the labour readiness of the electrical contracting industry.

Ontario Electricity Sector

Net Zero Influences

Ontario's electricity sector is influenced by government policy, economics and customer preferences. While electricity supply and delivery to customers must be reliable, resilient, and affordable, it is broadly recognized that decarbonizing the electricity sector is foundational to achieving greenhouse gas emission reduction targets. Furthermore, electricity demand is expected to significantly increase through economic growth and increased electrification (e.g., transportation, building heating, industrial processes), which will require significant investment in new transmission and distribution infrastructure, the development of new, clean electricity supply, and energy conservation and demand management capabilities (e.g., load control and energy efficient technologies). These incremental investments are required to update, maintain and replace aging electrical infrastructure.

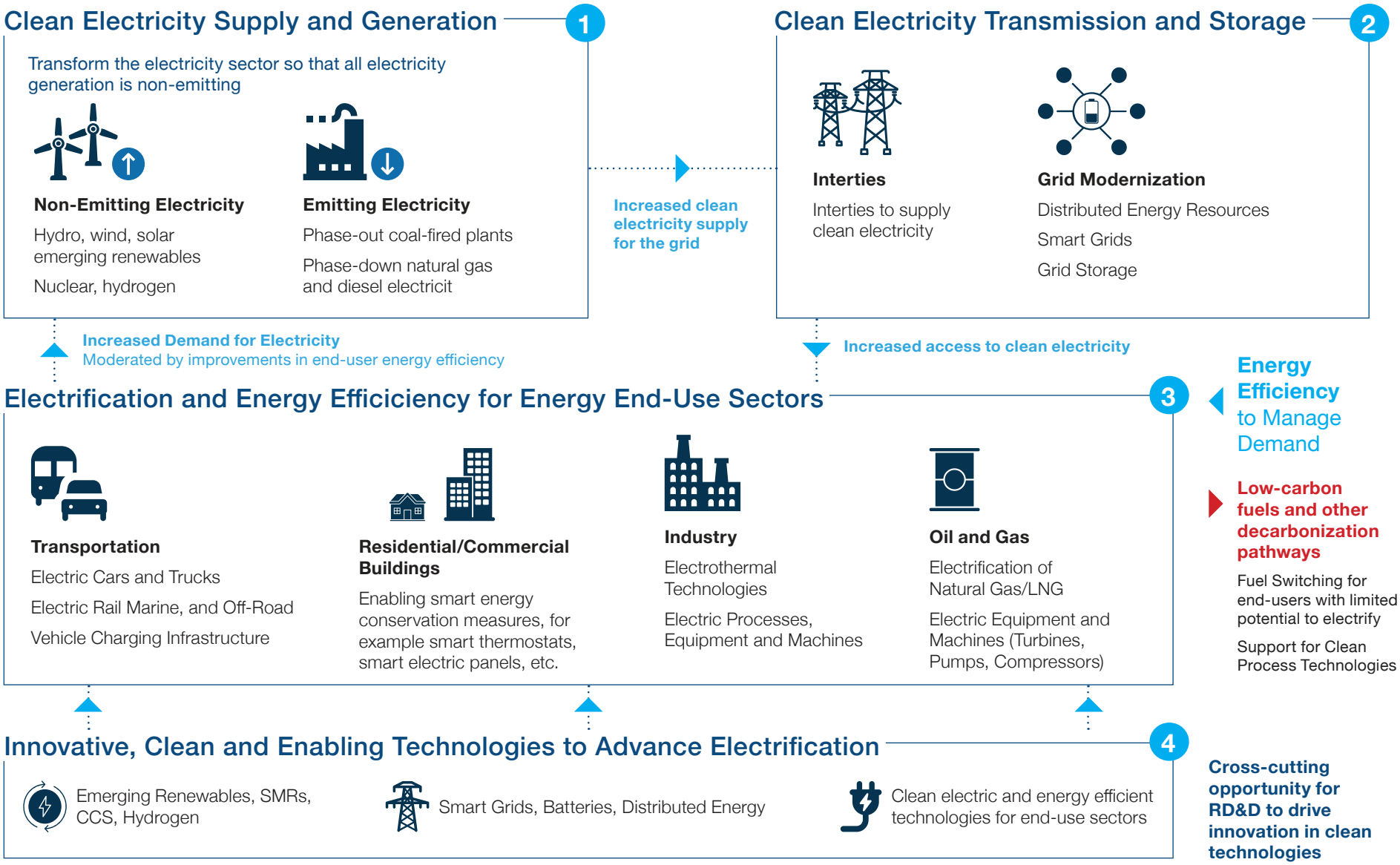


Figure 1. Electrification and Energy Efficiency Overview[2]

Canada has established that the electricity sector will be net-zero by 2035.

The Government of Canada has committed to reducing greenhouse gas emissions by 40-45% below 2005 levels.[1] To achieve this ambitious target, the government has advanced several policy and legislative measures, including, but not limited to:

- Implementing Canada-wide carbon pricing that will increase at a rate of $15 per tonne, year-over-year, topping out at $170/ tonne by 2030;
- Enacting the Canadian Net-Zero Emissions Accountability Act to enshrine Canada's commitment to achieving net-zero emissions by 2050;
- Developing a Clean Fuel Regulation requiring fuel suppliers to lower the emissions intensity of fossil fuels;
- Establishing Clean Electricity Regulations to enforce the phase-out of fossil fuel sources of electricity generation in each province;
- Enforcing a mandatory target for all new light-duty cars and passenger trucks sales to be zero-emissions by 2035;
- Providing corporate tax rate reductions to attract investment in zero-emissions technology manufacturing (e.g., renewable generation equipment, electric vehicles, batteries, green hydrogen, etc.);
- Establishing tax credits (up to 30% capital costs) for the development of clean energy generation (wind, solar, hydro, small modular reactors (SMRs), energy storage, low carbon-heat equipment (heat pumps/ solar heating), and industrial zero-emission vehicles adoption/charging; and
- Introduction of a national critical minerals strategy to complement zero emissions targets.

Overall, the policies of the federal government are intended to overhaul Canada's energy sector, with a particular focus on decarbonizing the electricity sector, as shown in Figure 1. To achieve emissions targets, new clean electricity generation must be built, the electricity transmission and distribution systems must be re-enforced and modernized, end-use sectors (e.g., transportation, buildings and industry) must be electrified, and new clean technologies (e.g., small modular reactors, distributed energy resources, smart grids, etc.) must be enabled.

TAKE AWAY 1

Significant transformation is happening in a concise timeframe.

The Government of Canada has established that the electricity sector will have 12 years to reach a net-zero grid and less than 25 years to reach a net-zero economy. This means a doubling or tripling of the size of our grid today, utilizing the latest advanced technologies and newly emerging technologies. This transformation will require the entire energy ecosystem to re-think how it does this today. Electrical contractors and their skilled workforce will be at the forefront of this change.

Ontario is embracing the energy transition to support economic growth.

The Government of Ontario is supporting climate-friendly policies to attract investment and future economic development. In recent years, leading businesses and corporations have adopted Environmental, Social and Government (ESG) targets in response to growing demand from capital markets. Therefore, the provincial government has enacted a series of policy mandates to support the economy in the energy transition, including, but not limited to:

- New programs to support the modernization of the automotive sector, including the adoption of clean electricity;
- A low-carbon hydrogen strategy and funding to enable the production and adoption of hydrogen by end-users;
- A framework for registering Clean Energy Credits (i.e., a form of environmental attribute) to enable corporations to meet their renewable energy targets; and
- A new mandate for the Ontario Energy Board to support the integration of distributed energy resources and remove barriers for the adoption of electric vehicles.

Ontario already has one of the cleanest electricity grids nationally, with more than 90% of the province's electricity generation being emissions-free.

This provides Ontario with a competitive advantage. That said, while Ontario is touting its clean electricity supply to attract new investments, there is also a recognition that there is an increased strain on the province's electricity grid. One example of this would be Algoma Steel's decision to replace the current steel furnace operations with a new electric arc furnace. The investment will decrease Algoma's carbon footprint and reduce future carbon costs (e.g., carbon taxes); however, it will contribute to a massive new electricity demand of 300 MW. Numerous other examples of future industrial load growth include:

- Umicore in eastern Ontario projecting to expand electrical load by 180 MW by 2030;
- Canada Nickel in northeastern Ontario projecting to expand electrical load by 250 MW by 2030; and
- Kirkland Lake Gold in northwestern Ontario projecting to expand electrical load by 50-100 MW between 2025 and 2027.

Based on publicly available information (e.g., electricity planning reports, government announcements and public news releases), approximately 1,400 MW to 2,200 MW of new industrial electrical load is expected between 2024 and 2030. For context, this is a new electrical load that is between approximately 30%-45% of the size of the City of Toronto.

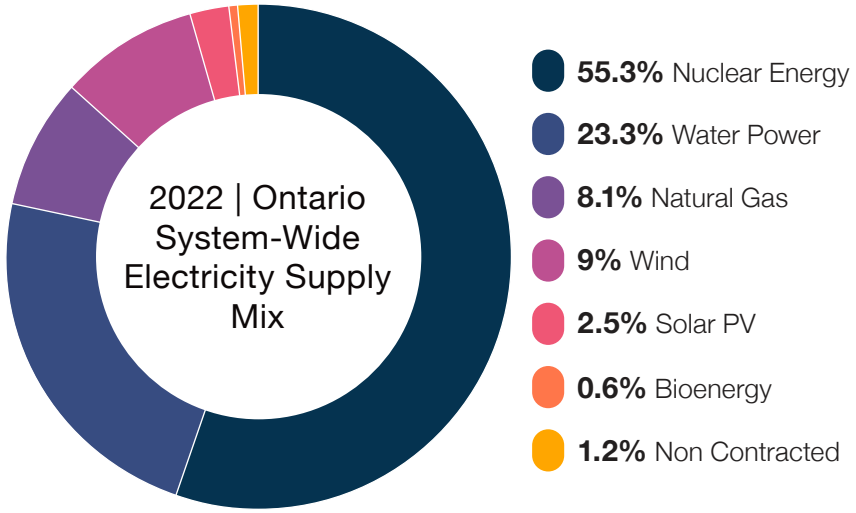
1 MEGAWATT CAN POWER...

2 refridgerators run for a year

1.2 Months of Power for an Average U.S. Home

3,600 miles driven by an electric car

2 60-watt light bulbs run nonstop for a year



Ontario's Municipalities are continuing to champion environmental sustainability.

Municipal policies that support energy efficiency, electrification and renewable energy development are also shaping Ontario's energy future. Municipalities across Ontario have begun implementing climate-friendly policies with various degrees of ambition. Many of Ontario's municipal climate plans show two key priorities:

- Electrification of public transportation; and
- Electrification of the heating and cooling of residential and commercial buildings.

As a leading example, the City of Toronto's climate action plan, named TransformTO, addresses every city's challenge by reducing and eliminating natural gas and gasoline from residential and commercial buildings and transportation. The City of Toronto is pairing independent funding with intergovernmental funds, leading to successful programs such as the Tower Renewal Toolkit, which provides expertise, grants, and low-interest loans for projects that reduce the emissions of residential buildings across Toronto. The City of Toronto has also articulated a desire to install bi-directional EV chargers, with the ambition to create microgrids that support local energy needs.

Similarly, the City of Markham, a rapidly growing suburb, is also moving forward with its Municipal Climate Plan. The City of Markham has established goals for implementing heat pumps, encouraging the deployment of EV charging stations and implementing a green building standard to ensure new high-density construction is more efficient than previous generations.

TAKE AWAY 2

The pursuit of a net-zero economy has impacts on the electrical contractor industry and Ontario's workforce.

Given the changing electricity landscape, Ontario's electrical contractors and their workforce will need to prepare for the adoption of clean technologies, including:

- Renewable generation (e.g., hydroelectric, wind, solar), nuclear generation (e.g., SMRs), energy storage (e.g., batteries, pumped hydro, etc.)
- Distributed energy resources, such as rooftop solar and batteries, which may be adopted by customers
- Transportation electrification, including cars, trucks, buses and trains
- Industrial electrification, such as the use of electric arc furnaces
- Building electrification, such as the adoption of heat pumps for space and water heating
- Smart home technology, energy management or load control systems
- Smart grid technologies, including microgrids, non-wires solutions and advanced distribution management systems/ communications systems

In short, the electricity system of 2035 will be much more diverse, complex and interconnected relative to today's electricity grid and will require a highly-trained, skilled workforce of electrical contractors to support its development. Further, while electrical contractors are already viewed as the "experts" in this regard, technology and services are being developed faster than ever before. There will be a greater need for electrical contractors in the economy, given the demand to connect new electrical devices (e.g., EV Chargers, heat pumps, micro-grids, etc.) to the grid.

The confluence of federal, provincial, and municipal policy factors and other economic factors shapes Ontario's electricity resource outlook.

Energy demand is poised to grow at rates much faster than previously anticipated by the Independent Electricity System Operator (IESO), Ontario's wholesale market operator responsible for electricity resource planning and procurement. For example, given federal, provincial and municipal government policies, Ontario will experience a significant uptick in electric vehicle (i.e., personal, public transportation and fleets) adoption.

Ontario's baseline electricity needs are forecasted to grow from 148 TWh annually in 2024 to 208 TWh in 2043. For context, the projected increase of 66 TWh over the next 20 years is roughly equal to adding a new electrical load of 80% of the province of Alberta. Should Ontario experience higher demand growth as anticipated by a net-zero economy (e.g., widescale economy-wide electrification), Ontario's electricity demand would surpass 266 TWh annually by 2043.[3] This would be like adding 1.5 Albertas.

At the same time, this new electricity demand is coming at a period when Ontario must renew its existing electricity generation fleet. The dual pressure of increasing electricity demand and retirement of existing generation is putting significant pressure on Ontario's electricity sector, as demonstrated in the next section.

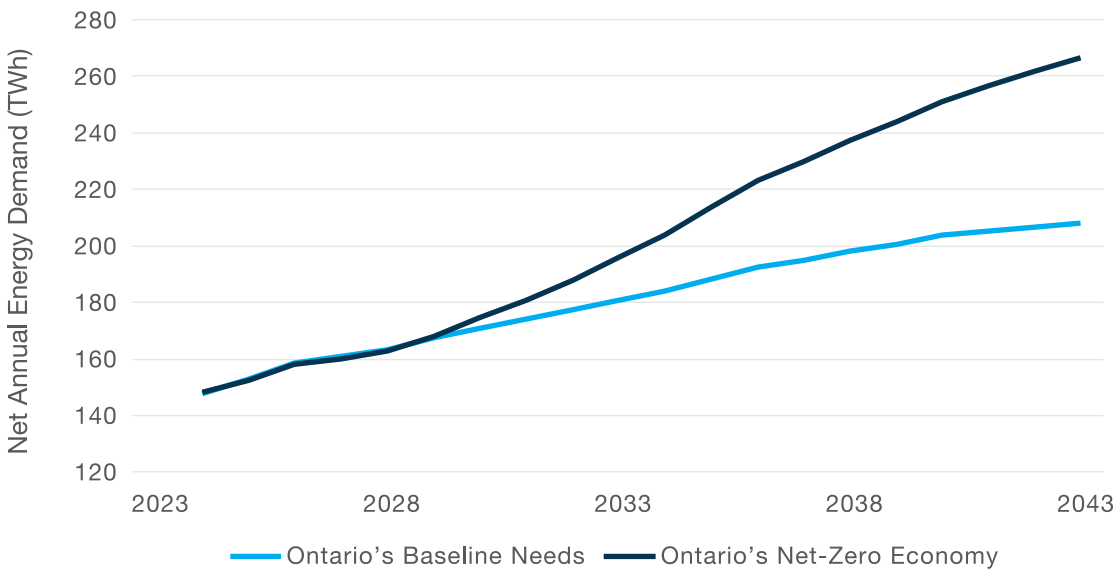


Figure 2. Ontario's Forecasted Energy Demand[3]

1 TERAWATT-HOUR OF ENERGY CAN POWER...

1,300 schools

400 hospitals

40 small towns

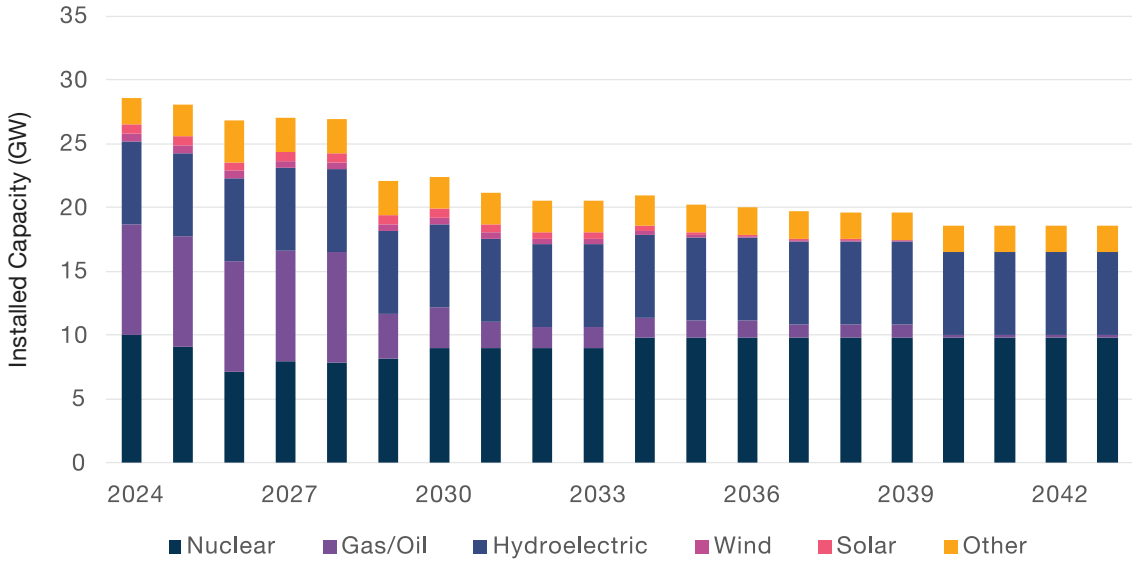
...for a YEAR

Renewing Ontario's Electricity System

Although Ontario has experienced a lengthy period of a supply surplus, it is no secret that Ontario is now facing a potentially significant electricity supply shortfall. Much of Ontario's electricity generation fleet is nearing its end of life or future of contract term with the IESO. If existing generation assets are not recommitted, then Ontario's existing summer effective capacity[4] drops from 41 GW in 2024 to 23 GW in 2043, as shown in Figure 3.[5]

Not all of Ontario's generation fleet is currently capable of operating past its current commitment period. For example, Ontario Power Generation's Pickering Nuclear Generating Station is expected to retire by 2026 and be decommissioned.[6] While the IESO is pursuing plans to recontract or recommit other existing supply resources, realistically it is anticipated that a significant portion of Ontario's existing electricity generation fleet may not operate past its current IESO contract term given the location, refurbishment costs or constraints, or restrictions due to government regulations (e.g., Clean Electricity Regulation).

Figure 3. Ontario Effective Capacity[5]



**Graph depicts electricity resources expiring at the end of their current commitment period; existing resources will need to be renewed, or new resources will need to be built to meet electricity needs*

Ontario's annual peak summer demand is expected to grow from less than 25 GW in 2024 to more than 30 GW in 2043. For context, this is like adding approximately the peak demand of Toronto over the next 20 years to Ontario's electricity system. Should Ontario experience higher peak demand needs as anticipated by a net-zero economy, Ontario's annual summer peak demand would surpass by 33 GW by 2043.[7] This would be like adding almost two Torontos.

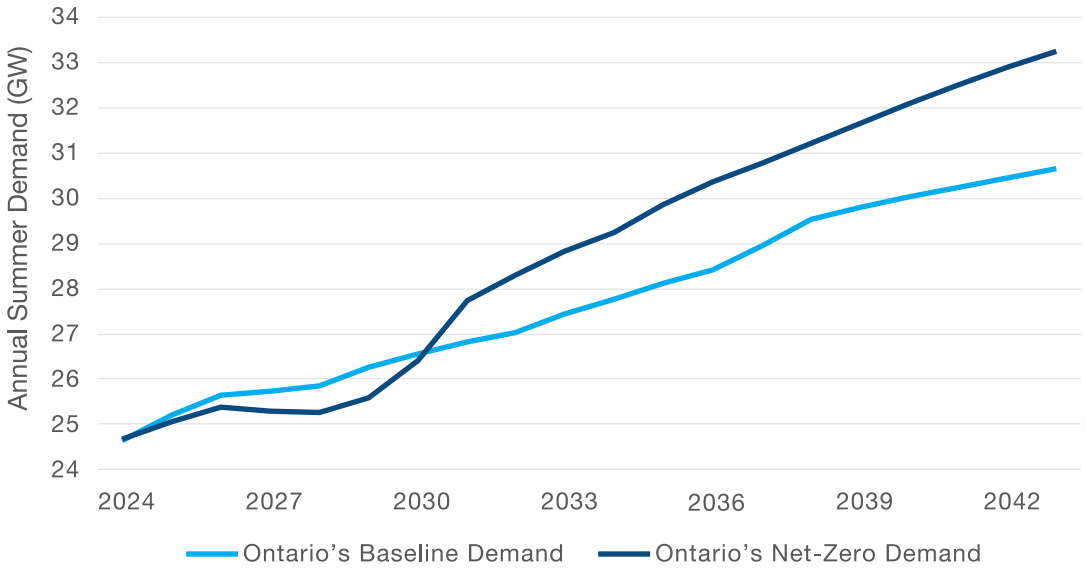


Figure 4. Annual Summer Peak Demand[7]

Kilowatts (kW), megawatts (MW) and gigawatts (GW) are all measures of capacity.

Generation capacity is the maximum amount of electricity that a power station can produce on demand.

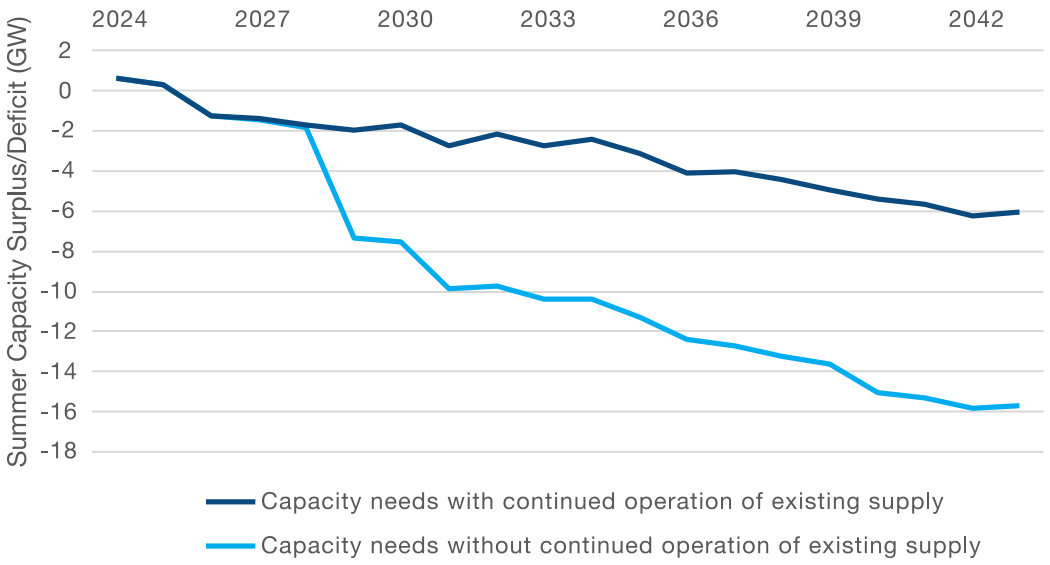
100 kilowatts = 100 kilowatts is enough to power around **30 homes**.

1 megawatt = One megawatt is enough to power around **300 homes**.

1 gigawatt = One gigawatt is enough to power around **300,000 homes**, more than enough for Kitchener and Waterloo

Even with the continued operation of existing resources post-contract expiry, Ontario needs new investments in electricity supply.

Ontario's forecasted generation capacity needs are driven by the retirement of existing generation and demand growth. Under baseline supply needs, Ontario's demand will continue to outpace the capacity of electricity supply resources unless additional generation is brought online. Ontario needs approximately 1.8 GW of new capacity by 2027. Even with the continued operation of existing generation resources post-contract expiry, Ontario needs at least 6 GW of new supply resources by 2043. The need can be as great as nearly 14 GW of supply by 2024 if existing resources do not continue operations post-contract expiry.[8] Further, the conditions may be even more pronounced if Ontario experiences higher electricity demand due to a net-zero economy. Given the expectation that the electricity supply will be decarbonized, there is the reasonable assumption that most new sources of electricity will be non-emitting, such as renewable (e.g., wind, solar, hydroelectric) and nuclear (e.g., new SMRs or refurbished assets).



**Graph depicts surplus/deficit under baseline demand forecast*

Figure 5. Ontario's Baseline Capacity Needs[8]

TAKE AWAY 3

Considering the need for new electricity supply, Ontario requires significant investment in new electricity resources and expertise.

The magnitude of new electricity supply needs is unprecedented in Ontario, even under baseline forecasts. At a minimum, 2 GW of new supply is needed by 2027. By 2035, the conditions can grow by as much as 11 GW if the existing generation is not contracted. This represents a massive amount of electricity supply resources that need to be either permitted, constructed and connected to the electricity system or, at the very least, existing capacity will require some refurbishment to continue operations.

Ontario's electrical contractors will need to train and develop skills at an unprecedented pace. Failure to do so will result in project delays and will jeopardize Ontario's ability to meet decarbonization targets. In addition, the inability to train electrical contractors could be detrimental to Ontario's electricity reliability and the growth of our economy.

The IESO has plans to procure the required new electricity supply resources to meet Ontario's electricity resource needs.

The IESO leads Ontario's acquisition of generation resources to ensure an adequate electricity supply to meet reliability needs. Currently, the IESO has four active procurements to contract for new generation from greenfield sites or expansions at existing sites, as shown in Figure 6.[9] Most notably, Ontario is proceeding to contract for up to 900 MW of new energy storage, representing the first significant energy storage procurement in Ontario's history. Given the policy mandates for clean electricity supply (e.g., Clean Electricity Regulation), it is expected that an increased share of electricity supply will need to come from non-emitting sources such as hydroelectric, wind, solar, storage (including hybrid renewable and storage facilities) and nuclear.

	Procurement Name	Target Capacity (GW)	Resource Eligibility	Year to be In-service
1	Same Technology Upgrades	0.3	Cost-effective capacity upgrades from existing contracted facilities.	2025
2	Expedited Long-Term RFP	1.5	On-site expansions and new greenfield resources. Targeting up to 900 MW of storage and 600 MW of non-storage projects.	No later than May 2026
3	Long-Term 1	2.2	Targeted towards storage, hybrids (i.e., renewables plus storage) and biofuels. On-site expansions and new greenfield resources.	No later than 2027
4	Long-Term 2	1.5	To be determined.	2030

Figure 6. IESO Procurement Targets and Timelines

In addition to the competitive procurement process, the IESO is also negotiating with high-priority generators to ensure that capacity remains available for reliability (e.g., Brighton Beach Generation Station, Lennox Generation Station). Further, the IESO and the Government of Ontario intend to make use of the following options to try to ensure that the province's supply challenges do not result in actual shortfalls materializing:

- Adjusting nuclear outage schedules;
- Promoting additional energy efficiency programs;
- Initiating the renegotiation of biomass facility contracts;
- Broadening the scope of IESO's annual capacity auctions;
- Incentivizing earlier delivery of new resources; and
- Encouraging the adoption of demand response programs focussed on the commercial/industrial and residential sectors.

Beyond the currently planned procurements, the IESO is anticipating a regular cycle of procurements for long-term commitment periods (20-year contracts) and medium-term commitment periods (5-year contracts) and will continue to run annual capacity auctions for short-term commitments (1-year commitments).

TAKE AWAY 4

Ontario is entering a period of regular procurement and developing new electricity resources.

Consistent with the scale of the need, electrical contractors should begin to ramp up engagement with electricity suppliers to prepare for the commencement of new projects as early as May 2023. Given supply chain constraints and turnover of skilled workers, it is imperative that the industry works closely to coordinate the delivery of electrical contractor services.

Ontario's transmission and distribution system must also expand to accommodate growing electricity demand.

As demand grows in Ontario, additional transmission capacity will be required. The immediate need for new capacity is region-concentrated in four areas of the transmission system, due to increases in regional demand growth reaching the capacity of the existing transmission system. These "hot spots" are:

- Southwestern Ontario (west of London, and especially the area west of Chatham) – challenges to emerge around 2030;
- East of the "Flow East Towards Toronto" (FETT) interface, especially the GTA – emerging around 2027/2029;
- Ottawa area – emerging around 2027; and
- Northeastern Ontario (Sudbury-Timmins-Wawa) – the IESO is currently conducting a mining development study to confirm needs in this region.

By way of example, supply and transmission constraints are particularly prevalent in the southwest of the province. To ensure that the high-voltage transmission system is ready to meet growing demand from new economic development activity (i.e., Stellantis-LG Energy EV battery plant and agri-food producers), the Ontario government has designated three lines in this region as priority projects under the Ontario Energy Board Act, 1998, essentially fast-tracking certain regulatory approvals processes for these lines to ensure that they are built expeditiously:

- A new 230 kV transmission line from Lambton TS to Chatham SS;
- A new 500 kV transmission line from Longwood TS to Lakeshore SS; and
- A new 230 kV transmission line from Lakeshore TS to the Windsor area.

A second 500 kV transmission line from Longwood TS to Lakeshore SS is also contemplated.

However, developing new transmission takes time, even with the designation as a priority. Therefore, the IESO prioritizes new electricity supply resources within the above-constrained areas to ensure continued electricity reliability.

TAKE AWAY 5

To alleviate regional transmission constraints, the IESO is planning new transmission projects and prioritizing the procurement of generation resources in regionally constrained areas.

In addition to significant generation capacity, a considerable amount of new transmission is also planned. A robust electrical contractor and skilled technician workforce is required to ensure new transmission is developed within the required period.

There is also a need to ensure the sufficient availability of electrical contractors in high-priority areas.

Emerging electricity resources will also be part of Ontario's energy mix.

Distributed energy resources (DERs, i.e., resources that are connected to the distribution rather than the transmission system) will have a central role in the province's transition strategy. For example, clean technologies such as heat pumps, energy storage, solar panels and virtual energy management systems can all be deployed locally, lessening the load on local distribution systems and the provincial transmission system. Ultimately DERs can lower demand at the bulk system level while simultaneously providing cost, reliability, and/or sustainability benefits to local communities.

Increasingly, local distribution companies (LDCs) are integrating DERs into their distribution networks. Faced with increasing load growth on their systems, LDCs must find cost-effective ways to expand the grid's capability to meet customers' needs. For example, LDCs can utilize energy storage or demand response as alternatives to traditional wires infrastructure investment. This means distribution systems are becoming increasingly complex to plan and operate.

Another emerging electricity DER would be microgrids. This type of DER acts as a self-contained electrical network that is a single controllable entity concerning the larger grid. Microgrids can connect and disconnect from the grid (known as island mode) when necessary and are known to improve customer reliability and resilience to grid disturbances. Currently, there are three microgrid projects either in the planning, development or close-to-implementation stages across the province.

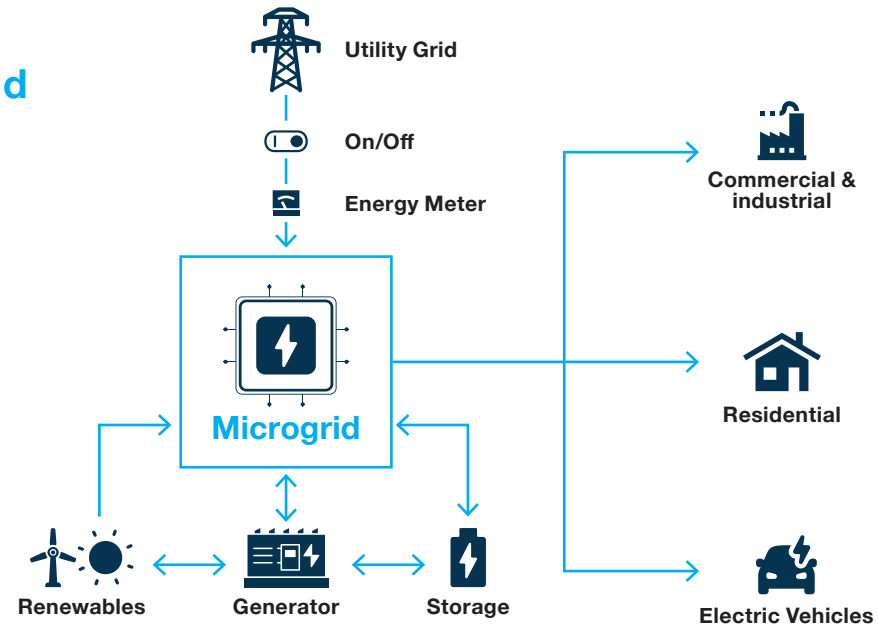
As the province looks to build 1.5 million new homes over the next ten years and meet federal net-zero emission goals, there is a compelling case for using microgrid systems. An example of an Ontario-based microgrid pilot project close to the implementation stage is the Sault Smart Grid Project (SSG Project). Slated to be up and running later this year, this $34 million project will employ Volt-VAR optimization (VVO) technology which will reduce distribution voltage and lower customer energy consumption. This in turn will improve system distribution and reliability by reducing the frequency and duration of power outages and ultimately reduce greenhouse gas emissions of the project by 2,804 tonnes of carbon annually. Additional microgrid pilot projects currently in the planning and development stages include residential developments in London and Ajax. Microgrids may also support reliability in critical areas, such as hospitals, national defence, schools and government offices, depending on local needs.

TAKE AWAY 6

Electricity grids are becoming more complex with increased deployment of DERs and non-wires solutions.

As Ontario's electricity grid modernizes and integrates DERs, new technologies and innovative approaches will be incorporated into the grid. As a result, electrical contractors need to ensure ongoing training and skills development.

How a Microgrid Works



Securing Ontario Energy Future

Investing in Ontario's Workforce

Ensuring the reliability of Ontario's electricity supply is essential to Ontario's future economic success. Moreover, given the expectation that Ontario's electricity grid is on a pathway to eventual decarbonization and anticipated economy-wide electrification, Ontario's electricity system is even more foundational.

At the core of every decarbonization plan is the following:

- Expanding the electricity transmission and distribution systems;
- Connecting more clean energy supply, including renewables and nuclear; and
- Deploying innovative technologies to manage the increasing complexity of the grid (e.g., variable generation, changing electricity consumption patterns, etc.).

Expand Grid Capacity → **Connect Cleaner Electricity Supply** → **Deploy Smart Grid Solutions**

Significant investments are required in the near term to enable this transition, including supporting the training of electrical contractors.

Overall, as this report has demonstrated, Ontario's contractors are foundational to the functioning of the electricity sector, and there is a need to:

- Prepare and train the electrical contractors for emerging widespread adoption of clean technologies;
- Ramp up quickly to ensure the availability of electrical contractors and power lines technicians to meet near-term and significant supply and transmission development;
- Closely coordinate electrical contractor skills training with procurement as new electricity resources are planned and developed; and
- Ensure resources are available in high-priority regions of the province where significant development is expected.

Final recommendations

Final Recommendations

Given the rapid pace and magnitude of the energy transition, electrical contractors and skilled workforce will be at the forefront of ensuring electrification occurs in a manner that ensures safety, affordability, reliability and resiliency. The energy transition will likely include a variety of pathways in which electrical contractors and their skilled workforce will need so that they are appropriately skilled and trained. Key areas of focus to consider include:

- Smart grid and transmission technology such as advanced meters;
- Proficiency in clean technology, both large (large nuclear, small modular reactors, renewables, battery storage, long duration storage, and so on) and small (heat pumps, residential electrical vehicle chargers, smart thermostats and the overall connected home);
- Understanding microgrids and connecting multiple technologies that operate in island mode or are related to the grid but can participate in market systems in the wholesale or local markets. This will entail having a firm grasp of market rule requirements relating to meters and telemetry; and
- For industrial and residential customers, electrical contractors will be essential in advising on energy management systems. Electrical contractors must remain trusted advisors and support customers through the transition.

Endnotes

1 Backgrounder; Canada's Enhanced Nationally Determined Contribution, https://www.canada.ca/en/environment-climate-change/news/2021/04/canadas-enhanced-nationally-determined-contribution.html

2 Proposed Frame for the Clean Electricity Regulations https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/proposed-frame-clean-electricity-regulations.html

3 See IESO's 2022 Pathways to Decarbonization Study, Appendix D, Figure 7.

4 The summer effective capacity of an electricity resource (e.g., generation unit) means the maximum capacity contribution that can be relied on during a peak summer day.

5 See IESO's 2022 Annual Planning Outlook, Figure 7.

6 The Government of Ontario has requested Ontario Power Generation OPG to extend the life of the Pickering Nuclear Generation Station by approximately eighteen months to 2026. Approval to continue operations requires regulatory approval by the Canadian Nuclear Safety Commission.

7 See IESO's 2022 Pathways to Decarbonization Study, Appendix D, Figure 8.

8 See IESO's 2022 Annual Planning Outlook, Figure 19.

9 See IESO's 2022 Annual Acquisition Report, as well as Directives from the Minister of Energy to the IESO dated January 28, 2022, October 7, 2022, and December 23, 2022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