

Powering Ontario's Growth

Ontario's Plan
for a Clean Energy Future



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Ontario 

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Minister's Message



Over the past five years, our government has worked to make Ontario the best place to create jobs and build the industries of the future. By reducing electricity costs, lowering taxes and cutting red tape, we have significantly reduced the cost of doing business and we've seen companies and investment surge into our province as a result.

Ontario is quickly becoming a leader in building electric vehicles and batteries with historic investments from Stellantis in Windsor to Volkswagen in St. Thomas. And we are working with the steel industry to end coal use and electrify their operations to support the production of green steel in Hamilton and Sault Ste. Marie, fueling our growing automotive sector.

At the same time, our government has a plan to build 1.5 million new homes as Ontario's population is expected to grow by two million people by the end of this decade.

As a result, for the first time since 2005 Ontario's electricity demand is rising, and we know that to support this type of growth we need to ensure the continued availability of reliable, affordable, and clean energy.

Our government is on track to acquire the electricity resources we need this decade to power economic growth and increasing electrification, with major projects and procurements already announced, including Canada's first grid-scale small modular nuclear reactor (SMR), a \$342 million expansion of energy efficiency programs and the largest energy storage procurement in Canada's history.

But looking ahead on the path to 2050, we know economic growth and electrification are going to continue to increase energy demand. In fact, Ontario's Independent Electricity System Operator's (IESO) analysis shows that electricity demand could more than double by 2050.

We need to act today to ensure we have the energy we need to power economic growth and electrification over the next three decades while maintaining our clean electricity advantage.

Powering Ontario's Growth is the next chapter in Ontario's clean energy story and lays out the plan to provide families and industries with the reliable, low-cost, and clean power we need to power Ontario's growth.

Generational decisions, like starting pre-development work for a new nuclear station at Bruce, the first large scale nuclear build since 1993, and advancing three additional small modular reactors at Darlington will provide the dependable clean, green, zero-emissions electricity that businesses around the world are looking for.

Connecting Ontario and opening new regions for clean energy generation through strategic new transmission lines and developing long-duration storage, like pumped hydroelectric, will also be pivotal to ensuring our grid is as efficient as possible. While we build the next phase of Ontario's electricity grid to reliably meet peak demand, in the near-term natural gas generation will continue to provide our province with an insurance policy to maintain system reliability and support electrification across our economy.

This growth can only be successful with the participation and leadership from Indigenous communities and partners across the province, whose voices will help ensure energy infrastructure is developed in a way that considers future generations.

With the world-class talent in Ontario's energy sector, I'm confident we will continue to build our clean energy advantage that has made our province so attractive for investment, while providing the reliable and affordable electricity that will keep energy costs down for families.

Sincerely,

A handwritten signature in black ink, appearing to read "Todd Smith", enclosed in a thin black rectangular border.

Todd Smith
Minister of Energy

Top 10 things to know

The Government of Ontario is taking action to build the electricity system to support new investments, electrify our economy and power the 1.5 million homes the province is building to house our growing population. All of this work has been informed by the advice of Ontario's Independent Electricity System Operator who identified "no-regret actions" to meet growing energy demands through 2050.

1. **New Nuclear at Bruce:** Starting pre-development work to site the first large-scale nuclear build since 1993 at the Bruce nuclear site.
2. **New Nuclear at Darlington:** Moving ahead with three additional small modular reactors at the Darlington nuclear site.
3. **Building New Transmission:** Three new transmission lines to power the conversion from coal to Electric Arc Furnaces at Algoma Steel as well as growth in Northeastern Ontario.
4. **Building New Transmission:** One new transmission line to power growth in the Ottawa region and across eastern Ontario.
5. **Pumped Hydroelectric Storage:** Advancing the Ontario Pumped Storage Project and Marmora Pumped Storage Project to Ontario's first Long-Duration Storage Assessment.
6. **Hydroelectric Power:** Optimizing Ontario Power Generation's hydroelectric fleet to increase generation.
7. **Energy Efficiency:** Planning for the future of energy efficiency programs in Ontario.
8. **Next Competitive Electricity Procurement:** Starting planning for Ontario's next competitive electricity procurement focused on new clean resources including wind, solar, hydroelectric, batteries and biogas.
9. **Integrated Energy Planning:** Advancing foundational work toward Ontario's first long-term integrated energy plan through the Electrification and Energy Transition Panel.
10. **Keeping Costs Down:** Ontario is cementing its commitment to maintain an affordable electricity system to support electrification across our economy.

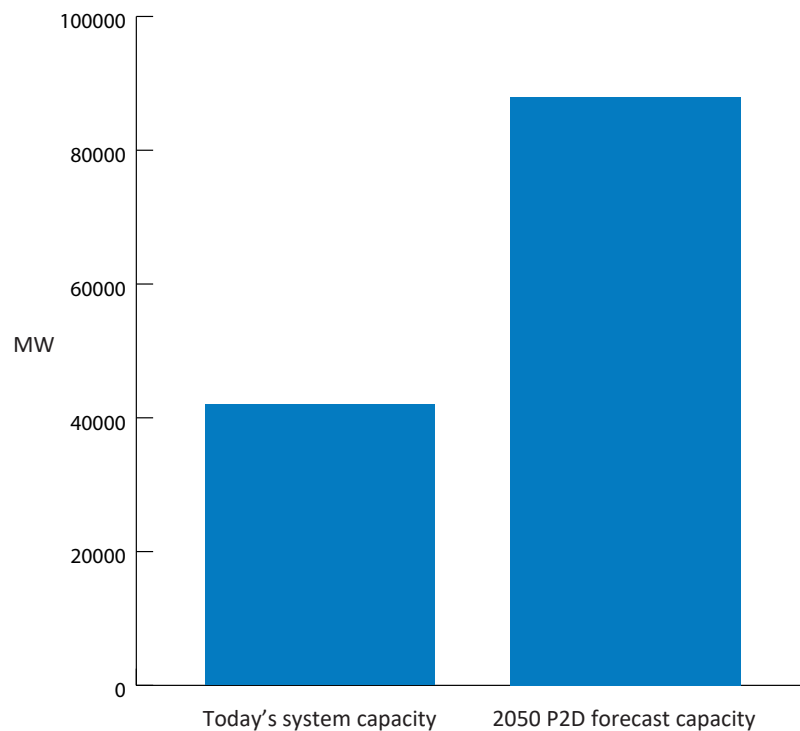
Executive Summary

Ontario's economy and the day-to-day lives of its 15 million residents depend on a reliable electricity system that delivers power on demand.

Demand for electricity is increasing in Ontario, because of the province's economic success and global attractiveness as a place to live and work. As rapid economic growth and electrification continue, demand for electricity will increase at a rate not seen since the 1970s.

According to the Independent Electricity System Operator's (IESO) *Pathways to Decarbonization (P2D)* report high-growth scenario, in less than 30 years Ontario could need more than double its electricity generating capacity, from 42,000 megawatts (MW) today to 88,000 MW in 2050. Up to 20,000 MW in capacity may be needed just to replace generation that will come to the end of its life or be phased out over the next three decades.

Figure 0.1: Ontario Electricity System Capacity: Historic vs P2D 2050 Pathways Forecast



The Ontario government is planning and building the electricity infrastructure for a more electrified Ontario, where economic growth continues to drive new jobs and emissions continue to be reduced. It is developing an integrated planning process that looks at the province's energy mix and system as a whole (electricity, oil and natural gas), unlike previous governments, which built and planned energy systems in isolation, and it is taking the necessary steps to ensure the province is set up for success.

Executive Summary

To meet this growing demand this decade, the government has already acted by re-contracting existing electricity resources, increasing energy efficiency programs in the electricity and natural gas sectors, supporting the continued safe operation of the Pickering Nuclear Generating Station, and building 4,000 MW of new generation and storage as well as Canada's first grid scale small modular reactor (SMR).

As the planning process moves forward, the Ontario government is acting now to ensure that the province has the electricity it will need this decade while making the decisions necessary to prepare for the decades ahead. That includes starting the development of long-lead generation and storage assets like nuclear and pumped hydroelectric so the government has a range of options to choose from to contribute to our diverse energy system.

This work will ensure Ontario maintains and builds on the clean electricity advantage that has made our province so attractive for new investments.

Working in partnership with Indigenous leaders and communities, as well as ensuring meaningful opportunities for consultation and Indigenous community participation in energy planning and projects, will be key to achieving these goals.



This document is a road map to that reliable, affordable, and clean energy future. It provides a detailed overview of where the province is now and how it will build the electricity system that is needed in the years ahead:

- Chapter 1 provides an outline of Ontario's overall energy mix today with electricity, natural gas and refined petroleum products making up 96 per cent of the energy the province consumes.
- Chapter 2 explores the factors driving demand for electricity, including the province's robust economic growth, electrification, and the demand for clean energy.
- Chapter 3 describes the current actions that the province is taking to meet the needs of this decade, from new battery storage, Canada's first small modular reactor and small-scale hydro projects to the refurbishment of Ontario's nuclear generation fleet, supported by natural gas generation.
- Chapter 4 outlines the steps the government will take to meet the needs of the 2030s and beyond and create an emissions-free electricity system, potentially doubling today's capacity, and ensuring Ontario is on the path to meet the demand for electricity in 2050.
- Chapter 5 describes Ontario's progress towards integrated energy planning that considers energy investments at a macro level, whether they be electricity, natural gas or green and renewable fuels.



Chapter 1

Ontario's Energy System

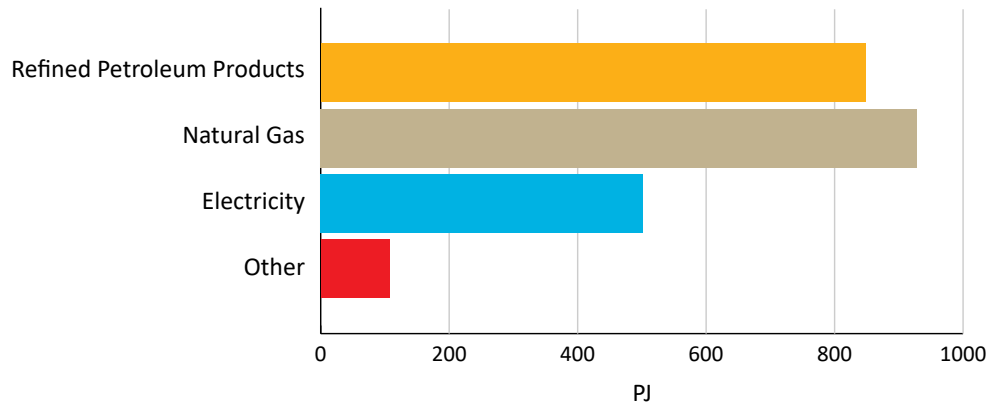
Ontario's Energy System

1.0 Introduction

Ontario relies on a mix of energy sources to drive its economy, heat, cool and light the homes of its 15 million residents and move people and goods across our vast province.

Electricity, natural gas, and refined petroleum products together account for 96 per cent of the energy Ontario needs with other fuel types such as bio- and industrial-fuels (coal, coke and coke oven gas which are being phased out through the electrification of the steel sector) – accounting for the remaining four per cent.

Figure 1.1: Ontario's Energy Mix: End Use Demand by Fuel Type

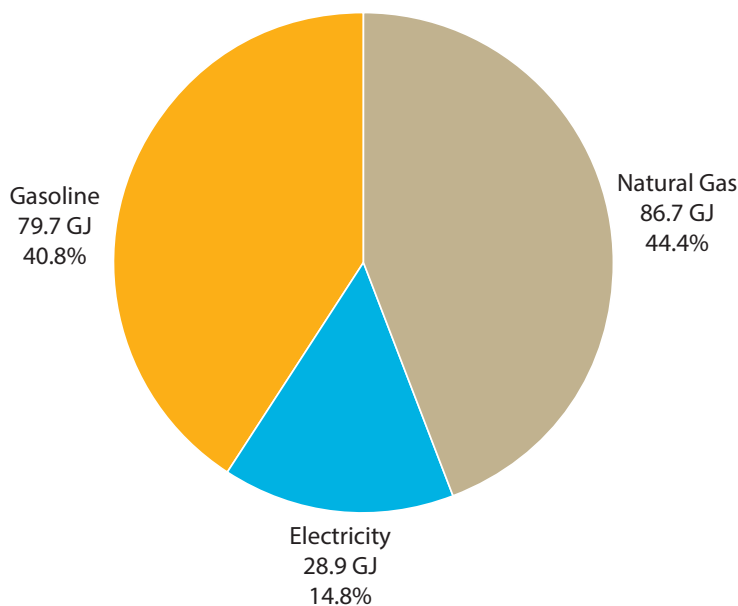


Average household energy consumption is similar to the overall economy with natural gas and gasoline accounting for approximately 44.4 and 40.8 per cent respectively with electricity providing the remaining 14.8 per cent (Figure 1.2). These levels will change as individuals make choices to electrify vehicles and home heating.

Through investment, regulation and innovative public policy, the Ontario government has a leading role in ensuring the province has access to the reliable, affordable supply of energy needed to keep people safe, create jobs and grow the economy.

This chapter describes the role of electricity, oil, refined petroleum products and natural gas in Ontario's energy mix and how they work together to deliver the energy the province needs. It includes an overview of the steps being taken to ensure a reliable supply of electricity and to keep electricity and natural gas costs affordable as needed investments are made to increase generating capacity and meet anticipated demand.

Figure 1.2: Household Energy Consumption (source: Statscan, 2019 data)

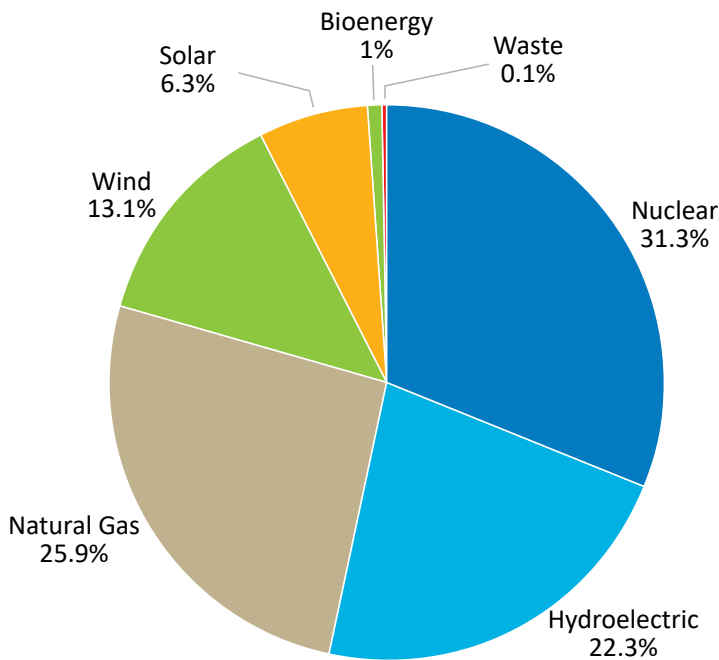


1.1 Ontario's Clean Electricity Advantage

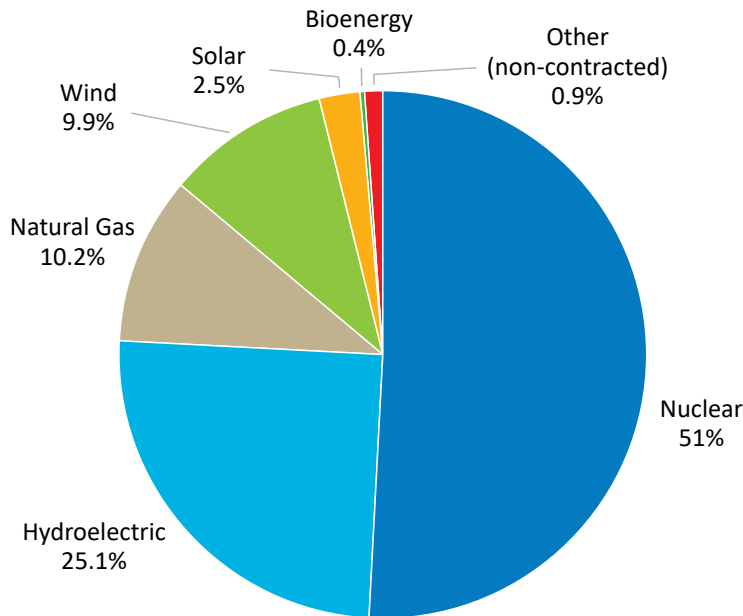
Ontario's electricity system is one of the cleanest and most reliable in the world, providing affordable electricity to serve a growing population, attract new investment and continue to power the province's strong economic growth.

Ontario's world-class electricity grid benefits from being comprised of a range of diverse resources, including hydroelectric, nuclear, natural gas, solar, wind and bioenergy. Each resource generates electricity differently and has unique operating characteristics. Because no single resource can meet all of the system's needs at all times, maintaining a diverse supply mix is an effective way to ensure the ongoing reliability of Ontario's electricity system.

Figure 1.3: Total Transmission and Distribution Connected Capacity in 2022



'Capacity' is a measure of the maximum amount of electricity the province's system can supply at any given time. Ontario's capacity is constantly changing as new supply comes online, older generators are taken out of service and new innovative technologies are introduced (Figure 1.3). Resources like nuclear, natural gas and hydroelectric that can be depended upon are said to have a 'high-capacity factor', while intermittent resources like wind and solar have a 'low-capacity factor,' unless paired with energy storage. While nuclear, hydroelectric, and natural gas each account for between 25 to 35 per cent of the province's total capacity, that does not correlate to the amount of electricity they supply every day. Ontario's nuclear and hydroelectric fleet run most often, while natural gas plants fulfil an insurance policy role, providing electricity at times of peak demand when other generators cannot.

Figure 1.4: Total Electricity Output by Source in 2022

While capacity represents the maximum amount of electricity that the system can supply, 'energy' represents the actual amount of power that a specific resource provides (Figure 1.4). For example, while natural gas represented about 26 per cent of Ontario's capacity in 2022, it only produced about 10 per cent of the province's electricity. In contrast, nuclear and hydroelectric respectively accounted for 51 and 25 per cent of Ontario's electricity, providing reliable sources of emissions-free baseload power, required to ensure system reliability.

For many hours of a typical day, all of the province's energy needs can be met by baseload and intermittent (i.e., wind and solar) resources. However, as Ontario is a province with hot summer days and cold winter nights, energy demand tends to 'peak' largely due to weather. A mix of natural gas, hydroelectric with reservoirs and bioenergy provides additional energy on those days when electricity demand rises.

According to the IESO, Ontario's natural gas fleet will remain a critical capacity resource, complementing the province's nuclear and hydroelectric fleets when needed to support homes and businesses with reliable power and keeping bills down while the province further builds out its clean electricity grid.

While meeting Ontario's own energy needs, Ontario also engages in trading with neighbouring jurisdictions like Quebec, New York, Michigan, and others. Each day, electricity is imported or exported based on market conditions in the province and neighbouring markets, ensuring system reliability in Ontario and elsewhere while also decreasing costs for ratepayers.

Ontario is also the first jurisdiction in North America to completely phase out coal-fired electricity generation, a landmark achievement made possible in large part by the province's fleet of CANDU nuclear reactors.

As a result, in 2022 Ontario had one of the cleanest electricity grids in North America and the world, with about 90 per cent of Ontario's electricity coming from non-emitting sources. Compared to neighbouring Great Lakes States, Ontario's system emits far less greenhouse gas per unit of electricity produced – seven times less than New York, 17 times less than Michigan and 26 times less than Indiana. Jurisdictions like Quebec and Manitoba are able to reduce their emissions even further due to their abundant access to clean hydroelectricity, a resource that is not as plentiful in Ontario due to its topography.

Figure 1.5: Carbon Intensity in North America

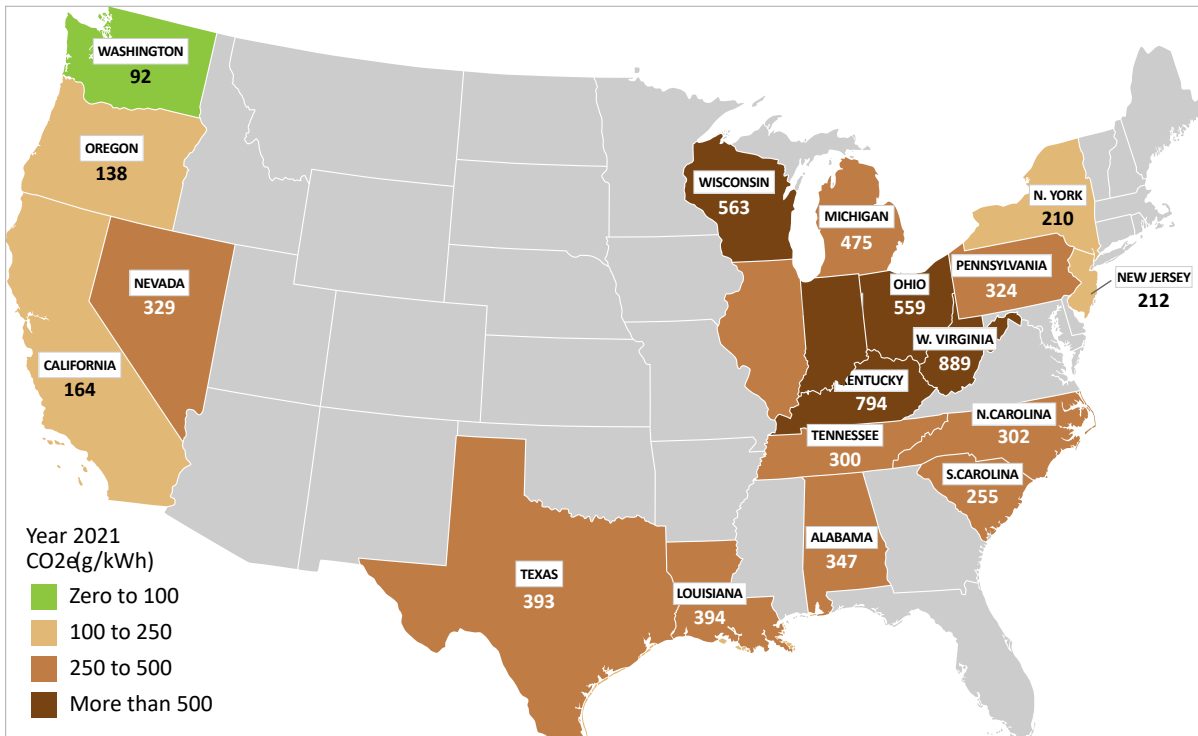
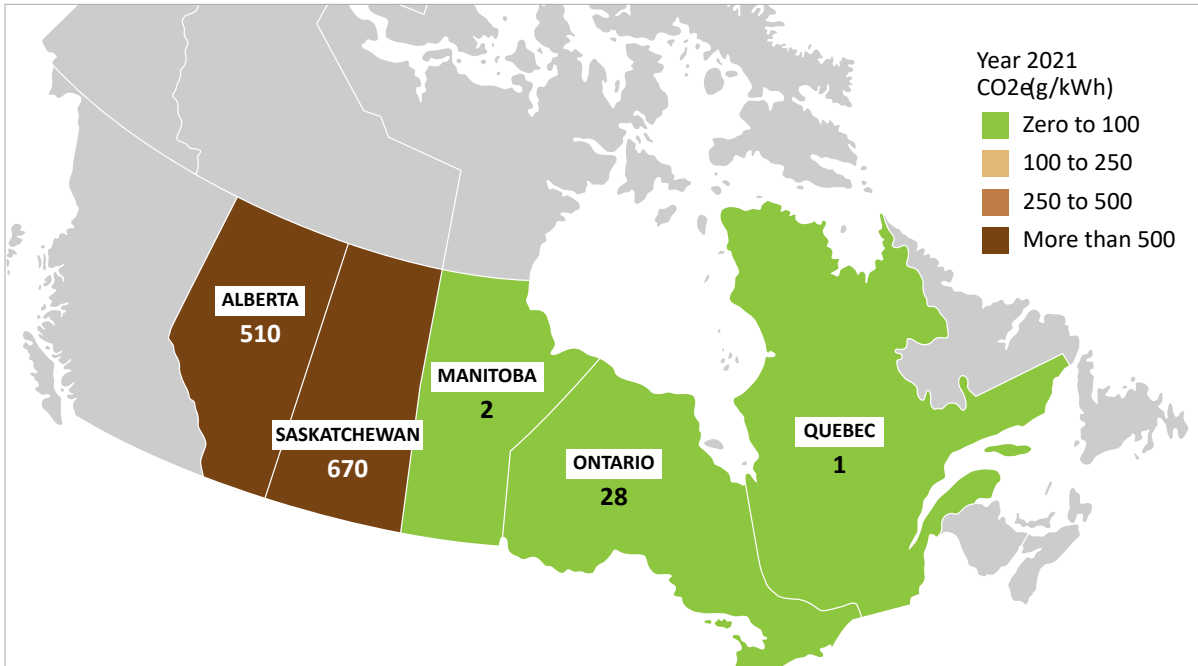
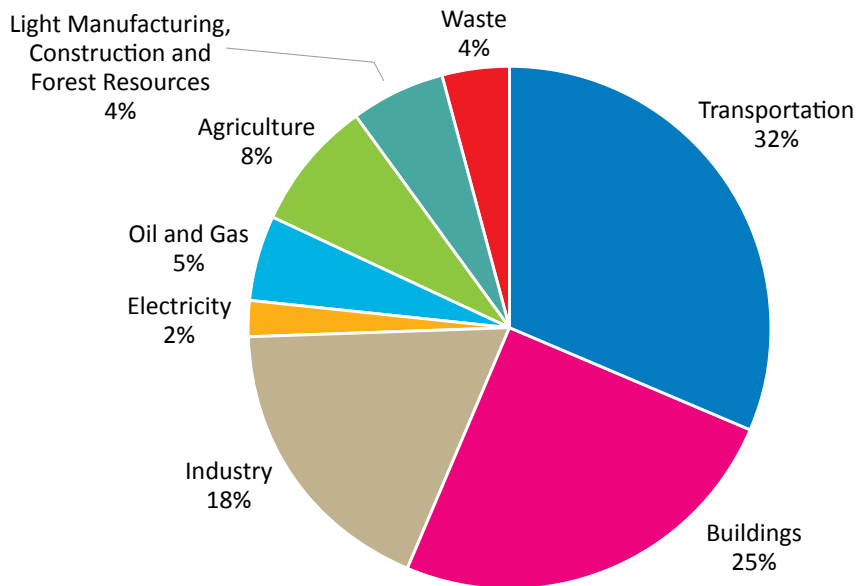


Figure 1.6: Ontario GHG Emissions by Sector in 2021

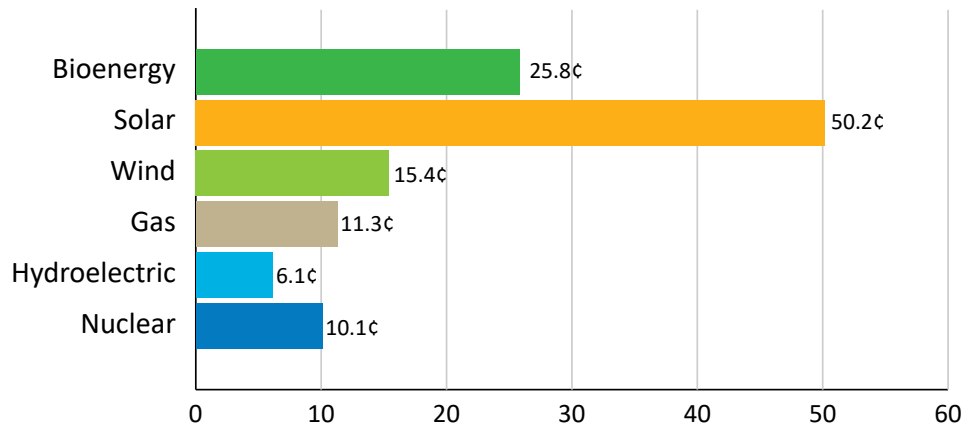
Thanks to our diverse supply mix, Ontario's world-leading clean electricity sector accounts for only two per cent of the province's total greenhouse gas emissions, and as such is a key tool in helping other sectors of the Ontario economy reduce emissions through electrification. Today, Ontario's transportation, industrial and building sectors currently are responsible for 75 per cent of the province's emissions but electrification is playing a critical role in driving down emissions in these sectors. For example, charging an electric vehicle on Ontario's grid could reduce that vehicle's emissions by up to 90 per cent in comparison to a traditional internal combustion engine vehicle. But to meet increasing demand as other sectors of Ontario's economy electrify, new generating resources will need to come online to provide the key services the grid needs, like capacity and energy.

Over the last few years, the Ontario government has acted through a multi-pronged approach, outlined in this plan, to ensure continued system reliability and support a growing and increasingly electrifying province this decade. This plan also outlines the steps the government is taking to develop new long-lead assets that will meet demand in the decades to come.

Keeping Electricity Affordable for Ontario Residents and Businesses

To ensure the province's continued success in attracting new investments and growing Ontario's economy, the government remains focused on keeping electricity affordable as demand grows. The province is also committed to continuing to provide electricity relief for residents and businesses while making the needed investments in the system.

Figure 1.7: Unit Cost of Electricity by Resource Type as of October 2022 (per kilowatt-hour)



The government's approach to ensuring affordability is based on leveraging the existing resources on the system today. Currently hydroelectric and nuclear provide the lowest-cost power to Ontario's grid, with contracted solar and wind costs being higher, reflecting the over-market priced contracts signed between 2004 and 2016. Ontario's recently procured clean storage resources will help these renewable energy resources provide capacity, by addressing their intermittency due to weather-dependency, while also helping Ontario to better integrate future renewables assets to support the province's growing electricity needs.



Support for Residential Customers

To keep costs down for families, Ontario residential customers benefit from the Comprehensive Electricity Plan, the Ontario Electricity Rebate and other more targeted programs that support our province's most vulnerable.

Comprehensive Electricity Plan (CEP)

Ontario's Comprehensive Electricity Plan (CEP) is lowering electricity commodity costs for all electricity consumers by funding the above-market costs of the approximately 33,000 existing renewable energy contracts, signed between 2004 and 2016.

Ontario Electricity Rebate (OER)

Introduced in 2018, the Ontario Electricity Rebate (OER) provides electricity rate relief to eligible customers including households, farms, long-term care homes and small businesses. Effective November 1, 2022, the OER is providing an 11.7 per cent rebate on electricity bills. The OER is adjusted every November following the Ontario Energy Board's annual electricity rate setting to help provide consumers with affordable and predictable electricity bills.

The OER and CEP are automatically applied to all consumers' bills. Together, the OER and CEP reduce an average residential bill by about 23 per cent in 2023.

Ontario Electricity Support Program (OESP)

The Ontario Electricity Support Program (OESP) provides a fixed monthly credit directly on qualified low-income customers' electricity bills. Credit amounts range from \$35 to \$113 and are based on household income and size, as well as energy intensity criteria. The credit further reduces electricity bills for lower-income households.

Energy Affordability Program (EAP)

The Energy Affordability Program (EAP) offers electricity savings measures that can help eligible low-income households further manage their energy use and lower electricity bills by up to an additional \$750 per year at no cost to the customer.

In 2023, Ontario raised the income eligibility thresholds, by \$11,715 for a four-person household and by \$8,285 for a couple, helping thousands more Ontario families reduce energy use and save money. Customers who already receive benefits from a list of energy bill support and social assistance programs automatically qualify.

The energy efficiency upgrades and types of support available are based on factors including home heating system, location, and an assessment of energy needs. Some free measures include energy-efficient refrigerators, window air conditioners, additional attic or basement insulation, smart thermostats and weatherstripping around doors and windows.

Since 2018, the IESO's Energy Affordability Program and the previous Home Assistance Program have helped more than 47,000 households across Ontario create more energy efficient homes, lowering electricity bills for years to come.

The Energy Affordability Program (electricity efficiency) and Enbridge's Home Winterization Program (natural gas efficiency) are now also delivered through a one-window approach, improving customer experience, and making it easier for income-qualified consumers to receive free energy-efficient measures and products that will help lower both electricity and natural gas bills.

Rural or Remote Rate Protection Program (RRRP)

The Rural or Remote Rate Protection Program (RRRP) is a \$60.50 monthly credit for eligible customers of Hydro One's R2 (low density) rate class. The RRRP also provides support to customers of Hydro One Remote Communities Inc., Algoma Power and three First Nation-owned distributors on the James Bay coast. This program helps to lower electricity bills for those living in rural and remote areas where the cost of electricity service is higher.

Distribution Rate Protection Program (DRP)

The Distribution Rate Protection (DRP) Program caps base distribution charges for eligible residential customers of eight prescribed Local Distribution Companies (LDC) serving lower density parts of the province.

The LDCs are:

- Algoma Power Inc.
- Atikokan Hydro Inc.
- Chapleau Public Utilities Corporation
- Hydro One Networks Inc. R1, R2 customers
- InnPower Corporation
- Lakeland Power Distribution Ltd (including the former Parry Sound Power service area)
- Northern Ontario Wires Inc.
- Sioux Lookout Hydro Inc.

This program helps to lower electricity bills for those that have a higher-than-average electricity distribution cost due to their geography.

Disconnection Ban

Between November 15 and April 30 every year, the OEB prohibits LDCs and rate-regulated gas distributors from disconnecting homes and turning off electricity for non-payment, ensuring that these customers continue to have access to heat and electricity during the cold winter months.

First Nations Delivery Credit (FNDC)

The Ontario government provides immediate relief on delivery charges for on-reserve First Nation residential customers through the First Nation Delivery Credit (FNDC) Program. FNDC funding, which was \$28 million in 2021, provides a 100-per-cent credit to cover the electricity delivery charge on the bills of on-reserve First Nation residential customers of licensed distributors.

Customer Choice

While the government focuses on reliable, affordable, and sustainable electricity, the province is also giving households more control over their energy bills. Customers can now choose a billing structure that best suits their lifestyle and individual electricity use. In November 2020, the provincial government introduced Customer Choice, giving residential and small business customers who pay Time-of-Use (TOU) pricing under the Regulated Price Plan (RPP) the choice to switch to Tiered pricing.

TOU pricing may be best for consumers who use most electricity during evenings and weekends, which are off-peak hours. Tiered Pricing structures may be better for consumers who use electricity mostly during higher-peak times like weekdays.

Ultra-Low Overnight Price Plan

In May 2023, the province provided a third choice to customers with the introduction of the Ultra-Low Overnight electricity price plan, giving families and small businesses that use more electricity overnight more ways to save.

The Ultra-Low Overnight rate of 2.4 cents per kilowatt-hour is possible as the province continues to have excess clean electricity during overnight hours.

The new price plan is most likely to benefit those who are employed in shiftwork, electrically heat their home, or charge their EV and could save them up to \$90 per year by shifting demand to the overnight period when province-wide electricity demand is lower.



"We strongly support the province's ultra-low overnight electricity price. This rate structure will not only make electric vehicles even more affordable to own and operate but will also make better use of Ontario's surplus of electricity at night, benefiting the electricity system as a whole."

– Cara Clairman
President and CEO, Plug'n Drive

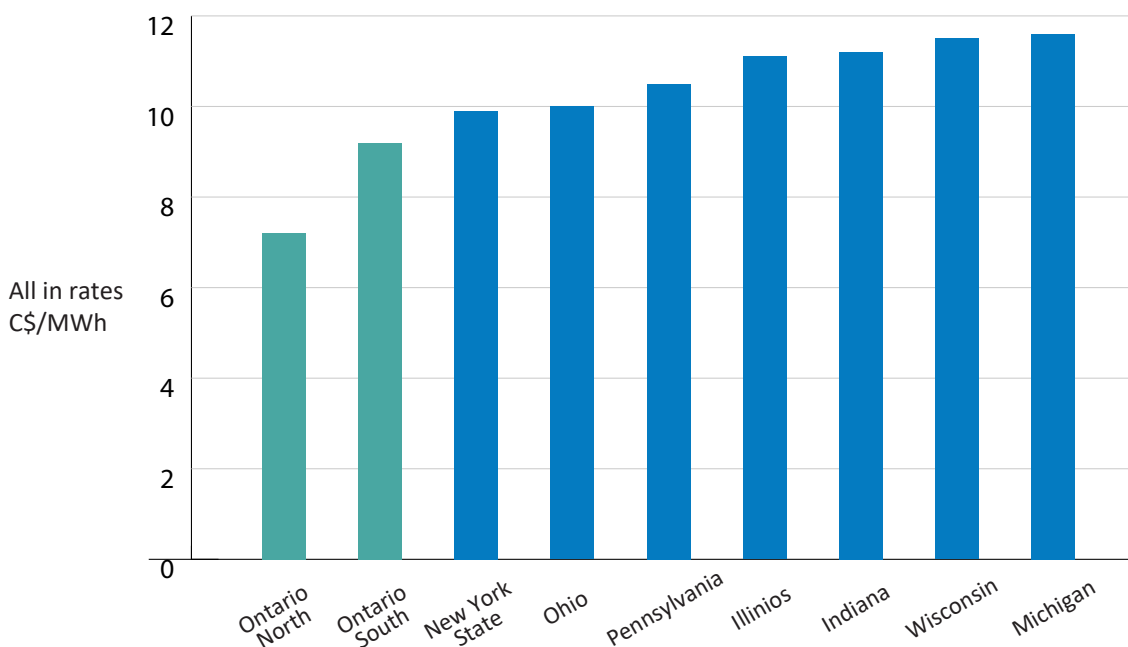
"The introduction of Ontario's new Ultra-Low Overnight Electricity Pricing Plan provides customers another pricing option to fit their business and lifestyle needs. Customers now have additional choice and flexibility to manage their energy costs and consumption. We welcome this initiative as a positive step towards supporting electrification and a sustainable energy future in Ontario."

– Teresa Sarkesian,
President and CEO, Electricity Distributors Association

Support for Business Customers

Ontario also provides clean and affordable electricity to power businesses through the Comprehensive Electricity Plan, Industrial Conservation Initiative, and other programs. As a result, Ontario electricity rates are priced at or below the rates in neighbouring Great Lakes States. As environmental and sustainability goals become more important for businesses making decisions on where to invest, this advantage makes Ontario the best place to create jobs and to grow or electrify their businesses.

Figure 1.8 Electricity Costs for Medium and Large Businesses



Comprehensive Electricity Plan (CEP)

The Comprehensive Electricity Plan, introduced on January 1, 2021, is reducing electricity costs for industrial and commercial businesses by funding the above-market cost of Ontario's approximately 33,000 renewable energy contracts signed between 2004 and 2016.

In 2023, industrial and commercial customers could see average savings from the CEP of between 14 and 17 per cent. Savings vary depending on location and consumption.

Industrial Conservation Initiative (ICI)

The Industrial Conservation Initiative (ICI) is a demand response program in which participants - including large manufacturers, mines, and forest product operations - can significantly reduce Global Adjustment costs by reducing their electricity demand during peak periods. This reduction in peak demand helps the province defer investments in new electricity infrastructure that would otherwise be needed, keeping costs down for all customers.

Interruptible Rate Pilot (IRP)

In 2021, the Minister of Energy directed the IESO to develop an interruptible rate pilot to that would provide increased rate predictability to large industrial customers in exchange for an agreement that these facilities will reduce their electricity use when the province's electricity demand is high. If the pilot is successful, leading to the creation of a permanent interruptible rate, large consumers would be able to choose a rate that best suits their manufacturing process and corresponding electricity usage profile. The pilot launched on July 1, 2023.

1.2 Natural Gas

Natural gas makes up almost 40 per cent of Ontario's energy mix and is the dominant fuel used for heating in Ontario, serving about 3.7 million customers. About 75 per cent of Ontario's residential customers use natural gas to heat their homes. Additional uses for natural gas include industrial processes (e.g., to produce chemicals and for process heat) and as a transportation fuel. It is also used for electricity generation.

While residential consumers represent about 96 per cent of all customers, they account for about 33 per cent of all natural gas volumes consumed, as industrial processes often require large volumes of natural gas.

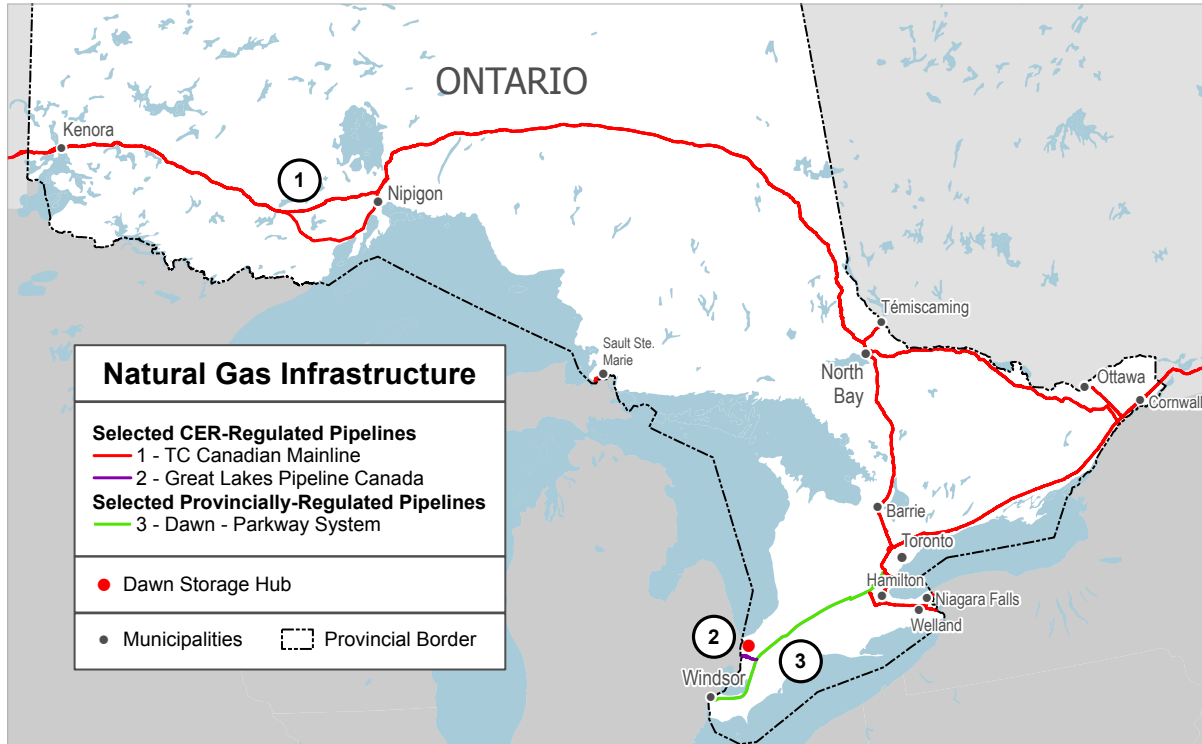
Ontario's Natural Gas Supply

Ontario imports almost all its natural gas from other jurisdictions. Historically, Ontario was predominantly supplied by Western Canada, but now also has a variety of sources from the United States, including nearby jurisdictions such as Pennsylvania, Ohio, and West Virginia. Once natural gas is delivered to the province, Ontario's extensive pipeline infrastructure transports it to end users.

The Enbridge Gas Dawn Hub, located in southwestern Ontario, is one of the largest integrated underground natural gas storage facilities in North America. Dawn is also one of the top three physical trading points in North America. Natural gas storage at Dawn helps meet Ontario's seasonal natural gas demand. Natural gas is injected into storage during periods of low use in spring, summer and fall when natural gas costs are

low, and then withdrawn during periods of peak demand in the winter when natural gas import costs are higher. This ensures sufficient volumes of gas are available during the peak winter heating season and helps protect natural gas ratepayers.

Figure 1.9: Southwestern Ontario Natural Gas Infrastructure: Dawn Storage Hub and Pipeline Connections



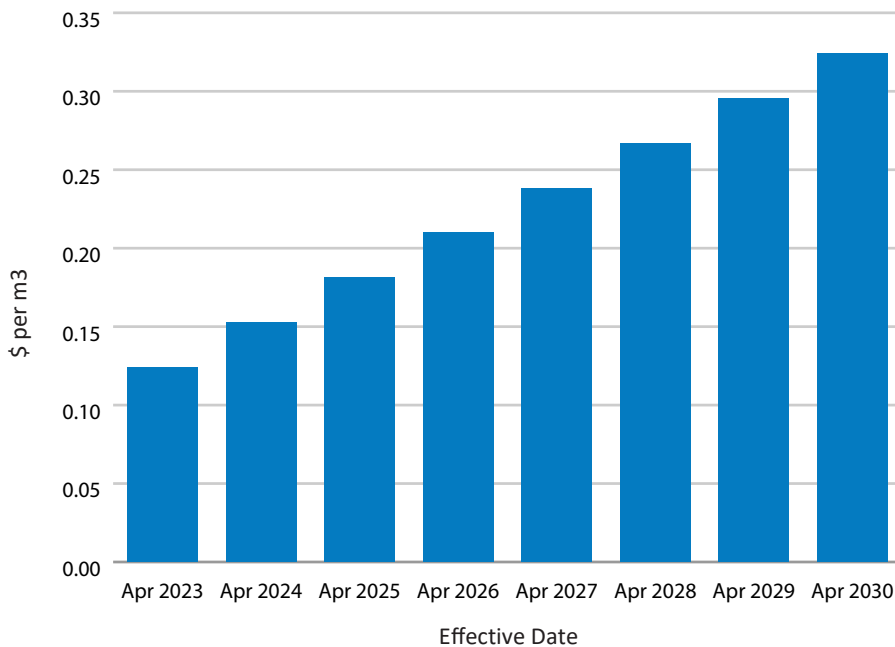
A major natural gas pipeline source to and through Ontario is via the TC Energy (formerly TransCanada) Mainline. The Mainline originates in Western Canada, crosses northern Ontario, and forms a triangle between North Bay, Toronto, and Montreal. Supply entering Ontario from the U.S. in southwestern Ontario is delivered on the Dawn-Parkway system (owned by Enbridge).

Availability of natural gas for residential, commercial, and industrial users is restricted to parts of the province with pipeline access.

Ontario's natural gas distribution utilities are regulated by the Ontario Energy Board (OEB), Ontario's independent energy regulator. The OEB uses the Quarterly Rate Adjustment Mechanism (GRAM) to protect consumers from fluctuations in market prices due to factors such as seasonal demand, bad weather, and interruptions in supply. For example, the GRAM protected Ontario consumers by smoothing gas prices in 2022, which spiked on international markets in the early months following the Russian invasion of Ukraine. Utilities are also not allowed to earn a profit on the sale of gas, regardless of price fluctuations.

They are permitted to pass through only the cost of obtaining natural gas on their customer's behalf. The OEB regulates the delivery rates Enbridge and EPCOR can charge customers for their delivery service (i.e., storage and delivery of natural gas to customers through their distribution system) from which the distributors recover their operating and capital costs and earn a return. Under the QRAM, the OEB requires Enbridge and EPCOR, Ontario's two major natural gas utilities, to forecast market prices every three months and use that forecast to seek OEB approval of any price changes. Forecasts are based on future costs – the estimated market prices for natural gas for the next 12 months, and past costs. If a utility collected more from customers than it paid for gas in the past, the difference is credited to a customer's account. If not enough was collected, the rate would be higher. Natural gas prices are however impacted by the federal carbon tax, which is scheduled to increase each year through at least 2030, which will increase costs for consumers who heat their homes using natural gas. Regardless, for areas with existing natural gas access, in most cases natural gas remains the most cost-effective home heating source.

Figure 1.10: Federal Carbon Tax on Natural Gas (per m³) Through 2030



To help families keep energy costs down and move off higher-emitting fuel sources including propane and home heating oil the Ontario government is expanding access to natural gas across the province to help keep the cost of energy low for families, businesses and farmers while reducing emissions.

In 2021, the province allocated \$234 million in Phase 2 of the Natural Gas Expansion Program to support approximately 8,750 connections in 43 rural, northern, and Indigenous communities. The average household could save between \$250 to \$1,500 a year in energy costs by switching to natural gas from costlier fuel sources. Businesses are expected to save up to 30 per cent on energy costs a year.

Clean Home Heating Initiative (CHHI)

The Ontario government is exploring how natural gas and electricity systems can be leveraged to further save homeowners money and reduce emissions when it comes to heating their homes.

In September 2022, the province launched the Clean Home Heating Initiative (CHHI) with funding of up to \$4.5 million to bring hybrid heating to as many as 1,000 homeowners in St. Catharines, London, Peterborough, and Sault Ste. Marie. The initiative provides homeowners with incentives of up to \$4,500 to install electric air-source heat pumps with smart controls. Funding was increased to \$8.2 million in May 2023 and the program expanded to Barrie, Pickering, Ajax, and Whitby, bringing the total number of eligible Ontario households to more than 1,500.

With about 75 per cent of Ontario homes currently heated with natural gas, hybrid heat pumps provide the energy efficiency benefits of an electric air-source heat pump with the reliable heat of an existing natural gas furnace to help support the transition to clean energy.

A hybrid heating system also mitigates increases in electricity peak demand on the coldest days compared to an all-electric heating system and is estimated to reduce greenhouse gas (GHG) emissions by up to 2.1 tonnes of carbon dioxide equivalents each year per household.

"I thank the Government of Ontario for introducing this innovative program, which will not only help homeowners save money on their energy bills, but also help significantly reduce their emissions. It's a win-win for the wallet and the environment."

- Kevin Ashe
Mayor, City of Pickering

"A hybrid heating system can reduce a home's greenhouse gas emissions by as much as 30 percent a year while increasing the flexibility and reliability of its heating system. We appreciate the support from the provincial government, participating cities and the electricity sector for supporting this program and its ongoing commitment to energy efficiency and carbon reduction measures. Together, we are working towards a cleaner energy future."

-Sarah Van Der Paelt
Director of Marketing and Energy Conservation, Enbridge Gas

Energy Efficiency and Innovation

New technologies and innovative approaches are being introduced to reduce emissions from natural gas. This includes energy efficiency programs designed to reduce the usage of natural gas, and the expansion of lower emissions fuels such as low-carbon hydrogen and renewable natural gas that can be injected into the existing natural gas pipeline system.

Natural Gas Energy Efficiency

Ontario has many energy-efficiency programs in place that help residential and business consumers manage their natural gas usage and bills through the installation of energy-saving measures.

Ontario natural gas customers pay roughly \$2 per month to fund energy efficiency programs as a cost-effective way to reduce natural gas demand. Ontario's primary natural gas utility, Enbridge Gas, is delivering natural gas conservation programs to its customers under a 2023–2025 Demand Side Management Plan. For 2023, the budget is \$167 million, and the natural gas savings target is 114 million cubic metres (m³) in the first year. This is equivalent to GHG emissions reductions of about 0.2 Mt per year. These natural gas savings and GHG emissions reductions are driven by a range of programs such as Residential Whole Home, which provides funding for measures including new insulation, air sealing and heat pumps.

On May 27, 2021, Natural Resources Canada (NRCan) launched the Canada Greener Homes Grant to provide up to \$5,000 in grants to help homeowners make energy-efficient improvements. Starting January 2023, Ontario's natural gas energy efficiency programs are being co-delivered with the Canada Greener Homes Grant through the new Home Efficiency Rebate Plus program, which allows customers to stack funding from both programs to implement energy conservation measures.

According to the Ontario Energy Board, for each \$1 spent on natural gas conservation in 2021, there were up to \$2.56 in future savings.

Low-Carbon Hydrogen and Renewable Natural Gas

Low-carbon hydrogen and renewable natural gas (RNG) can both be blended with conventional natural gas in existing natural gas networks, reducing the carbon intensity of the fuel. Both low-carbon hydrogen and RNG can also be blended into natural gas-fired electricity generation facilities where feasible, helping lower the carbon footprint of these peaking units when they are required.

Ontario already has active hydrogen and RNG projects in municipalities across the province including, but not limited to, London, Ottawa, Toronto, Markham, Hamilton, Ilderton and Niagara Falls.

Enbridge: Markham Hydrogen Demonstration Project

In 2018, Enbridge and Hydrogenics (subsequently purchased by Cummins Inc.) developed and built the Markham Energy Storage Facility, which converts clean electricity from the provincial power grid into low-carbon hydrogen. From 2018 to 2021, Ontario's IESO contracted with the facility to help maintain electricity grid reliability by providing regulation services to help balance electricity supply and demand. Enbridge Gas is now blending hydrogen from the Markham facility into the natural gas system on a pilot basis, offsetting a portion of natural gas with hydrogen. This utility-scale facility, commissioned on October 1, 2021, is the first of its kind in North America.

Stanton Farms: First Ontario Dairy Farm to Produce RNG

RNG is a pipeline-quality gas that is the product of the decomposition of organic matter that after processing is fully interchangeable with conventional natural gas. RNG is commonly collected from waste facilities, sewage treatment plants and green bin programs.

Stanton Farms in Ilderton is Ontario's first agriculture based RNG supplier that produces more than 3 million cubic metres of RNG each year. That RNG is then blended into the Enbridge Gas natural gas distribution network, providing enough fuel to heat more than 1,300 homes.

With the expansion of their biogas plant in 2022, Stanton farms is able to annually divert 60,000 tonnes of organic waste from landfill and by capturing methane, reduce GHG emissions by more than 11,000 tonnes.



Enbridge Gas consumers have the option of adding RNG to their natural gas supply for \$2 per month through the voluntary OptUp program. All the funds generated from the OptUp program are used by Enbridge to purchase locally produced RNG from StormFisher's facility in London, Ontario.

Natural gas will continue to play a critical role in providing Ontarians with a reliable and cost-effective fuel supply for space heating, industrial growth, and economic prosperity. With developments in energy efficiency, and low-carbon fuels such as RNG and low-carbon hydrogen, the natural gas distribution system will help contribute to the province's transition from higher carbon fuels in a cost-effective way.

1.3 Oil and Refined Petroleum Products

Petroleum products, derived from crude oil, comprise just under 40 per cent of Ontario's end-use energy consumption. Petroleum products are critical fuels to move goods and people, heat homes and have non-energy applications.

Transportation fuels account for about 80 per cent of Ontario petroleum consumption —gasoline (49 per cent), diesel (22 per cent), and jet fuel (8 per cent). Non-energy uses of petroleum include inputs to the petrochemical sector (7 per cent) and asphalt (3 per cent). Other applications – including lubricants and heating oil – account for about 10 per cent of overall petroleum demand.

While the first oil well in North America was drilled in Oil Springs, near Sarnia, Ontario crude oil production now accounts for less than one per cent of Ontario refinery requirements today. Ontario relies almost entirely on imported crude oil, primarily delivered by interprovincial and international pipelines. The main pipeline network (Enbridge Mainline) supplying Ontario with crude oil originates in Western Canada and passes through the U.S. before entering Canada near Sarnia (Enbridge Line 5 and Line 78). U.S. crude oil production can also access the U.S. portion of the Enbridge Mainline and supply Ontario. In 2021, about 86 per cent of Ontario's crude oil requirements came from Alberta, Saskatchewan, and British Columbia; 14 per cent came from the U.S.

Ontario's four refineries supply approximately 78 per cent of Ontario's refined product demand, with Quebec and the U.S. supplying the remainder. Pipelines, rail, marine (during the shipping season) and trucks (for delivery to retail gasoline stations) are all part of the supply chain to move fuel from refineries to end-users. Petroleum product infrastructure (terminals, bulk plants, pipelines, retail stations) is owned by private companies in Ontario.

The Sarnia Natural Gas Liquids (NGL) fractionator is one of the main sources of propane and butane for eastern Canada. It processes NGL mix delivered from western Canada by the Enbridge Mainline (Lines 1 and 5). From Sarnia, propane is delivered by rail and truck to locations in Ontario, Quebec, other eastern Canadian provinces, and to export markets in the U.S. Midwest and East Coast.

Ontario's Gasoline and Diesel Market

The Competition Bureau, an independent federal agency, oversees competition in Canada's gasoline market. The Bureau enforces the Competition Act and investigates anti-competitive practices, such as price fixing.

For retail gasoline prices, crude oil costs and taxes typically account for the bulk of retail gasoline prices in Ontario (75-80 per cent). The refining (or wholesale), and retail components for the supply chain account for about 20-25 per cent of the gasoline price. To illustrate, using 2022 average retail gasoline prices in Toronto, crude oil costs accounted for 45.9 per cent of the retail price, taxes 30.5 per cent, wholesale gross margins (also called refining margins) 18.5 per cent and retail gross margins 5.1 per cent. As part of its plan to help keep costs down for Ontario families and businesses, the government extended the current gas and fuel tax rate cuts to December 31, 2023.

As part of its plan to help keep costs down for Ontario families and businesses, the government extended the current gas and fuel tax rate cuts to December 31, 2023. The government cut the gas tax by 5.7 cents per litre which will save Ontario households \$195 on average between July 1, 2022 and December 31, 2023. The federal government continues to charge a 10 cent/L federal excise tax and a 14.3 cent/L federal carbon tax.

In 2020, the government announced the Cleaner Transportation Fuels Regulation, which requires that fuel suppliers blend 10 per cent renewable content (such as ethanol) in gasoline from 2020 to 2024, 11 per cent in 2025, 13 per cent in 2028, and 15 per cent in 2030 and onward. The regulation also requires 4 per cent renewable content in diesel.

The use of petroleum fuels in cars and trucks is declining as electrification spreads. As of May 2023, there are more than 118,000 EVs registered in Ontario, including both battery-electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV). By 2030, there are expected to be more than one million EVs on the road in Ontario, reducing the use of refined petroleum products like gasoline.

As electric cars use electricity instead of gasoline, they are using a much more affordable fuel. This is especially true if you charge overnight or on weekends when the cost of electricity is lower. The average Ontario driver, travelling 20,000 km per year, can save as much as \$2,000 per year on fuel alone.

In other sectors, like shipping, heavy trucking, rail, and aviation, where electrification is more challenging, fuels like sustainable aviation fuel, renewable diesel, renewable natural gas, hydrogen, and fuel cells will help reduce emissions.



Chapter 2

Economic Growth and Electrification Driving Electricity Demand

Economic Growth and Electrification Driving Electricity Demand

2.0 Introduction

Demand for electricity is projected to increase at unprecedented rates over the next three decades as a result of the government's open for business approach and the energy transition.

Electricity demand is expected to grow significantly more than oil and natural gas and make up an increasing share of Ontario's overall energy mix. By 2050, IESO forecasts indicate Ontario may need to more than double its generating capacity, from 42,000 MW to 88,000 MW, to meet demand for electricity.

This chapter explores the three main drivers of demand – economic growth, electrification, and a growing population.

2.1 Economic Growth

Ontario is attracting unprecedented investments in electric vehicles (EV), battery manufacturing, clean steelmaking and other sectors, creating new jobs and driving demand for new electricity generation and storage.

Five major investments alone, when they come online, will increase industrial demand by the equivalent of 21 per cent of today's industrial load (Figure 2.1).

In April 2023, the Ontario government announced a \$7 billion investment by Volkswagen Group to build an EV battery manufacturing facility in St. Thomas. The plant, Volkswagen's largest to date, will create up to 3,000 direct and 30,000 indirect jobs. Construction is expected to begin in 2024 and once complete in 2027, the plant will produce batteries for as many as one million EVs a year, bolstering Canada's domestic battery manufacturing capacity to meet demand now and into the future. It will be the largest manufacturing plant in Canada generating about \$200 billion in value.

The St. Thomas plant will be Ontario's second EV battery manufacturing plant, following a decision by NextStar Energy, a joint venture between LG Energy Solution, Ltd. (LGES) and Stellantis N.V., to build a battery manufacturing facility in Windsor.

With a production capacity of 45 gigawatt hours (GWh) of EV batteries each year, the Windsor battery facility will employ an estimated 2,500 people and supply Stellantis plants across North America. Construction is underway with production expected to begin in the first quarter of 2024. The plant will be fully operational by 2025. In addition, Stellantis is investing \$3.6 billion to retool its existing plants in Windsor and Brampton.

Ontario has also secured a major investment from Umicore Canada Inc. to establish its first North American EV battery component manufacturing plant, in Loyalist Township near Kingston.

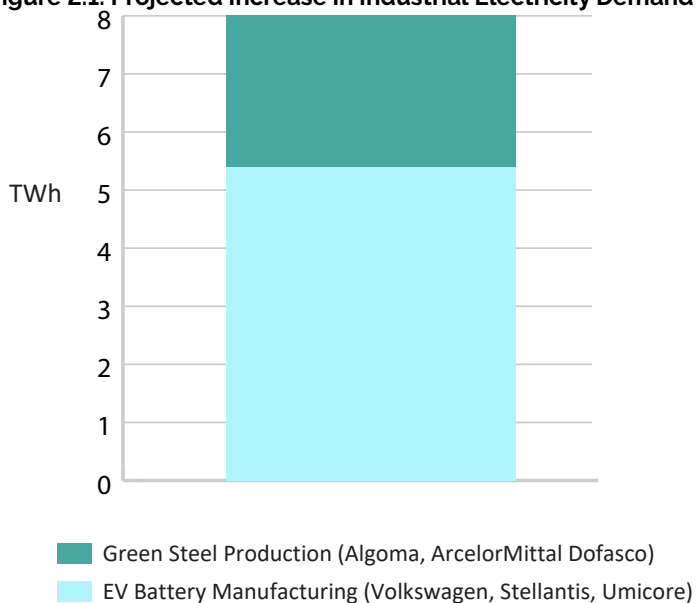
Each component of the battery supply chain plays an important and interconnected role in the production of electric vehicles. These historic investments will advance Ontario's mission to become a globally competitive, vertically integrated EV battery manufacturing jurisdiction and build an end-to-end supply chain to serve the North American EV market. They are helping to secure the province's position as a competitive player in the low-carbon economy of the future.

Ontario's combination of top-quality manufacturing talent, clean competitive electricity supply, access to investment-ready sites and commitment to streamline the approvals process continues to make the province a destination for major investments, ensuring that everyone in the province benefits from the auto sector's long-term growth and success.

Ontario has also secured major investments in clean steelmaking projects in Hamilton and Sault Ste. Marie with ArcelorMittal Dofasco and Algoma Steel. These once-in-a-generation investments will transform the province into a world-leading producer of green steel.

These investments will also boost the robust auto parts supply chain and skilled workforce in communities with deep roots in steel manufacturing and help meet the global demand for low-carbon auto production.

Figure 2.1: Projected Increase in Industrial Electricity Demand



As Ontario continues to secure massive investments, electricity demand from our industrial sector will continue to rise. Taken together, the forecast increased electricity demand from Umicore, Stellantis, Volkswagen and the electric arc furnace at Algoma and Dofasco are equivalent to the annual electricity consumption of the Ottawa Region.

Clean Energy Credits Support Investment

Access to clean energy is a key consideration for businesses making investment decisions. Companies around the world want to invest in jurisdictions with affordable, reliable, clean energy, creating a competitive advantage for Ontario.

Greenhouse gas emissions per kilowatt-hour from Ontario's electricity system are 17 times lower than Michigan's and 20 times lower than Ohio's, providing a major competitive advantage over neighbouring Great Lakes States in attracting industrial and commercial investment.

To drive new investment, Ontario has introduced a Clean Energy Credit Registry to support the sale of clean energy credits (CECs). The registry will help boost competitiveness and attract jobs by helping businesses meet their environmental and sustainability goals. Proceeds from the sale of CECs will help keep costs down for electricity ratepayers and fund the construction of clean electricity projects through the new Future Clean Electricity Fund. The fund will help the province compete for new investments in electric vehicle and battery manufacturing, clean steel, and other sectors while continuing to build a clean economy.

Minister Smith attends the Clean Energy Credits event with Ontario Power Generation and Microsoft



"The introduction of Clean Energy Credits in Ontario is an important step to make the allocation of renewable energy transparent and to support industrial customers as they fulfill their sustainability requirements."

–Dr. Michael Reik,
Head of Rollout Standard Factory St. Thomas, PowerCo SE/Volkswagen



2.2 Electrification



These historic investments in EV and battery manufacturing – and many more – reflect the province's economic competitiveness and will help build our reputation as a leader in clean transportation solutions.

As of May 2023, there are more than 118,000 EVs registered in Ontario, including both battery-electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV). By 2030, there are expected to be more than one million EVs on the road in Ontario.

The IESO's 2022 Annual Planning Outlook states that electricity demand from transportation is forecast to grow from about 2 TWh in 2024 to 30 TWh in 2043, an average annual growth rate of 17 per cent. Investments in generation will ensure that energy will be there to power the future of Ontario's transportation systems.

Many of the impacts from electrification of transportation will also be felt at the distribution level. That's why Ontario is creating the right conditions to ensure the electricity system is ready for charging infrastructure, and that the charging infrastructure deployed can help reduce the impact of EVs on the grid.

The Minister's 2021 mandate letter to the OEB noted that increased adoption of EVs is expected to impact Ontario's electricity system in the coming years and the OEB must take steps to facilitate their efficient integration into the provincial electricity system, including providing guidance to LDCs on system investments to prepare for EV adoption.

Based on Minister's direction, the OEB developed its Electric Vehicle Integration (EVI) initiative to inform actions it may take to support the efficient integration of EVs and ensure that Ontario has the transmission and distribution systems to charge them. As this work continues, Ontario is also exploring ways to reduce red tape and enable the province-wide deployment of EV charging infrastructure.

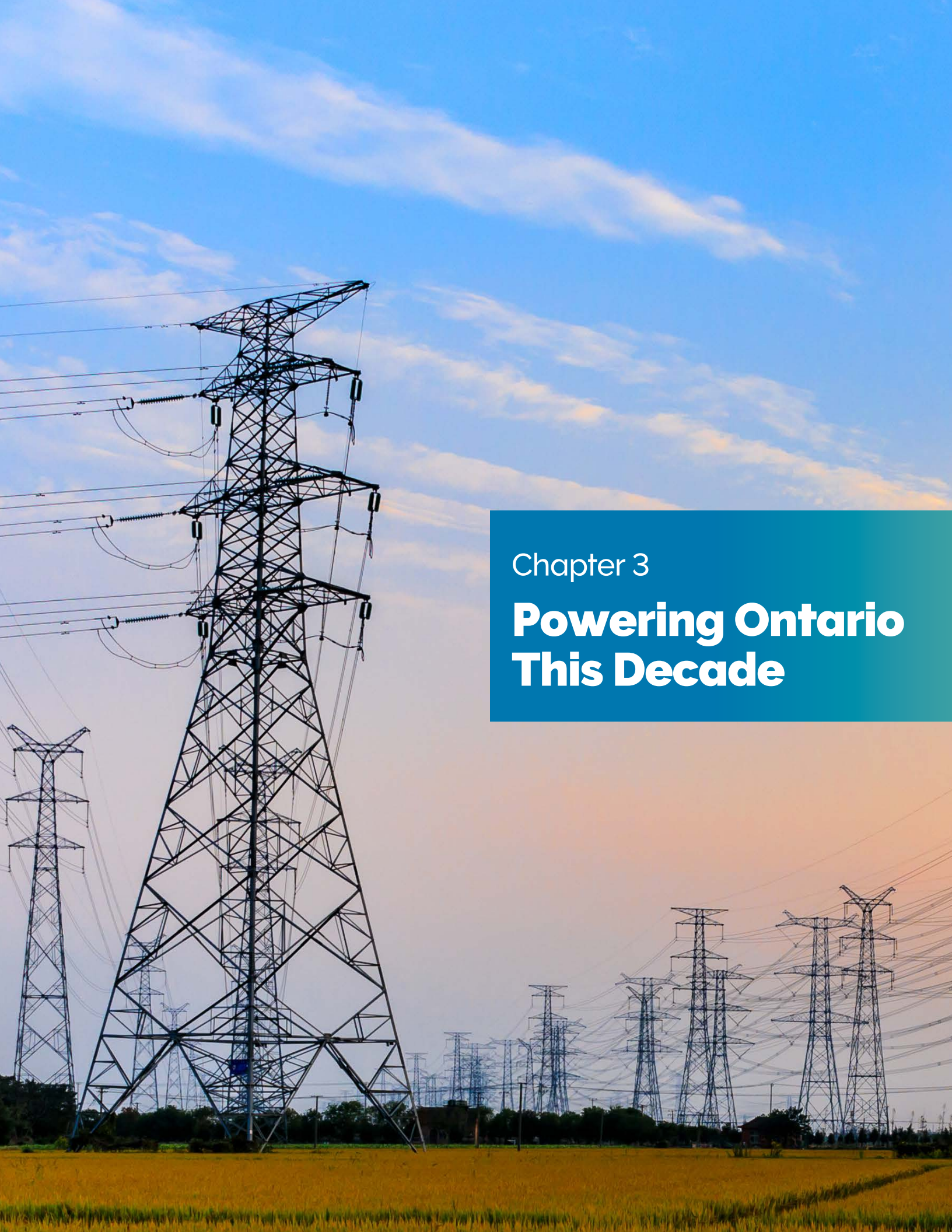
Electrification will have an impact in other areas, including the increasing use of heat pumps in hybrid home heating systems, supported by government programs to reduce cost and encourage adoption.

2.3 Population Growth

Ontario's population is expected to grow by almost 15 per cent or two million people by the end of this decade. Ontario is committed to build 1.5 million new homes to accommodate this growing population.

All of these homes will require reliable electricity, especially as households increase their consumption to heat and cool their homes and power their vehicles.





Chapter 3

Powering Ontario This Decade

Powering Ontario This Decade

3.0 Introduction

For the first time since 2005, demand for electricity in Ontario is rising. Economic development including historic investments in electric vehicles and battery manufacturing, together with population growth and electrification, are driving the demand for electricity.

Electricity demand in Windsor-Essex and Chatham-Kent alone are forecast to grow from roughly 500 MW of peak demand today to about 2,100 MW in 2035, almost the equivalent of adding a city the size of Ottawa to the grid.

The Ontario government is acting on many fronts to ensure that the province has the electricity it needs to power economic growth and meet increasing demand this decade. It is making major investments in refurbishing the province's nuclear fleet, building new transmission lines, and expanding energy efficiency programs.

The province is taking the lead in cutting-edge technologies including building Canada and the G7's first grid-scale SMR which will supply enough clean electricity to power 300,000 homes. Leadership in the SMR field is also providing Ontario with new export opportunities and helping the province become a key player in the race to produce cost-competitive green hydrogen.

Ontario is also moving forward with the procurement of clean energy storage and incremental natural gas generation, which will be required to meet peak demand as nuclear reactors are taken temporarily offline for refurbishment while demand for electricity continues to increase. Natural gas currently plays a pivotal role in supporting grid reliability – with the ability to respond to changing system needs in ways other forms of supply simply cannot.

This chapter provides details of the actions that the provincial government is taking on all fronts to ensure reliable electricity supply this decade.

3.1 Nuclear Energy

Nuclear Refurbishment

CANDU reactors require refurbishment after 30-40 years of operation. The Darlington Nuclear Generating Station and Bruce Nuclear Generating Station have now reached that point in their operating lives and refurbishments are underway. These are currently the largest clean energy projects in Ontario and these scheduled refurbishments have long been anticipated and planned for.

The Darlington refurbishment will secure 3,500 MW of clean, reliable, low-cost power until 2055. It is expected to contribute a total of \$90 billion to Ontario's GDP and increase employment across the province by an average of 14,200 jobs a year.

The Bruce refurbishment will secure at least 6,550 MW of clean, reliable, low-cost generation capacity over the long-term and enable Bruce Nuclear Generating Station operation to 2064. The refurbishment and long-term operation is expected to secure 22,000 direct and indirect jobs a year and generate \$4 billion in annual economic benefits in communities throughout the province.

Once completed, these powerful CANDU reactors will secure a clean energy supply for Ontario for decades to come, as well as a supply of life-saving medical isotopes.

Figure 3.1: Darlington and Bruce Refurbishment Schedule

YEAR:	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Darlington																			
Darlington G1																			
Darlington G2																			
Darlington G3																			
Darlington G4																			
BRUCE																			
Bruce G3																			
Bruce G4																			
Bruce G5																			
Bruce G6																			
Bruce G7																			
Bruce G8																			

The Darlington refurbishment program started in 2016 and is scheduled to end in 2026. The Bruce refurbishment started in 2020 and is scheduled to end in 2033. At peak, four nuclear units will be down at one time, representing about nine per cent of Ontario’s generating capacity, or about 3,400 megawatts. While these units are down electricity demand will be met by natural gas generation and by recently procured clean energy storage battery projects.

“As the world’s largest operating nuclear facility, Bruce Power is investing in securing our future through our Life-Extension Program that enables operation to 2064 and beyond, while innovating to produce even more clean energy from our existing reactors.”

- Mike Rencheck
 President and CEO, Bruce Power

Continued Safe Operations of Pickering Nuclear Generating Station

The provincial government is also supporting OPG's plan to continue the safe operation of the Pickering Nuclear Generating Station. Pickering A would operate until 2024, and Pickering B would operate through September 2026 to provide affordable, reliable, zero-emissions electricity.

Safety is always the top priority and OPG will continue to ensure the safe operation through rigorous monitoring, inspections and testing of the Pickering facility.

Operating Pickering through September 2026 will provide affordable and reliable electricity to power strong economic growth and electrification, lower emissions, support the continued production of life-saving medical isotopes and protect good jobs in Durham Region. It will reduce GHG emissions by 2.1 megatonnes in 2026 alone, the equivalent of taking 643,000 cars off the road and representing an approximate 20 per cent reduction in projected emissions from the electricity sector in that year.

In June 2023 OPG submitted their official application to the Canadian Nuclear Safety Commission (CNSC) to amend the power reactor operating license to operate Pickering B through September 2026. The final decision regarding the safe operating life of Pickering will be made by the CNSC following a comprehensive, transparent process.

Operating Pickering B beyond 2026 would require a refurbishment, similar to Darlington and Bruce. The Ontario government has asked OPG to update its feasibility assessment for refurbishing Pickering B units, which the province expects to receive later this year. Pickering A is expected to reach end of life in 2024 and cease operations.

"Pickering Nuclear Generating Station has never been stronger in terms of both safety and performance. Due to ongoing investments and the efforts of highly skilled and dedicated employees, Pickering can continue to safely and reliably produce the clean electricity Ontarians need."

- Ken Hartwick
President and CEO
Ontario Power Generation

Darlington Small Modular Reactor (SMR) Build

Ontario's CANDU reactors' unique ability to be refurbished after 30-40 years helped Canada's nuclear sector to continue to thrive. In turn, this has positioned Ontario as a leading jurisdiction in nuclear technology at a time when tackling climate change and the need for clean zero-emitting energy is an international priority.

The provincial government is building on this experience and moving forward with the first grid-scale SMR project in North America at the Darlington nuclear site to help meet the demand for reliable, affordable, and clean electricity, while at the same time showcasing Ontario's nuclear expertise to the world and leveraging it to create export opportunities to drive economic growth.

The new SMR at Darlington will be Ontario's first nuclear reactor build in a generation. This project alone will deliver 300 MW of electricity, which is enough to power 300,000 homes. OPG is partnering with GE Hitachi Nuclear Energy, SNC-Lavalin, and Aecon on the project, with construction scheduled to be complete by 2028. Its "modular" construction aims to help this design to be mass-produced and easily replicable, helping to further drive down production costs of clean energy and to cement Ontario's nuclear supply chain as the supplier of clean energy technology to the world.

The Darlington SMR project is situated on the traditional and treaty territories of the seven Williams Treaties First Nations and is also located within the traditional territory of the Huron Wendat peoples. OPG is actively engaging and consulting with potentially impacted Indigenous communities, including exploring economic opportunities in the Darlington SMR project such as commercial participation and employment.



The Canada Infrastructure Bank (CIB) has invested \$970 million in the project to date, its largest investment in any clean energy project. The investment marked major step forward in demonstrating the significant opportunities of SMRs, and the important role of nuclear power in meeting future demand for reliable, zero-emissions power.

Ontario's leadership in new nuclear technologies, particularly SMRs, is raising the province's international profile to an unprecedented level.

Last November, the Minister of Energy concluded a successful trade mission to Czech Republic, Poland, and Estonia to discuss SMRs, strengthen existing relationships and support European allies looking to build their energy independence in the face of Russian aggression and to help reduce their reliance on coal power. The mission resulted in signing agreements with major European energy companies ČEZ and Synthos Green Energy.

Other jurisdictions are following Ontario's lead. Earlier this year, Estonia's Fermi Energia chose GE Hitachi's SMR technology – the BWRX-300 – for deployment, citing the Darlington SMR project as a factor in their selection decision. Poland's Synthos Green Energy has also signed agreements with Ontario manufacturers to build components in Ontario for SMRs that will be deployed in Poland, as well as a letter of intent with OPG to provide nuclear expertise to Synthos in developing its SMR program.

3.2 Competitive Procurements for New Build Electricity Generation and Storage

In October 2022 the Minister of Energy directed the IESO to acquire 4,000 MW of new electricity generation and storage resources through competitive procurements to ensure the province has the electricity it needs this decade to support a growing population and economy. This procurement will target 2,500 MW of stand-alone energy storage resources and a maximum of 1,500 MW of natural gas generation.

Energy Storage

As Ontario becomes a leader in the batteries of the future by connecting resources and workers in northern Ontario with the manufacturing might of southern Ontario, the procurement of a targeted 2,500 MW of clean energy storage represents the largest battery procurement in Canada's history.

In the first round of the procurement which concluded in May 2023, the IESO has acquired seven new battery storage projects, representing 739 MW of new storage supply.

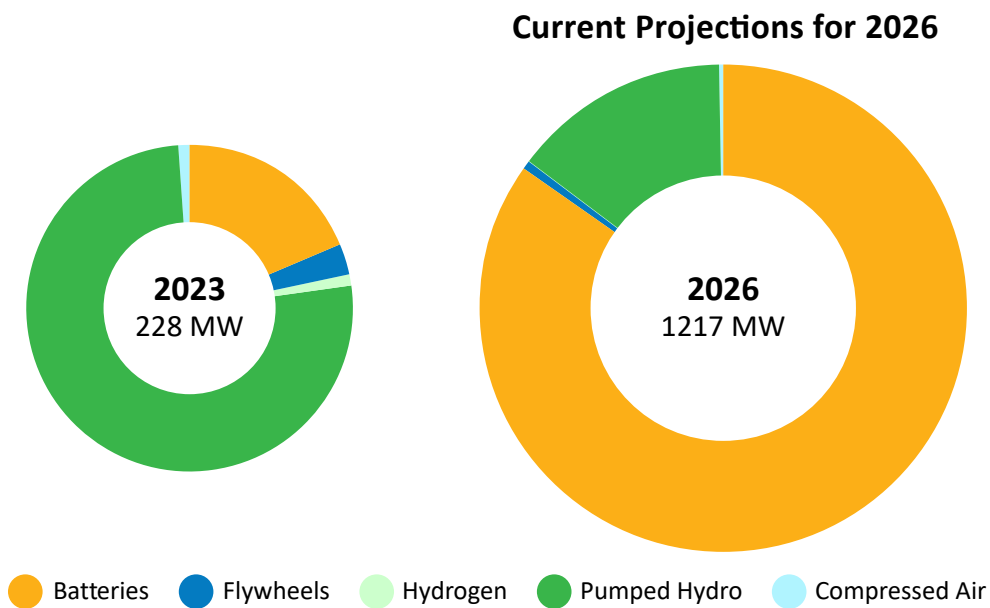
These facilities will support the operation of Ontario's clean electricity grid by drawing and storing electricity off-peak when power demand is low and intermittent renewable generation is high and returning the power to the system at times of higher electricity demand. The grid will benefit from using more non-emitting energy at peak. Grid-scale energy storage also offers the potential to provide critical flexibility to help keep the system in balance.

Most of these projects are in partnership with Indigenous communities, which have at least 50 per cent economic interest in five of the seven projects. These projects complement the recent agreement for the 250 MW Oneida Energy Storage Facility and conclude the first of two stages within the procurement.

These projects are scheduled to be operational in 2026, at which time Ontario will have Canada's three largest battery projects, located in Hagersville (285MW), Ohsweken (250MW), and Napanee (250MW).

The current procurement for 4,000 MW of new capacity will run through April 2024.

Figure 3.2: Growing Role of Storage in Ontario Electricity Markets



Oneida Energy Storage Project

In addition to the province's record setting clean energy storage procurement, the Governments of Ontario and Canada are working together to build the 250 MW Oneida Energy storage project, which will be the largest battery storage project in the country when it comes online in 2025. The facility is being developed in partnership with the Six Nations of the Grand River Development Corporation, Northland Power, NRSor and Aecon Group.

Ontario has directed the IESO to enter into a 20-year contract for the Oneida Energy storage project to support the growth of the province's clean energy supply.

The federal government is also providing \$50 million in funding through the Canada Infrastructure Bank, which has played a key role supporting project development and is collaborating with the Oneida Energy storage project on an investment agreement.

Operations will begin in 2025 and when fully charged the 250 MW facility will be capable of meeting the peak demand of a city the size of Oshawa.

"Energy Storage Canada applauds Ontario's Minister of Energy, Todd Smith, whose government has just committed to the largest storage specific procurement in Canada. The Ford government recognizes the critical role clean energy storage resources must play in ensuring reliability, resiliency and helping to reduce Greenhouse Gas (GHG) emissions in Ontario's electricity grid."

– Justin Rangooni
Executive Director, Energy Storage Canada



Natural Gas Generation

Natural gas generation currently plays a key role in supporting grid reliability, with the ability to respond to changing system needs in ways other forms of supply cannot.

When electricity demand spikes on hot summer days, Ontario's natural gas generators can be turned on and ramped up quickly to ensure the province does not need to be reliant on emergency actions such as conservation appeals and rotating blackouts to stabilize the grid, according to the IESO.

While during most hours throughout the year Ontario can meet its electricity generation needs with nuclear, hydroelectric, bioenergy, wind and solar power, natural gas generation also acts as the province's insurance policy that can be turned on if the wind is not blowing or sun is not shining, or another generator is offline for repairs (see figure 3.3). There is currently no like-for-like replacement for natural gas and the IESO has concluded it is needed to maintain system reliability until nuclear refurbishments are complete and new non-emitting technologies such as storage mature.

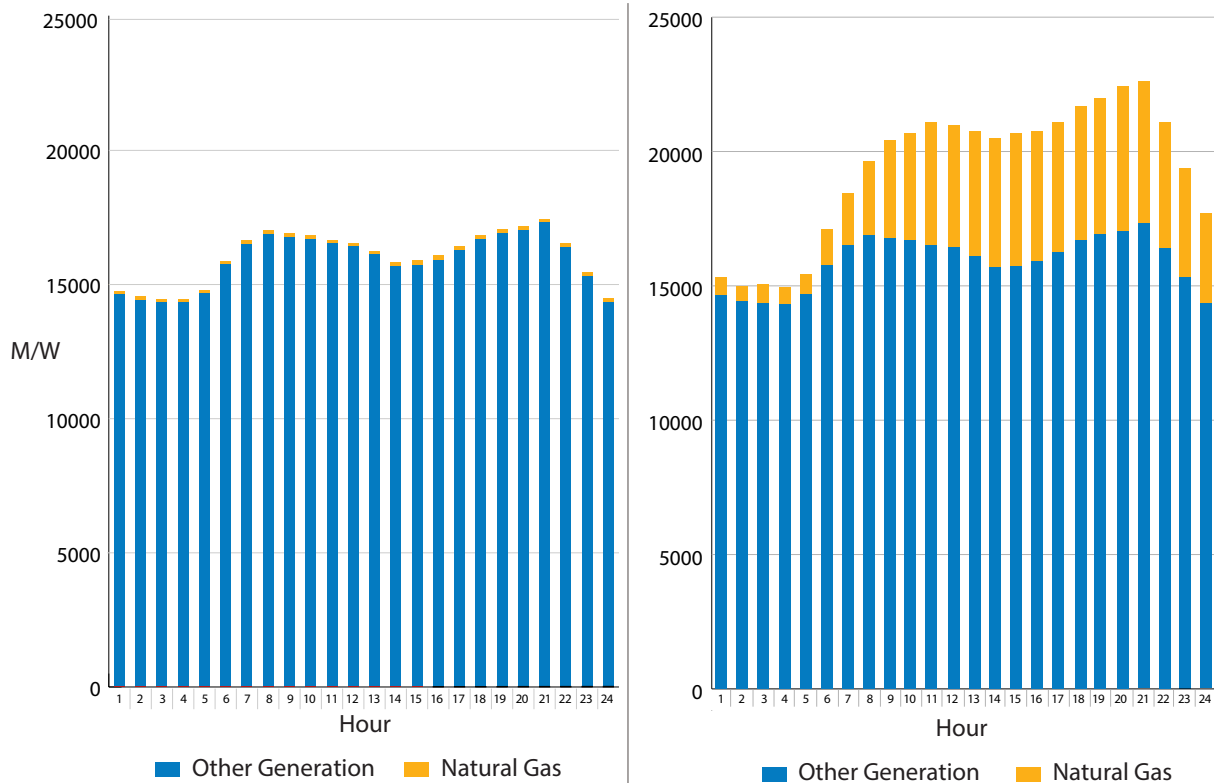
This means natural gas will be needed until reliable replacements (such as hydrogen) have been identified, put into service, and demonstrated their capability.

To meet this near-term need the IESO has secured 586 MW of new natural gas capacity from expansions and efficiency upgrades at existing sites through the first round of procurements.

"The government and the IESO are taking a prudent approach by procuring a diverse portfolio of non-emitting resources, with limited natural gas to ensure system reliability over the short-term."

– Rocco Rossi
President and CEO, Ontario Chamber of Commerce

Figure 3.3: Energy Supply Mix May 6, 2022 (16°C max) and July 19, 2022 (34°C max)



May 6 2022
 On a mild day in May, natural gas generation was only needed to meet small changes in demand.

July 19 2022
 On a hot summer day in July, natural gas generation was needed to meet increased demand from air conditioning. This backs up intermittent sources such as wind and solar, which output 35% and 50% of their installed capacity, respectively, at 5pm when demand was highest.

Natural Gas Generation Helps Meet Peak Demand on Hot Summer Days

In Ontario, nuclear power and hydro generally provide the continual baseload power needed to ensure system reliability and meet average daily demand. Additional power is required to meet peak electricity demand, such as when the weather is hot and air conditioners across the province are turned on. Wind and solar power provide what's called intermittent generation – they are available as weather conditions permit, and do not offer the reliability the system needs when additional power is required. As these charts demonstrate, natural gas provides this reliability on peak days.

3.3 Energy Efficiency Program Enhancements

Reducing electricity demand through energy efficiency programs, also known as Conservation and Demand Management (CDM), is an essential, cost-effective component of the province's strategy to meet the increased demand for electricity in this decade and beyond.

Electrification of our homes, businesses and transportation means we will consume more electricity than ever before. This increases the importance and value of maximizing energy efficiency, as it allows us to avoid building even more supply in the future.

The IESO's *Pathways to Decarbonization* report identifies acceleration of energy efficiency as a no-regret action to cost-effectively help meet growing demand. It assumes the highest potential from its energy efficiency programs.

In September 2022, the provincial government increased funding for energy-efficiency programs by \$342 million, bringing total funding to more than \$1 billion over the current 2021-2024 CDM framework period.

This additional funding is supporting four new and expanded programs to help families and businesses reduce their electricity use and save money on their energy bills while helping to meet the province's emerging electricity system needs by reducing demand at peak times. These are:

1. A new Peak Perks Program was launched in Spring 2023 for homes with existing central air conditioning and smart thermostats to help deliver peak demand reductions. Households that meet the eligibility criteria and voluntarily enroll in this program will be paid a \$75 incentive for giving their thermostat manufacturer secure access to their thermostat. This access will enable the manufacturer to reduce the participants' air conditioner by no more than three degrees for up to three hours on up to ten summer afternoons. This will help reduce provincial peak electricity demand, while also help the participants lower their monthly electricity bills and contribute to reducing the province's greenhouse gas emissions. Peak Perks has been designed to ensure participants are always in control and they can opt-out of any temperature change event, without impacting their incentive, by adjusting their thermostat. There are an estimated 600,000 smart thermostats installed across Ontario.
2. Targeted support for greenhouses in Southwest Ontario, including incentives to install LED lighting, non-lighting measures or behind-the-meter distributed energy resources (DER), such as combined solar generation and battery storage.
3. Enhancements to the Save On Energy Retrofit Program for business, municipalities, institutional and industrial consumers to include custom energy-efficiency projects. Examples of potential projects could include chiller and other HVAC upgrades for a local arena, building automation and air handling systems for a hospital, or building envelope upgrades for a local business, like new insulation or windows.

4. Enhancements to the Local Initiatives Program to reduce barriers to participation and to add flexibility for incentives for DER solutions. The Local Initiatives Program provides targeted programs for areas of the province with identified system needs. For example, in Etobicoke the CoolSaver program helps homeowners and tenants upgrade their home cooling systems by offering incentives for air conditioner tune-ups, central air conditioner replacements, portable dehumidifiers and smart thermostats.

These enhancements are expected to have a particular impact in Southwest Ontario, with regional peak demand savings of 225 MW helping to alleviate electricity system constraints in the region and foster economic development.

Ontario's energy efficiency programs will also reduce GHG emissions by an estimated three million tonnes of GHG emission reductions over the initiative's lifetime, the equivalent to taking approximately 900,000 vehicles off the road for one year.



Energy efficiency programs are delivered by the IESO through its Save On Energy brand and are available for income-eligible residents, small businesses, large businesses, and First Nations communities. They focus on cost-effectively meeting the needs of Ontario's electricity system through provincial peak demand reductions and targeted approaches to address regional and local electricity system needs.

"We applaud the government for moving to expand provincial conservation and demand management (CDM) programs, which are the most cost-effective way to meet both electricity system needs and emission reductions objectives."

– Vince Brescia
President and CEO, Ontario Energy Association

"Ontario's Greenhouse Vegetable Growers are on the technological cutting-edge of safe, sustainable and secure food production - here at home and around the world. Ontario's Save on Energy initiatives are critical tools that allow greenhouse farmers to be competitive and environmentally sustainable. This is a win-win-win for our sector, the provincial government and the people of Ontario."

– George Gilvesy
Chair, Ontario Greenhouse Vegetable Growers

Ontario's Next Energy Efficiency Framework

Energy efficiency and conservation programs have traditionally been under time-bound frameworks with fixed terms. For example, electricity energy efficiency programming under the current 2021-24 Conservation and Demand Management (CDM) Framework will end in 2024. A more efficient, long-term model is needed to recognize the role of energy efficiency as a non-emitting resource that better responds to evolving system, market, and customer needs.

In the summer of 2023, the Ministry of Energy is launching a public and stakeholder consultation, including targeted outreach to Indigenous communities in Ontario on the scoping of future energy efficiency and conservation frameworks. This will inform the Ministry's work on developing a proposed path forward for CDM programming for January 1, 2025 and beyond.

The consultation will build on the 2021-2024 CDM Framework Mid-Term Review, which was conducted in 2022 by the IESO and included two extensive stakeholder engagements. Topics will include the primary objectives of electricity energy efficiency programming, considerations for emission reductions, the definition of CDM including treatment of beneficial electrification and fuel switching measures and improving customer experience including the coordination of CDM with natural gas demand side management programs.

3.4 Re-Contracting Ontario's Small Hydroelectric Stations

Ontario's fleet of 107 small hydroelectric generating stations play an important role, both in generating electricity and providing benefits such as recreational opportunities, flood control, irrigation, tourism and supporting local employment and economic development. To secure these benefits and maximize the use of these existing generating sites, some of which are 100 plus years old, the Minister of Energy has asked the IESO to design a Small Hydro Program to recontract existing facilities whose current agreements are coming to an end.

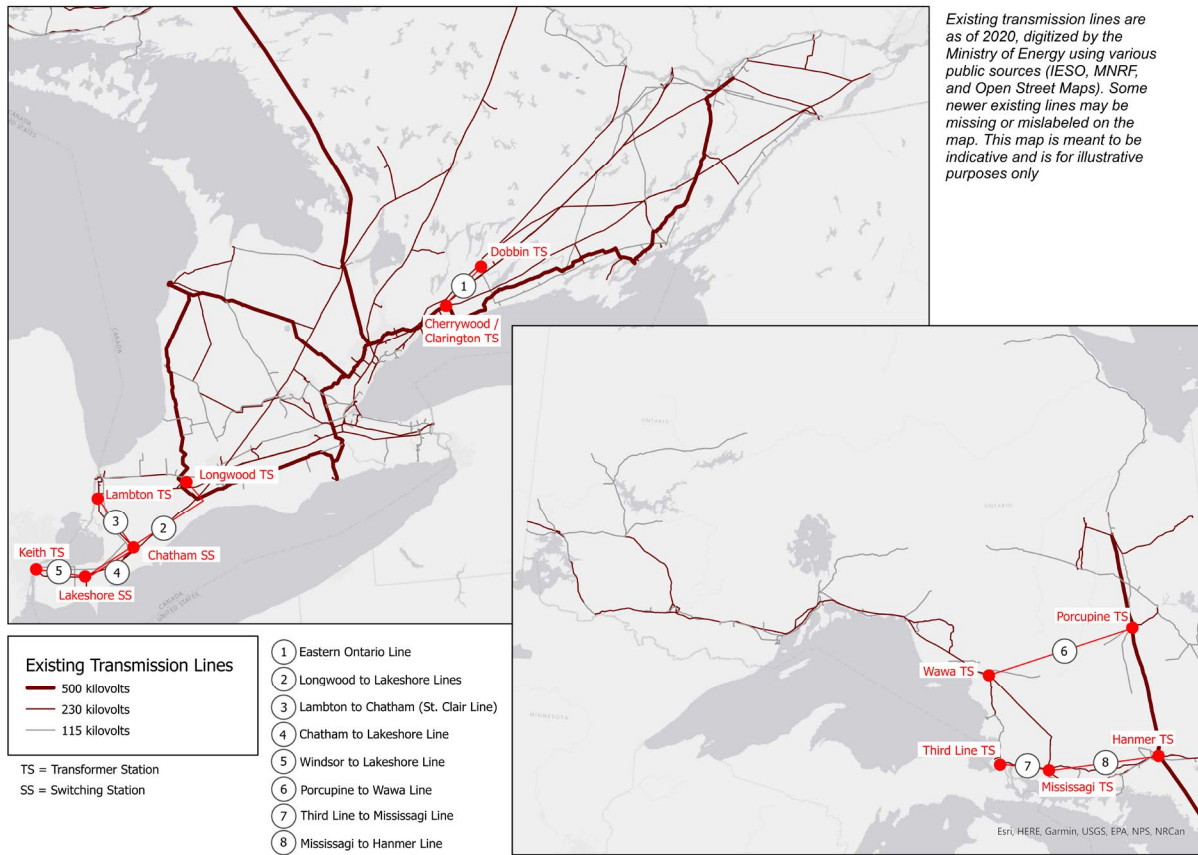
At the request of the province, OPG has several projects underway to modernize small hydro generating facilities to improve existing generating capacity, uncover additional efficiencies and in some cases, rehabilitate an entire site. Among the project now underway:

- Calabogie GS Redevelopment Project in Eastern Ontario will double hydro generation from 5 MW to approximately 11 MW.
- Smoky Falls Dam Safety Project that will rehabilitate the 100-year-old spillway and sluiceway structures along the Lower Mattagami River at OPG's Smoky Falls Generating Station in Northeastern Ontario.
- Little Long Dam Safety Project, which will increase the discharge capacity at the existing eight-gate Adam Creek spillway on the Little Long Reservoir in Northeastern Ontario.

The provincial government has also asked OPG to identify additional opportunities for hydroelectric power generation and engage with Indigenous communities to understand how Indigenous communities could participate in and benefit from future hydroelectric generation projects.

With over 100,000 kilometers of rivers and streams, Ontario has a significant potential for hydroelectric power generation, which can be developed by individuals, businesses, or communities. The viability of new projects is largely dependent on the cost to connect to the province's transmission grid.

3.5 Transmission Expansion



High voltage transmission lines act as a highway that carries electricity from where it is produced to local distribution companies that deliver electricity to power homes and businesses. Electricity demand in the Windsor-Essex and Chatham areas is forecast to grow from roughly 500 megawatts (MW) of peak demand today to about 2,100 MW in 2035, which is almost equivalent to adding a city the size of Ottawa to the grid. This demand is primarily driven by rapid growth in advanced manufacturing, greenhouse agriculture and electric vehicle battery manufacturing, an economic success story for the region.

New electricity transmission infrastructure is the most cost-effective way to meet this growing electricity demand and continue to drive economic growth in the region. Last year, Ontario acted to ensure the efficient and timely development of five new electricity transmission infrastructure projects in Southwest Ontario. These transmission lines include:

- Chatham to Lakeshore Line
- St. Clair Line running from Lambton to Lakeshore
- Two Longwood to Lakeshore Lines and
- Windsor to Lakeshore Line

The government has issued an Order-in-Council declaring three transmission line projects as provincial priorities, streamlining the OEB's regulatory approval process for these lines so projects can be brought online earlier. The transmission projects between London, Windsor and Sarnia represent an investment of more than \$1 billion and are proposed to be developed in phases through 2030. These transmission lines also present significant economic opportunities for Indigenous communities, through potential equity partnerships or other forms of participation.

Supporting Growth in Northeastern Ontario

Similar economic success stories are unfolding in other parts of Ontario, leading to the need for further transmission expansion. In the Northeast, electricity demand is forecast to grow rapidly over the next decade due to major industrial electrification initiatives, including Algoma Steel's planned conversion to electric steelmaking, as well as new mining opportunities. To meet these growing needs, the IESO has recommended three new transmission lines be in service by 2029 and 2030 in the Sault Ste. Marie and Timmins area, respectively.

Supporting Growth in Eastern Ontario and the Ottawa Region

Electrification and economic development in Eastern Ontario, especially Ottawa, are leading to growing electricity demands. To support continued growth, a new line is required between Peterborough and the Oshawa/Pickering area by 2029. This new line will address growing needs in these two regions, while also relieving constraints on existing lines to the Ottawa region.

To ensure these four new transmission lines are in service when they are needed, the Ministry will be launching consultations on a proposal to designate transmitters to start development work on these lines, and to declare these lines provincial priority projects. This includes targeted consultations with potentially impacted Indigenous communities. These proposed actions are the same actions that were taken to ensure that critical transmission infrastructure was built in a timely manner in the Southwest.

In parallel to these actions, the government is continuing its work with IESO to develop a formalized and competitive transmitter selection process for future lines. This process will replace Ontario's current approach to transmitter selection and provide a more timely, transparent, and predictable process for transmitters, stakeholders, and Indigenous partners. The IESO will announce new consultations on this framework in the coming months.

Indigenous leadership and participation will be critical for the successful development of linear infrastructure like transmission lines. There is a growing interest from Indigenous communities and organizations in building and operating transmission lines as a means of advancing and supporting reconciliation with Indigenous peoples. Involvement in major transmission projects can provide Indigenous communities with economic development opportunities, including jobs, partnerships, and long-term revenue streams. Partnerships are also valuable for project developers whose projects may benefit from working closely with communities whose Aboriginal and Treaty rights may be impacted by the development.

3.6 Ontario's Hydrogen Strategy

In 2022 Ontario released its forward looking Low-Carbon Hydrogen Strategy. This strategy identified significant potential for hydrogen to foster economic growth while lowering energy costs for families and businesses across the province through electricity storage and other applications that benefit Ontario's electricity grid.

This strategy is part of the provincial government's work to leverage Ontario's talent, infrastructure, and resources to become a leader in low-carbon hydrogen production and a global hub for innovation attracting high-paying jobs in science, technology, engineering, and the skilled trades, while also growing the provincial economy.

For example, surplus electricity is usually generated overnight by Ontario's wind energy fleet and nuclear and hydroelectric baseload facilities when demand is low and generation cleanest. The province can maximize this surplus electricity using it to produce low-carbon hydrogen and potentially storing it to generate clean electricity during times of system need.

In April 2022, the Minister of Energy announced that Ontario is advancing work to develop the Niagara Hydrogen Centre, led by Atura Power. This project would increase the amount of low-carbon hydrogen produced in Ontario by eight times by using excess water at Niagara Falls that would otherwise be sent over the falls to generate clean electricity for low-carbon hydrogen production. This low-carbon hydrogen could then be sold to fuel transportation or industry or injected into a natural gas generating station to lower its carbon intensity.

Ontario will continue to develop an economically sustainable low-carbon hydrogen sector and connect Ontario with global markets by working together with Ontario businesses and industrial partners across the province, the federal government, municipalities, Indigenous communities, academic institutions, and other key stakeholders.

Assuming its availability, the IESO has identified hydrogen as a cost-effective resource for reducing peak demand.

In one scenario, the IESO predicted that Ontario could have 15,000 MW of hydrogen generating capacity by 2050, delivering more than 15 per cent of the 88,000 MW of clean energy Ontario is expected to need by then.



"As a society we have a compelling reason to pivot away from fossil fuels and build a sustainable low carbon energy future. Hydrogen is at the heart of sustainability and its practical applications here in Ontario can reduce carbon emissions dramatically by 2030. But hydrogen projects at home can also accelerate the pace of further developing a thriving hydrogen industry in this province with both environmental and economic benefits - as we export clean hydrogen technologies to the world."

– Robert Stasko,
Executive Director, Hydrogen Business Council of Canada (HBC)

"Achieving net-zero emissions for all of Canada will require chemistry-based solutions. Ontario's low-carbon hydrogen strategy will help to create the conditions that attract new innovative investments to decarbonize production and create high value jobs throughout Ontario's chemistry industry. The Chemistry Industry Association of Canada and its members look forward to working with Ontario on this important initiative."

– Bob Masterson
President and CEO, Chemistry Industry Association of Canada

Ontario's Businesses Are Leading the Development of a New Hydrogen Economy

In 2019, Cummins acquired Mississauga-based Hydrogenics Corporation. Hydrogenics was one of the world's premier fuel cell and hydrogen production technologies providers, having provided the technology for the world's first hydrogen fuel cell train, the Coradia iLint, developed by French train manufacturer Alstom, and also Enbridge's Markham Hydrogen facility.

Atura Power has also selected Cummins to design and manufacture the 20 MW electrolyzer system for its Niagara Hydrogen Centre in Niagara Falls, Ontario.

Hydrogen Optimized, located in Owen Sound, Ontario, also develops and commercializes large-scale hydrogen production systems. Their RuggedCell water electrolyzer converts clean electricity into low-carbon hydrogen for industrial, chemical, utility and energy end users. The recent operation of a 50,000 ampere RuggedCell unipolar electrolyzer represents a breakthrough in large-scale hydrogen production technology and a direct pathway toward the commercialization of single electrolysis modules up to 100 MW.

These companies and other Ontario businesses are already leading the world and place Ontario at the forefront of clean energy technologies and development.

Hydrogen Innovation Fund

In February 2023, the Ontario government launched the Hydrogen Innovation Fund which will see \$15 million invested over the next three years to develop opportunities for hydrogen and hydrogen storage that will be integrated into Ontario's clean electricity system.

The investment marks another milestone in the implementation of the province's Low-Carbon Hydrogen Strategy, positioning Ontario as a clean manufacturing hub.



Chapter 4

Planning Ahead For 2030-2050

Planning Ahead For 2030-2050

4.0 Introduction

While the Ontario government is moving forward on many fronts to secure the electricity the province needs for the decade, additional action is needed to plan for and meet expected long-term demand between 2030 and 2050.

IESO forecasts that the need for electricity system capacity in Ontario could, under one potential scenario, more than double, from 42,000 MW today to 88,000 MW in 2050. Over this time, up to 20,000 MW in capacity may be needed just to replace generation that will come to the end of its life or be phased out.

While some forms of generation like natural gas generation or intermittent renewables can be built relatively quickly, large infrastructure which can provide baseload power such as hydroelectric, nuclear facilities, and the transmission to get it to population and economic centres, can take 10 to 15 years to build.

The Ontario government is acting now to develop new generation capacity including assessing site potential for the first large-scale nuclear build since 1993, expanding the province's SMR program, and advancing long-duration storage projects so that these facilities are ready when they are needed.

In keeping with its forward-thinking approach to energy planning, the Ontario government asked the IESO to deliver critical reports to inform next steps. These reports and input from Ontarians have formed the basis for the additional actions the Ontario government is taking to meet the province's needs in the longer term which are described in this chapter.

4.1 Pathways to Decarbonization

In October 2021, the Minister of Energy asked the IESO to develop a *Pathways to Decarbonization* report. Released in December 2022, the report recommends "no-regrets" actions that could be taken today to develop needed electricity resources with long-lead times.

1. Accelerating current efforts to acquire new non-emitting supply, including the implementation of recent conservation and demand management directives.
2. Beginning the planning, siting and environmental assessment work needed for new nuclear, long-duration storage and hydroelectric facilities, as well as transmission infrastructure, to allow for faster implementation.
3. Investing in emerging technologies like low-carbon fuels. Further work is needed to determine if they can replace at scale some of the flexibility that natural gas currently provides the system.
4. Galvanizing collaboration among stakeholders and Indigenous communities.
5. Ensuring that regulatory, approval and permitting processes are ready to manage future investment at scale.

6. Establishing an open, transparent, and traceable process to measure progress and demonstrate the results of decisions and actions taken along the way.

In February 2023, the government launched a 90-day public consultation on IESO's Pathways to Decarbonization report, focusing on IESO's immediate "no-regret" recommendations. The public consultation closed on May 14, 2023.

Through the public consultation the government received 271 submissions. Submissions received had a wide range of themes and topics, including support for nuclear expansion and northern hydroelectric development, expressing caution regarding ratepayer costs, as well as support for more Indigenous-led projects and participation.

The Ontario government is acting now to advance projects in line with these recommendations to ensure the province is prepared to support future economic development, investment, and job creation, all through a reliable, clean, and affordable electricity system.

4.2 Competitive Procurements and Contracting

As outlined in Chapter 3, Ontario is proceeding with its plan to procure 4,000 MW of new electricity supply. But once this competitive process is complete in 2024, there will still be a need for additional generation in the 2030s as Ontario's electricity demand is expected to grow at about two per cent each year.

To ensure the province can move quickly to procure those resources when required the government is directing the IESO to begin planning for an additional round of energy procurements. While previous procurements have focused on capacity to meet peak electricity demand, this procurement will focus on energy to fill newly procured storage resources and meet demand at any time, including non-emitting energy technologies such as wind, solar, hydroelectric, and biogas.

Ontario is committed to bringing other levels of government to the table and making them partners in meeting the province's growing energy needs to the benefit of ratepayers. Consistent with procurements currently underway, community support resolutions from municipal councils will be required for any new build electricity projects.

Early engagement and meaningful consultation with Indigenous leaders and communities will also be critical to successfully developing new energy supply opportunities. Indigenous participation and support for proposed energy projects will continue to be a key feature of future procurement initiatives in Ontario's energy sector.

The IESO will report back to the government with the intent of launching this next round of procurements in 2025/26.

4.3 Nuclear

Nuclear power, which accounts for more than half of Ontario's electricity supply, was critical in Ontario's efforts to phase-out coal power generation and remains critical in Ontario's path to electrification and meeting its clean energy goals. In addition to a proven safety record and ability to deliver a clean, reliable supply of the baseload electricity required by homes, business and industry, nuclear power has significant economic benefits.

Ontario's three nuclear plants at Bruce, Darlington and Pickering directly employ close to 12,000 highly skilled workers, generate billions of dollars in economic activity and attract new jobs and investment to the province. Overall, Ontario's nuclear industry is one of the largest industrial employers in the province, supporting around 65,000 jobs. The nuclear industry in Canada also contributes around \$17 billion per year to the national economy. New nuclear projects could also play a growing role in meeting peak demand. Batteries and other forms of energy storage charged with zero emissions electricity from these facilities could discharge energy when needed, eventually eliminating the need for natural gas generation.

According to the International Energy Agency's pathway to global net zero emissions by 2050, nuclear power globally will need to double between 2020 and 2050.

Pickering Refurbishment Feasibility

Operation of Pickering Nuclear Generating Station beyond 2026 would require refurbishment. In light of projected increases in electricity needs due to electrification and economic growth in the coming decades, in September 2022, Ontario asked OPG to update its feasibility assessment for Pickering B refurbishment.

If feasible, Pickering B refurbishment could secure more than 2,000 MW of reliable, emissions-free baseload power for at least another thirty years.

OPG is expected to complete its feasibility assessment and report on the results to the Ministry later this year.

Bruce Power Expansion

Ontario's Bruce Nuclear Generating Station (6,550MW) is the largest operating nuclear generating station in the world.

Today, the province is starting pre-development work to site the first large-scale nuclear build in Ontario since 1993 at its existing Bruce nuclear site. Bruce Power will conduct an Impact Assessment with the intent of locating up to 4,800 MW of new nuclear generation on the Bruce site. The Impact Assessment Agency of Canada (IAAC) will be responsible for leading the review and will undertake consultations with Indigenous communities and engagement with the public throughout the process.

Ontario and Bruce Power are also committed to continuing cooperation and engagement with both the Chippewas of Saugeen First Nation and Chippewas of Nawash First Nation when it comes to energy planning and potential projects.

The final cost and timeline to complete the review will be dependent on what steps the federal government takes to reduce duplication and streamline the Impact Assessment process for new nuclear power. The Ministry of Energy is working with the IESO and Bruce Power on a contractual approach to address the costs associated with this pre-development work that minimizes impact on ratepayers. The province will also review opportunities to reduce costs on ratepayers through the application of funds collected from the sale of clean energy credits through the Future Clean Electricity Fund.

Ontario is initiating this pre-development work early, in order to ensure that development could proceed in time to meet future demand. Completion of early consultations and the Impact Assessment will allow the province to move quickly on this project which is critical in any transition to a 100 per cent clean grid.



Federal Impact Assessment

New large-scale nuclear projects in Canada are subject to a federal Impact Assessment which imposes new regulatory requirements and replaces the experts at Canada's independent nuclear regulator, the Canadian Nuclear Safety Commission, with the IAAC as the oversight body for conducting environmental and other impact assessments on these nuclear projects.

Overall, a large-scale new nuclear reactor project is expected to require a lead-time of a decade or more from Impact Assessment commencement to deployment, depending on the time it takes to complete regulatory assessments and approvals as well as to undertake planning and preparation, procurements, construction, and commissioning of the reactor(s).

The Impact Assessment Act complicates this timeline with opportunities for the IAAC, or Federal Ministers to pause the process without firm timelines to provide a final decision.

Ontario knows that the federal government shares our understanding that there is no path to a clean economy without the zero-emitting, reliable and low-cost power that nuclear facilities provide. As we collectively strive towards emission reductions and electrification, both SMRs and large-scale nuclear projects require a more flexible and streamlined regulatory framework to ensure these projects can progress and clean energy generation does not face unnecessary barriers and uncertainty.

Ontario looks forward to continuing to work with the federal government as it develops a concrete plan to clarify and reduce timelines, minimize inefficiencies, and enhance engagement and partnerships on major project reviews.

Expanding Ontario's Small Modular Reactor Program

To meet growing electricity demand in the 2030s the provincial government is also advancing three additional SMRs at Darlington and is working with OPG to advance the planning and licensing for these units in addition to the one already underway.

Building four BWRX-300 SMRs at Darlington would provide a total of 1200 megawatts of electricity generation, providing enough electricity to power about 1.2 million homes. Moving to a "fleet approach" for SMRs in Ontario (i.e., building multiple units of the same technology) will also provide significant benefits for the province's SMR program. For example, it would reduce costs as common infrastructure such as the cooling water intake, transmission connection and control room can be shared across four units instead of one. The modular nature of SMR manufacturing is also expected to reduce the cost of each additional unit.

Ontario's robust nuclear supply chain is uniquely positioned to support SMR development and deployment in Ontario, Canada and globally . Building additional SMRs at Darlington would provide more opportunities for Ontario companies as suppliers of nuclear equipment, components, and services. It would provide a clear signal to these Ontario companies to make further investments to expand their operations to serve the growing SMR market, both domestically and abroad.

Subject to Ontario Government and Canadian Nuclear Safety Commission (CNSC) regulatory approvals on construction, the additional SMRs could come online between 2034 and 2036. This timing would allow Ontario Power Generation to apply learnings from the construction of the first unit to deliver cost savings on subsequent units.



4.4 Pumped Hydroelectric Energy Storage

Energy storage is unique among electricity types in that it can act as a form of both supply and demand, drawing energy from the grid during off-peak hours when demand is low and injecting that energy back into the grid when it is needed most. Ontario's current procurement has to date secured new battery energy storage capacity that can discharge energy for about four hours before needing to be recharged.

In contrast, pumped hydroelectric storage makes up the vast majority of energy storage capacity in the world and can store vast amounts of energy and discharge over longer periods. Pumped hydroelectric storage is essentially hydroelectric power that pumps water into a reservoir during low-demand, low-cost hours to be held until needed. During periods of peak demand, the water is released, flows through a turbine and produces electricity, helping to displace the need for natural gas and other forms of peaking generation.

OPG has operated Ontario's only pumped hydroelectric storage facility since 1957. This six-unit, 175-MW pump-generator is part of the Sir Adam Beck Complex in Niagara Region.

Over the past two years Ontario has reviewed multiple pumped hydroelectric energy storage proposals and consistent with the advice of the IESO is advancing the two most viable projects into the province's first Long-Duration Storage Project Assessment. The IESO will review these two projects to determine whether one or both projects should be built to help meet Ontario's project electricity demand.

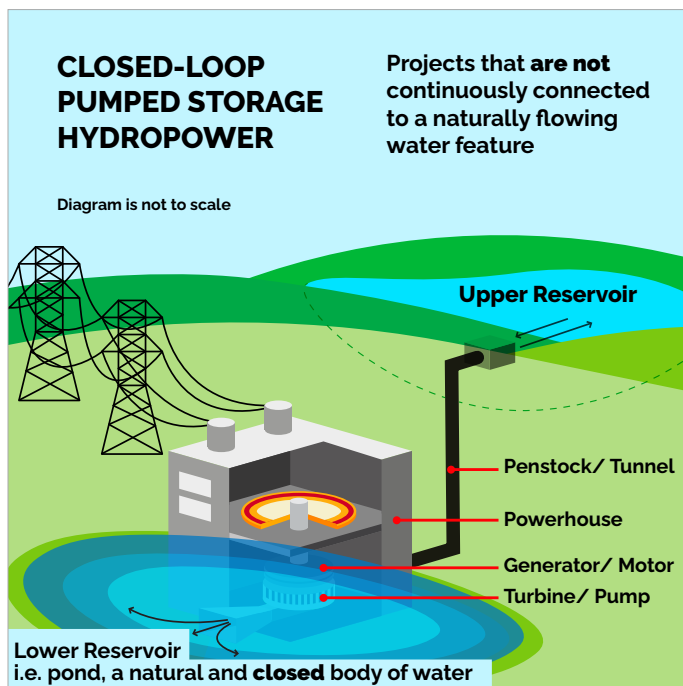
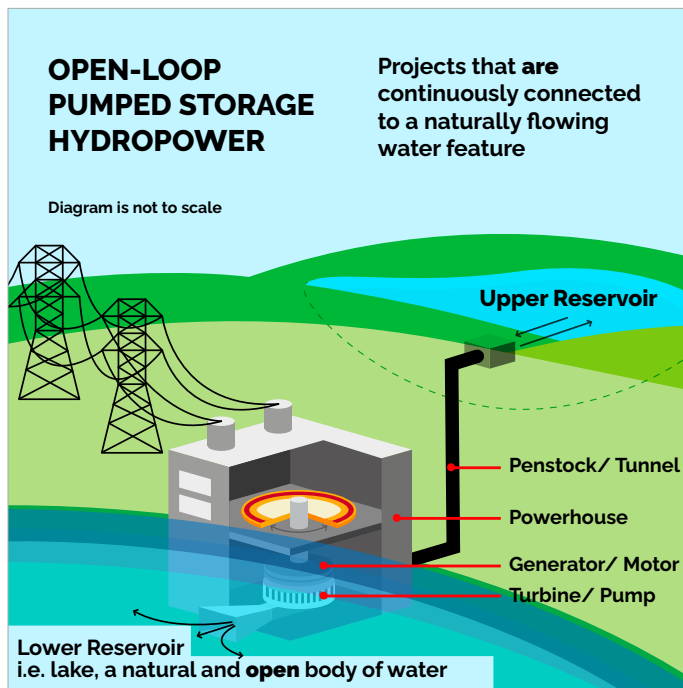
Ontario Pumped Storage Project

The Ontario Pumped Storage Project is a proposed 1,000 megawatt hydroelectric pumped storage project in the Municipality of Meaford. This open-loop project, proposed by TC Energy, would withdraw water from Georgian Bay, temporarily store it in a newly constructed reservoir, and later return the water to Georgian Bay to generate electricity.

Marmora Pumped Storage Project

The Marmora Hydroelectric Pumped Storage Project is a proposed 400 megawatt hydroelectric pumped storage project in the Municipality of Marmora and Lake. This eastern Ontario project is a partnership between OPG and Northland Power which would see Marmora's former open-pit iron mine become a part of Ontario's clean electricity grid.

The Marmora Project is proposing a closed-loop cycle design that recirculates the same water between the former open-pit mine and upper reservoir.



4.5 Distributed Energy Resources (DERs)

As Ontario's electricity system grows new technologies will also play a role in meeting increasing demand. Distributed energy resources (DERs), which can include rooftop solar systems, batteries, fuel cells, electric vehicles as well as responsive air conditioners and water heaters, are being deployed to meet customer needs and offer opportunities for innovation across the electricity system.

DERs are resources that generate energy, store energy, or control load and are directly connected to the distribution system or located behind a customer's meter. Innovation in DERs both through behind-the-meter and front-of-meter technologies can be used as cost-effective alternatives to conventional electricity infrastructure like pipes, poles, wires, and transformers. DERs can also provide valuable support to the IESO such as frequency regulation services.

Ontario has a well-developed DER sector comprised of hundreds of businesses that contribute to job creation and the broader provincial and global economies.

The IESO released its DER Potential Study on September 30, 2022, which shows estimated DER capacity in Ontario today of 10,000 MW. The study found that there is significant economic potential for DERs to meet Ontario's emerging needs over the next decade.

The provincial government is working with the IESO and the OEB on several initiatives to cost-effectively integrate DERs in a way that maximizes value to consumers, including the OEB's Framework for Energy Innovation and the IESO's DER Roadmap.

The Minister's 2022 letter of direction to the OEB called on the regulator to maintain momentum in this space by making use of stakeholder feedback to propose meaningful changes to how utilities can make use of DERs to cost-effectively meet emerging local and broader system needs, and how non-wires and non-pipeline alternatives are considered, given their significant potential to replace or defer the need for more costly traditional infrastructure.

At the same time, Ontario is moving forward with an initiative to ensure that Regulated Price Plan (RPP) net-metered customers, such as those with a rooftop solar system, have the same access to customer choice as those without. This includes the ability to choose between Ontario's three rate plans, tiered, time-of-use and ultra-low overnight rates. Net metering is a billing arrangement between a customer and their LDC, in which a customer can install renewable generation behind-the-meter to generate electricity for their own use and offset their electricity consumption from the grid.

The Minister of Energy also announced in April 2022, regulatory changes to permit third-party net metering to further enable DERs in Ontario. These regulatory changes open up the opportunity to participate in net metering to a significantly broader pool of commercial, industrial and residential electricity customers, who may not be in a position to own or operate their own behind-the-meter renewable energy generating equipment, like solar panels. Eligible third-party ownership arrangements now include leasing, renting and financing options with energy service providers as well as power purchase agreements with a licensed third-party generator, making roof-top solar and other DERs accessible to more Ontarians looking to better manage their energy costs.

The Ministry of Energy is also exploring further changes to the net metering framework that could drive further customer and system value such as virtual net metering.

Opportunities for using EVs as DERs and the impact on EV uptake is also being explored. In November 2021, the Minister announced that Ontario is piloting bi-directional charging pilots with EVs that test using EVs to provide backup power to a home during an outage or to act as a home power plant providing off-peak electricity stored in its battery to offset the need for the home to buy on-peak electricity, lowering the cost of the home's electricity bill.

EV Everywhere: Supporting the Integration of EV's into Ontario's Grid

The IESO forecasts that the adoption of EVs will increase electricity demand from the transportation sector by 17 per cent each year.

To prepare for increased adoption of EVs the province, through the IESO and the OEB, is supporting the EV Everywhere pilot project developed by BluWave-ai and Hydro Ottawa. EV Everywhere is using artificial intelligence (AI) shift EV charging to off-peak periods, saving customers money while extending the life of electricity infrastructure.

This project is also exploring how EV's can act as DER's by exploring customer interest in an online service for EV owners that will pool the storage capabilities of EV batteries to support the provincial grid.



4.6 Transmission

Ontario's electricity transmission system is over 30,000km long. Through it the province moves vast amounts of electricity from hydroelectric, wind, solar, nuclear, and natural gas generators over long distances to the Local Distribution Companies (LDCs) that power Ontario homes and businesses.

Transmission is critical to connecting our vast province and providing reliable, affordable clean electricity to every family and business and the future expansion of the transmission system is key to enhancing Ontario's clean energy advantage, enabling industrial electrification and growth, and supporting electric vehicle adoption. Early planning for future transmission development is important to ensure that energy is where it is needed at the lowest possible cost and to unlock all regions of our province to future economic growth and clean energy development.

Today, the Ontario government is working with the IESO to address existing transmission bottlenecks by identifying transmission projects that should proceed with early planning and development work, including identifying new and existing land corridors that should be protected for future transmission needs.

Unlocking Opportunities in Northern Ontario

Ontario's electricity system is currently undergoing upgrades to support a free flow of electricity from east to west, including the recently completed East West Tie (between Thunder Bay and Wawa) and the Waasigan Transmission Line Project (between Dryden and Thunder Bay). However, electricity flow between Northern and Southern Ontario is limited by existing transmission capacity. This restricts opportunities for economic growth, including investments in new electricity generation projects that would create jobs in both Northern and Southern Ontario.

To address this bottleneck the IESO will identify and report back to the Minister with options for new transmission between Toronto and Sudbury unlocking new opportunities for growth.

Powering Growth in the City of Toronto

Electrification, new housing, office towers, and job creators in the City of Toronto, and specifically in downtown Toronto, are also driving significant electricity growth.

While growth to date has been met by existing transmission lines, energy efficiency programs and strategically located generation assets, including Portlands Energy Centre (a natural gas generation station), future demand growth and a shift away from natural gas electricity generation would require new transmission to the downtown core.

To address this bottleneck, the IESO will also identify and report back to the Minister with options for future transmission lines in the Greater Toronto Area, recognizing the needs of the growing downtown core.

Work to site new transmission lines would be informed by consultations conducted by the IESO and could include a range of options including utilizing existing corridors, as well as underwater or buried cables.

4.7 Optimizing Ontario's Hydroelectric Fleet

Ontario built its electricity system from the power of hydroelectric generation in the 1920s and today it continues to provide a roughly a third of Ontario's total energy capacity and accounted for about 25 per cent of Ontario's electricity generation in 2022.

Some hydroelectric generating sites, like Niagara Falls' Sir Adam Beck facility, have served Ontario for more than a century and the province's commitment to the maintenance and upgrading of these facilities ensure that they will serve the province for the century ahead.

Last year, the Minister of Energy directed OPG to report back with options for future hydroelectric power development in the province and now has asked OPG to further that plan by proposing options to optimize electricity generation from existing sites as well as engaging with Indigenous communities to understand how Indigenous communities could participate in and benefit from future hydroelectric generation projects.

The viability of new projects is largely dependent on the cost to connect to the province's transmission grid.



4.8 Measures to Reduce Future Energy System Costs

Prior to 2018, high energy costs were chasing jobs and investments out of the province. Between 2004 and 2016 the previous government signed more than 33,000 contracts that paid up to ten times the going rate for power, significantly increasing electricity costs in the province in the process. They also stopped planning on critical infrastructure projects, including the refurbishment of Pickering Nuclear Generating Station and the Darlington SMR program, leaving the province with limited options, mainly batteries and natural gas, which could meet the province's reliability needs. Through Powering Ontario's Growth the government is advancing the planning necessary to develop new options to deliver reliable and clean electricity across the province, while keeping energy costs down.

Direct Energy Bill Support

From the implementation of the Comprehensive Electricity Plan which shifts the costs of over-market electricity contracts signed by the previous government off ratepayers' bills; to several low-income, rural and distribution support programs; to the Ontario Electricity Rebate that directly reduces all residential and small business' bills by 11.7 per cent; the government is committed to affordable and predictable electricity costs for all Ontarians.

In 2022, the IESO released its Gas Phase-Out Impact Assessment which stated that it was not cost-effective to rush the phase-out of natural gas and would harm Ontario's broader economy emission reduction efforts. The assessment stated that to phase-out the remaining approximately 10 per cent of natural gas fired generation by 2030 would require electricity bills to increase \$100 per month and would result in brownouts and blackouts.

The government is committed to grid reliability, and this option is unacceptable for several reasons, including that Ontarians cannot afford drastic rate increases and businesses cannot afford brownouts or blackouts. Affordability is key for individuals and businesses making the decision to electrify, and without affordable electricity the province will not see investments in green steel and EV and battery manufacturing.

Further details on direct energy bill supports can be found in Chapter 1.



Providing Customers with Tools and Choice

The government is also committed to providing customers with the tools they want and need to further reduce their energy costs, including through customer choice.

The first step to understanding how to lower your electricity bill, whether a home or business energy consumer, is understanding where, when and how you consume electricity. It is for this reason that the government rolled out the Green Button Standard.

Green Button allows energy consumers – residential, commercial, or industrial, to track their energy use (natural gas and electric) in real-time on their smartphone to understand where and how they are consuming energy and then Green Button application can provide advice on how to use less energy to help lower your bills, such as customized energy efficiency retrofit options or switching electricity price plans to achieve long-lasting savings. Studies have found that easy access to energy data, through Green Button, along with smart home devices, can help consumers make informed decisions and achieve energy savings of up to 18 percent. In 2021, the Minister of Energy passed a regulation that requires all electricity and natural gas utilities to provide their customers with Green Button no later than November 1, 2023. Ontario is the first province in Canada to mandate access to Green Button for energy consumers.



Reducing energy use through energy efficiency programs, whether electricity or natural gas, is an essential, cost-effective component of the province's strategy to provide long-term cost savings for consumers. In September 2022, the provincial government increased funding for energy-efficiency electricity programs by \$342 million, bringing total funding to more than \$1 billion over the current 2021-2024 energy-efficiency electricity framework period. These new and expanded programs help families and businesses reduce their electricity use and save money on their energy bills. Some programs include the Peak Perks program, Save On Energy Retrofit Program and Local Initiatives Program. Further details on electricity energy-efficiency programs can be found in Chapter 3.

In 2023, the Ontario Energy Board approved Enbridge Gas' 2023-2025 natural gas conservation plan. In 2023, this plan provides \$167 million in 2023 to help homeowners and businesses upgrade appliances, improve building envelope and insulation among other measures to provide long-term natural gas savings to customers. Further details on natural gas conservation programs can be found in Chapter 1.

The province has also provided other options for customers to reduce their electricity bills, such as providing new residential rate options like ultra-low overnight and tiered, alongside time-of-use, allowing customers to choose the rate that fits with their lifestyle and provide the most affordable cost of electricity. Further details on electricity rate options can be found in Chapter 1.

Lastly, the government has also permitted Third-Party Net Metering, the first province in Canada to do so. This new regulation makes it easier for homeowners and businesses to partner with companies to install roof-top solar systems. This is especially helpful for those who may not be in the position to fully-purchase or operate the equipment on their own. Roof-top solar systems can help customers generate some of their own electricity, often at times of the day when electricity is most costly, and in turn can help lower their electricity bill.

Government Making Better Energy Decisions

In 2018, the Government committed to move towards competitive procurement processes, where possible. The government believes through starting competitive procurements in Ontario to procure electricity generation assets, it can ensure that electricity is affordable today and tomorrow.

The government has since launched Ontario's first two competitive procurements, a Mid-term RFP and an Expedited Long-Term RFP, with a third expected later this year. This competitive process has already borne fruit. Last fall, the government announced that through the IESO, the mid-term RFP has re-contracted more than 760 megawatts of existing resources at a 30 per cent savings when compared to the previous government's contracts. This is a significant decrease which in turn will result in lower electricity system costs and lower costs for ratepayers.

Collaborating with the Government of Canada

The government of Canada has introduced three programs which directly can help Ontario reduce the costs of new electricity generation and protect ratepayers. To date, the Smart Renewables and Electrification Pathways Program has provided one grid-scale energy project grant funding and the Canada Infrastructure Bank has provided preferential financing to three grid-scale energy projects. Ontario hopes to work with Ottawa to ensure it receives its fair share of funding through both initiatives. Lastly, the introduction of the Federal Government's Clean Technology and Clean Electricity Investment Tax Credits should both help to lower the overall cost of new generating assets in Ontario for the next decade and help to address the competitive challenges posed by the *U.S. Inflation Reduction Act*.

Future Clean Electricity Fund

In March 2023, the Minister of Energy announced the launch of Ontario's Clean Energy Credit Registry and the Future Clean Electricity Fund. Proceeds from the sale of Clean Energy Credits held by the IESO and OPG will be directed to the government's Future Clean Electricity Fund. This new fund will help keep costs down for electricity ratepayers by supporting the development of new clean energy projects as the province builds out our grid to meet the demands of a growing population and economy, as well as the electrification of transportation and industry.

The Future Clean Electricity Fund will help to preserve and grow the province's clean energy advantage and offset future costs to electricity ratepayers. Ontario families have done the heavy lifting and built one of the cleanest electricity grids in the world, and now we can leverage that clean supply to reduce the cost of new clean generation through our Future Clean Electricity Fund.

Premier Ford meets with workers at Algoma Steel





Chapter 5

Integrated Energy Planning

Integrated Energy Planning

5.0 Introduction

Building the clean energy infrastructure necessary to power Ontario's future is a complex undertaking that requires the highest level of strategic energy planning and coordination.

Unlike previous governments, which viewed energy systems in isolation (refined petroleum products, natural gas, and electricity), the Ontario government is leading Canada in implementing an integrated energy planning process to ensure it is making the most cost-effective decisions necessary to prepare for a clean energy future.

This chapter describes the early planning process that began in 2021 with stakeholder and public consultation. The findings from that work have guided the government in creating the Electrification and Energy Transition Panel and commissioning the independent *Cost-effective Energy Pathways Study* as well as other initiatives that will inform planning, including at the IESO and OEB.

Building on the initiatives described in previous chapters, the next phase of the government's work will ensure that Ontario has the energy planning tools it requires to navigate the energy transition in a way that maximizes economic opportunities and the beneficial contribution of all parts of the energy system.

Roadmap to an Integrated Energy Strategy

The government began a review of the province's approach to long-term energy planning in 2021 to promote transparency, accountability, and effectiveness of energy planning decision-making, increase investment certainty, and ensure the interests of ratepayers are protected.

This review identified:

- The need for clear, high-level government policy direction;
- The importance of integrated, coordinated planning across energy sectors;
- A focus on independent, agency-led planning;
- The importance of independent planning oversight, with an emphasis on the role of the OEB as independent regulator; and
- The need for enhanced stakeholder and public participation.

As a result of this process, the government has taken steps to develop an integrated approach to meet Ontario's future energy needs. This has included:

- Bringing together the necessary technical advice to make informed decisions that are right for Ontario, including commissioning reports such as the *Gas Phase-Out Impact Assessment* and *Pathways to Decarbonization* by the IESO;

- Establishing the Electrification and Energy Transition Panel (EETP) and commissioning an independent *Cost-Effective Energy Pathways Study*;
- Directing the OEB to consult and report back on options to modernize Ontario's regulatory framework to support the energy transition in a cost-effective manner; implement clear guidance to LDCs to enable them to upgrade their distribution systems in preparation for electric vehicle and increased DER adoption; and to report back on distribution sector resiliency, responsiveness, and cost efficiency; and,
- Ensuring ongoing proactive planning by the IESO with support from sector entities and stakeholders.

These actions are the foundational steps the government is taking as it prepares to develop an integrated energy strategy based on additional consultation and input from the energy sector, Indigenous and local communities, and the public.

5.1 Electrification and Energy Transition Panel

Electrification and the energy transition are intensifying, driven by significant growth in electric vehicles and by corporate environmental and sustainability decisions. Electricity generation resources and transmission can take five to 15 years to develop, so early planning is increasingly critical as electricity demand growth accelerates. For these reasons, in April 2022, the Minister of Energy announced the creation of the Electrification and Energy Transition Panel (EETP) to help the government prepare Ontario's economy for electrification and the energy transition and take the necessary steps now to ensure we have the energy infrastructure to support the growing demand for clean energy.

While long-term electricity planning is important, fuel-switching will also play a key role in Ontario's evolving clean energy mix. Understanding where this is likely to occur, through integrated energy planning, Ontario will be empowered to make smart decisions that will further support lowering energy bills and create a more predictable and competitive investment environment.

The EETP will identify strategic opportunities and recommend necessary planning reforms to support emerging electricity and fuels planning needs in the context of the broader transition to a clean energy economy.

Comprised of chair David Collie and members Professor Monica Gattinger (University of Ottawa) and Chief Emerita Emily Whetung-MacInnes, former Chief of Curve Lake First Nation, the panel will advise the government on high-value short, medium and long-term opportunities in the energy sector. This includes opportunities to:

- Enable investment and job creation in Ontario by keeping energy rates low;
- Create a more predictable and competitive investment environment;
- Build on the government's work to meet energy needs and ensure a reliable, affordable and clean electricity supply; and
- Strengthen Ontario's long-term energy planning process by better coordinating the fuels and the electricity sectors.

"Growing Ontario's economy will require growing our supply of clean energy. The Board is glad to see the Electrification and Energy Transition Panel moving forward with a strong mandate and expert members to inform a cost effective, competitive transition. This builds on the government's timely action to invest in energy storage, build Canada's first grid-scale SMR, and grow our hydrogen industry."

- Jan De Silva
President & CEO, Toronto Region Board of Trade

Energy Transition and Electrification Panel Themes

The EETP is exploring five key themes to inform discussions with stakeholders, Indigenous communities, and the public and guide recommendations in its final report:

- 1. Energy Planning:** Improving long-term, integrated energy planning between the electricity and fuels sectors, exploring topics such as roles and responsibilities for the province and energy agencies and options to optimize energy demand and decarbonize future energy supply systems.
- 2. Governance and Accountability:** Improving energy sector governance such as potential changes to agency mandates or regulatory frameworks and new performance metrics for the province and energy agencies for a successful transition.
- 3. Technologies:** Improving regulatory and other frameworks and addressing barriers to core energy technologies and fuel types in energy and other sectors such as buildings, housing, transportation, industry and agriculture. Reducing barriers to low-carbon fuels, distributed energy resources and hybrid-heating solutions will be explored.
- 4. Community and Customer Perspectives, Affordability and Energy Sector Objectives:** Balancing energy system costs, energy reliability and climate objectives while considering the rights of Indigenous communities, and the public interest. How citizen and customer choice and perspectives should be considered through the energy transition will be explored.
- 5. Facilitating Economic Growth:** Identifying opportunities to advance economic development as it relates to the energy sector and the transition. Opportunities to improve Ontario's participation in green global supply chains and foster cross-sector collaboration in energy-intensive sectors, such as mining, steel and automotive sectors, while maintaining a cost-effective and low carbon electricity supply will be explored.

Cost-effective Energy Pathways Study

To support the work of the EETP and provide key inputs into long-term energy planning, the provincial government has commissioned an independent Cost-effective Energy Pathways Study to understand how Ontario's energy sector can support electrification and the energy transition.

This study will take an integrated, multi-fuel approach to optimize technological options to prepare the energy system for electrification and the energy transition.

The Panel, the *Pathways to Decarbonization* report, the *Cost-effective Energy Pathways Study* and other research together with ongoing consultation with stakeholders and the public will help the government make strategic decisions for the future of Ontario's energy system.

5.2 Low-Carbon Fuels

While much of the public focus has centred around electrification and meeting the province's electricity needs, exciting and innovative advances in low-carbon fuels continue to provide sustainable options that in some cases may provide a more cost-effective pathway to reduce emissions in the province's broader energy sector:

- Renewable Natural Gas (RNG) - is a pipeline-quality gas that is the product of the decomposition of organic matter that after processing is fully interchangeable with conventional natural gas. RNG is commonly collected from waste facilities, sewage treatment plants and green bin programs. Further details can be found in Chapter 1.
- Synthetic Natural Gas (SNG) - is a pipeline-quality gas that is produced through the Sabatier process in which methane and water are produced from a reaction of hydrogen and carbon dioxide. If low-carbon hydrogen is used, SNG can reduce the carbon intensity of the natural gas system.
- Ethanol - is a renewable fuel made from various plant materials (often corn). Gasoline in Ontario is blended at varying percentages to reduce the carbon intensity of the fuel and reduce air pollution.
- Renewable Diesel - is a fuel made from fats and oils, such as soybean oil or canola oil, and is processed to be chemically the same as petroleum diesel. Renewable diesel can be blended with petroleum diesel or can completely replace it to reduce the carbon intensity of the fuel.
- Biodiesel - is similar to renewable diesel but not chemically the same as diesel. It is made from vegetable oils, animal fats and recyclable restaurant grease and can be blended with petroleum diesel in limited quantities.
- Hydrogen - Depending on how it is produced, hydrogen has the potential to be a low-carbon fuel and can be blended with natural gas in limited quantities to lower the carbon intensity of the fuel.

5.3 Distribution System Innovation

Until recently, Ontario's electricity grid has been constructed to provide one-way flows of electricity generated at large power plants and transmitted lengthy distances to places where electricity is consumed. While large generators like nuclear and hydroelectric facilities at the bulk system level will continue to play an essential role serving as Ontario's electricity system backbone, the emergence of new tools, including DERs, at the local level is transforming the way families, businesses, and communities meet their energy needs. While DERs can increase the complexity of distribution planning, they also promise a broad range of benefits to consumers – from greater customer choice, improved system resilience and flexibility, to cost avoidance and large capital deferrals. Recognizing the important role these innovative technologies and business models will play in a clean energy future, in 2020, the Ontario government made “facilitation of innovation in the electricity sector” a new guiding objective for the OEB. OEB's 2022 System-Wide Electricity Supply Mix data indicates that roughly five per cent of Ontario's total annual generation comes from embedded DERs that send electricity to the grid and are quantifiable by LDCs and the IESO. Taking into consideration other demand side tools like EVs, smart thermostats and behind the meter (BTM) battery energy storage systems (BESS), IESO's DER Potential Study indicates that Ontario has an estimated DER capacity of 10,000 MW.

As more and more customers adopt BTM technologies (e.g., rooftop solar; BESS) to save money and take control of their electricity bills, much of this innovation will happen at the local distribution level. This requires Ontario's 59 Local Distribution Companies to modernize operations to keep pace with and enable customer connections and enable customer choice.

The government recognizes Ontario's regulatory framework can present barriers to testing innovative pilot or demonstration projects that show clear potential to support cost reduction or decarbonization objectives. To address this issue, the government made amendments to the *Ontario Energy Board Act, 1998* that allow the OEB to exempt proponents that wish to undertake innovative projects from various licence requirements on a time-limited basis. The government is considering additional steps to empower the OEB to issue exemptions from additional legislated or regulated requirements for innovators.

These changes will facilitate innovative pilot or demonstration projects that have the potential to benefit customers, the energy sector and the broader economy and support the transition to a more sustainable and renewable energy future.

Additionally, as customers seek new ways to participate in the energy transition, their relationship with LDCs is also changing, resulting in increasing expectations for LDCs to play a greater role connecting and integrating customer side solutions in new, varied, and concurrent opportunities, both safely and efficiently. Recognizing the grid must be there for customers when they need to “plug-in”, the government will consider conceptual models that will facilitate customer participation and reduce system costs.

For instance, a distribution system operator (DSO) model – responsible for coordinating DERs at the distribution system level - could operate a local market, akin to what the IESO operates at the bulk level today, providing local distribution services. These services, such as capacity, increased power quality, and non-wire alternative services, could result in increased reliability and lower costs for customers. A DSO could also facilitate electricity trading among homes and businesses.

Allocating the roles and responsibilities for DERs in the future should aim to maximize benefits for consumers. To this end, both the IESO and the OEB will continue to work with LDCs to explore these and other opportunities to innovate and meet the needs of customers – safely, affordably, and reliably – along with the clean energy objectives of the province.

"Long-term energy planning gives businesses the predictability they need to invest and grow with confidence in Ontario. An integrated approach recognizes that clean electricity and low-carbon fuels will both contribute to a reliable, sustainable, and affordable energy system in the province. Ontario's Electrification and Energy Transition Panel is an important step towards a competitive energy transition."

- Rocco Rossi
President and CEO of the Ontario Chamber of Commerce (OCC)



5.4 Strengthening Ontario's Resiliency to Extreme Weather

In recent years Ontario has experienced an increase in extreme weather events. More significant climate shifts are predicted in the coming decades, which will increase the frequency of heat waves, heavy precipitation and flooding, ice and windstorms, wildfires, and similar events.

Disruptions to the energy sector caused by extreme weather create significant financial and safety risks for Ontarians — Electricity in particular, as most of the infrastructure is above ground is at risk in severe weather events.

The Ontario government is acting to protect the province's electricity grid from the impact of extreme weather as demand continues to grow due to electrification, economic growth, and the increasing reliance by families on electricity for transportation and home heating.

In October 2022, the Minister of Energy directed the OEB to launch consultations on proposals to improve the reliability of Ontario's electricity grid in the face of increasing severe weather. The OEB will provide advice to the Minister in Summer 2023 which will include best practices to ensure Ontario is best positioned to continue to provide reliable electricity to Ontario families and businesses. Best practices may include things like increasing grid redundancies, ensuring materials and equipment are on hand in elevated risk areas and technological advances that can help predict outages and support recovery from outages.

Powering Ontario's Growth

For the first time since 2005, demand for electricity in Ontario is rising thanks to strong economic growth, electrification, and population growth.

To meet this demand the province is embarking on an ambitious, multi-pronged approach to secure a clean energy future for our province, the economic engine of Canada.

As outlined in this report, meeting this challenge will require major investments in clean energy, including new nuclear generating stations, new transmission, new pumped hydroelectric storage, and other infrastructure needed to maintain and build our clean electricity advantage.

And these investments will pay dividends for the people of Ontario. With a reliable and affordable supply of clean energy we can power Ontario's growth.

And we are already seeing results with historic investments in EV and EV battery manufacturing as well as clean steel production which are bringing jobs to communities across the province.

Building the next generation of clean electricity generation will make Ontario even more attractive for investment as we offer the certainty businesses are looking for. That includes the certainty that the clean power will be there to power the next major international investment, the new homes being built across the province and growing industries and sectors.

Unlike previous governments that viewed energy systems in isolation, this government is developing an integrated energy strategy that will meet Ontario's needs in 2050 and beyond.



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