

POWERING ONTARIO FORWARD

Submission for the

Ministry of Energy, Northern Development and Mines
review of Ontario's long-term energy planning framework



Situated on the shore of Lake Huron, Bruce Power provides nuclear power to one in three homes, hospitals, schools and businesses in Ontario at 30 per cent less than the average cost to generate residential power. Our people are the foundation of our accomplishments and are proud of the role they play in delivering clean, reliable, low-cost electricity across the province and life-saving medical isotopes across the globe, helping to sterilize 40 per cent of the world's single-use medical devices, including sutures, syringes, masks, gloves and more. Bruce Power has worked hard to build strong roots in Ontario and is committed to protecting the environment and supporting the communities in which we live. Learn more at www.brucepower.com.

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Introduction

Bruce Power is pleased to have this opportunity to respond to the Ministry of Energy, Northern Development and Mines review of Ontario's long-term energy planning framework.

At Bruce Power, our core business is supplying safe, reliable electricity to the people and businesses of Ontario, and medical isotopes globally. We have been a proud and active partner of the Ontario government for many years, helping the province to explore opportunities to use nuclear power to decarbonize its economy and achieve its climate change objectives, while simultaneously maintaining a reliable, affordable and stable electricity grid.

We are home to Canada's largest private-sector infrastructure project. Through partnerships with our vast Ontario-based supply chain, Bruce Power helps support more than 22,000 direct and indirect high-quality jobs in areas such as science, technology, engineering and math (STEM) and skilled labour each year while also generating \$9-11 billion of economic activity across Canada. Bruce Power is proud to be able to provide Ontario families and businesses with 30 per cent of their electricity at 30 per cent less than the average cost to generate residential power.

With the future of electricity generation so intrinsically tied to climate change and decarbonization, a renewed look at energy planning is needed. When it comes to decarbonizing our economy there are many challenges ahead, and Ontario's electricity sector will be paramount in this transformation. To enable this process, the Ontario government has signaled its intent to refocus Ontario's long-term energy planning framework.

Bruce Power's vision for Ontario's energy system respects the challenges of today but embraces the changes necessary to create the energy system of the future. We believe that the long-term planning process currently being reviewed by Ontario must:

1. Recognize the importance of a holistic planning process;
2. Focus on long-term sector needs;
3. Leverage Ontario's unique advantages; and
4. Plan for and embrace innovation

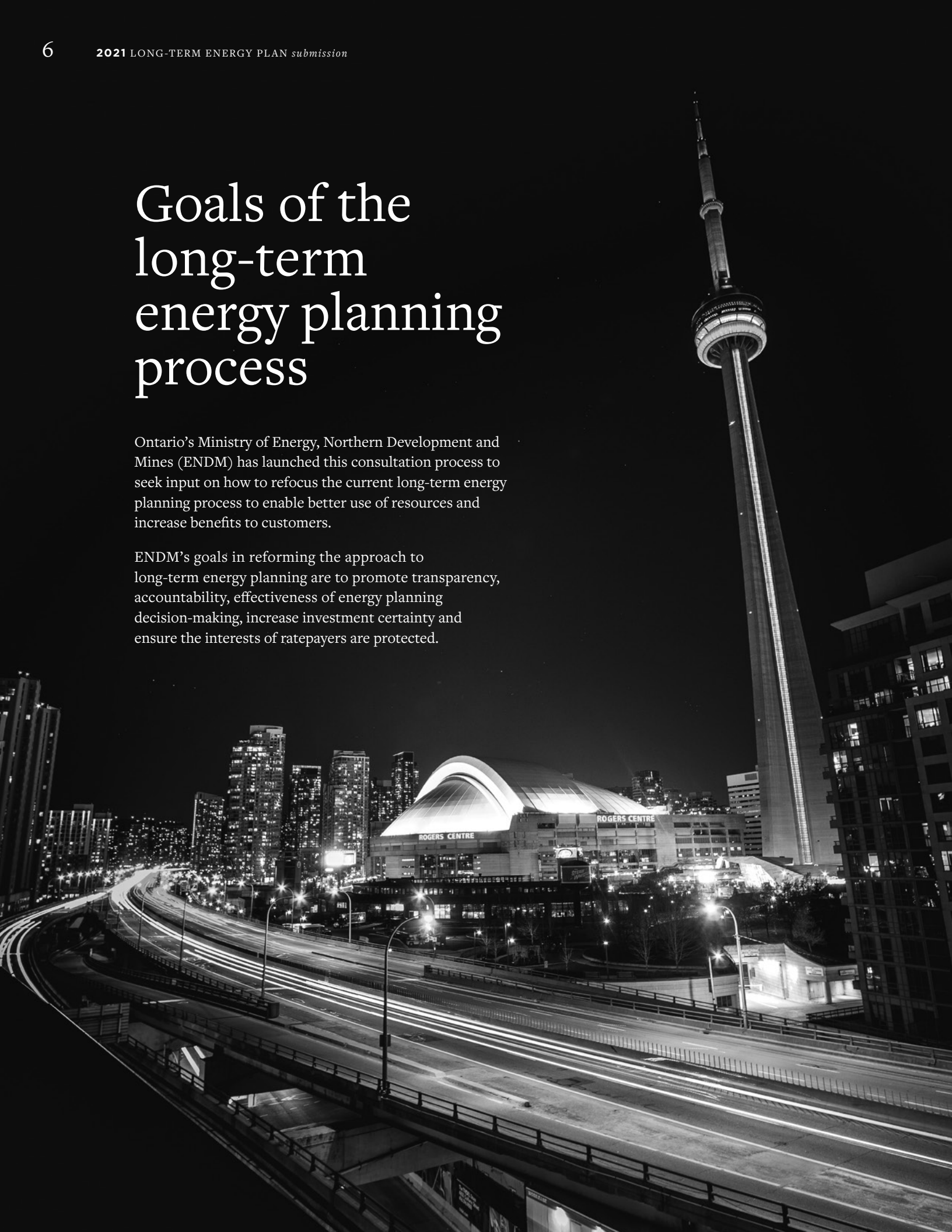


Bruce Power is pleased to provide its expertise to assist in this process and we are ready and able to help lead Ontario and Canada in its transition toward a net-zero future.

Goals of the long-term energy planning process

Ontario's Ministry of Energy, Northern Development and Mines (ENDM) has launched this consultation process to seek input on how to refocus the current long-term energy planning process to enable better use of resources and increase benefits to customers.

ENDM's goals in reforming the approach to long-term energy planning are to promote transparency, accountability, effectiveness of energy planning decision-making, increase investment certainty and ensure the interests of ratepayers are protected.

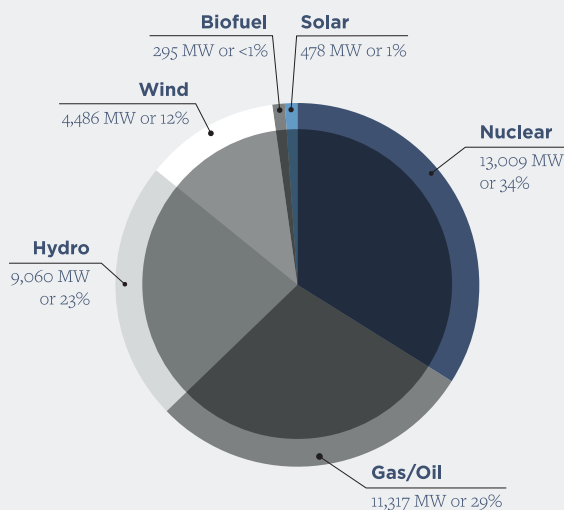


BRUCE POWER:

The Role of nuclear, now and into the future

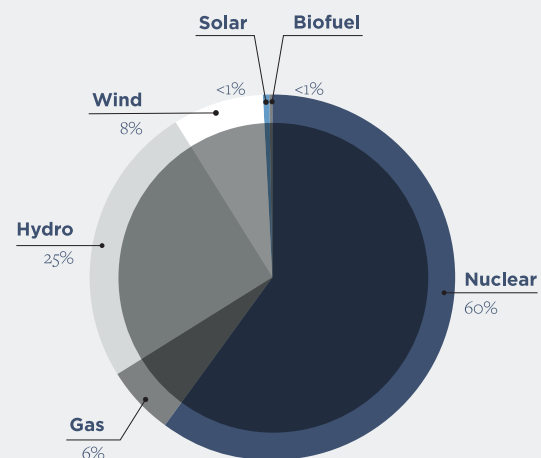
As the government affirmed in its 2021 budget, nuclear power is vital to Ontario's clean energy advantage. At the heart of Ontario's energy system is nuclear power. While nuclear generation is only 34 per cent of the total generation capacity available in the province, nuclear power accounts for more than 60 per cent of the total power generated to meet the province's needs.

fig. 1 Ontario's electricity supply mix



Source: IESO Reliability Outlook, 2020

fig. 2 Ontario's electricity production in 2020



Source: IESO

Ontario's current refurbishment of its nuclear reactors will extend the operating lives of both Darlington and Bruce Power generating stations to 2055 and 2064, respectively, resulting in decades of low-cost electricity while simultaneously creating tens of thousands of direct and indirect jobs.

Not only will these refurbishments provide an economic boost to Ontario, and Canada as a whole, but in an examination of value for money spent on these projects, the Financial Accountability Office of Ontario (FAO) concluded that "there are currently no alternative generation portfolios that could provide the same supply of low greenhouse gas (GHG) emissions baseload electricity generation at a comparable price to the Base Case Nuclear Refurbishment Plan."

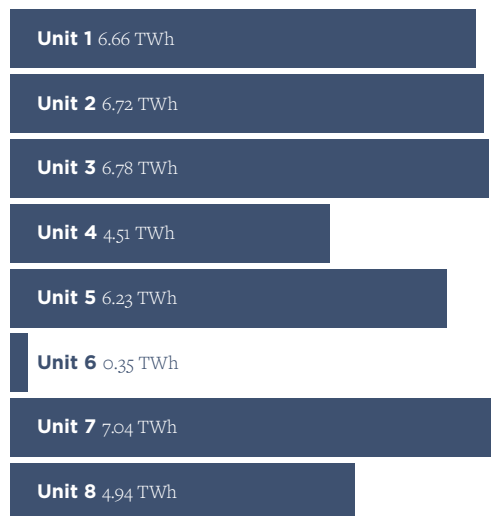
Nuclear power is the backbone of Ontario's energy system. Refurbishments at Darlington and Bruce are an investment in the future and a testament to the reliable, cost-effective product that nuclear power provides every day. As Ontario looks ahead, it should closely observe emerging nuclear technologies concurrent with its changing supply mix and emerging demand needs.

At Bruce Power, our life-extension program is recapitalizing the Ontario nuclear supply chain, supporting well-paying jobs here in Ontario and helping to grow our economy. Our site is the hub of a nuclear ecosystem that is recognized globally for its excellence. As Ontario – and the world – moves to a cleaner energy future, we must build on our strengths. Nuclear power is vital to Ontario's clean-energy advantage.

Electricity demand in 2020 was impacted significantly due to the COVID-19 pandemic. The COVID-19 pandemic created unusual and unexpected patterns in demand, as it impacted all businesses in devastating ways. Through this uncertainty, Bruce Power helped to keep the lights on for the businesses, hospitals, and homes in the province. Bruce Power's reliable, stable nuclear power helped to ensure Ontario always had the electricity it needs to power Ontario forward; all while keeping costs down.

Without nuclear power, Ontario's commitment to reduce emissions 30 per cent by 2030 becomes increasingly difficult. Nuclear power enabled the largest GHG

fig.3 Bruce Power 2020 output



Source: IESO

** NOTE: Bruce Power's Major Component Replacement (MCR) project took Unit 6 offline on January 17, 2020. The remaining Bruce Power units continued to provide reliable, safe power through the pandemic, providing 30 per cent of the province's electricity through the year.

** Terawatt hours (TWh)

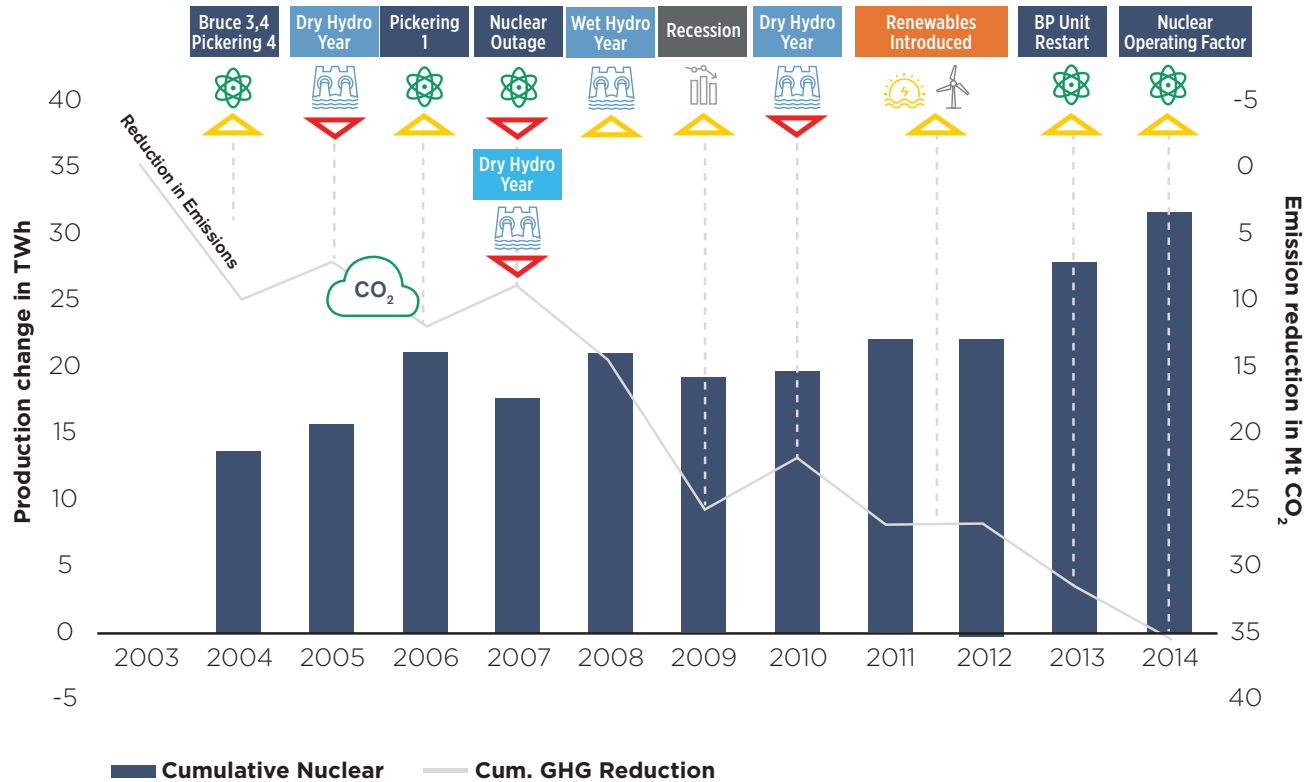
reduction initiative by closing coal-fired generation plants to clean Ontario's air; a monumental moment that would not have been possible under a capacity auction model. To achieve this transformation, 35 TWh of low GHG-emission generation were added to Ontario's supply mix, with nuclear generation accounting for 32 TWh or 89 per cent of that supply.

Bruce Power alone, with the restart of two units, provided 70 per cent of the energy capacity to enable this change, ultimately reducing the number of smog days in Ontario from 53 in 2005 to zero in 2015.

The Ontario government has set strong targets with its emissions reduction goals in its Made-in-Ontario Environment Plan to protect our air, land and water and reduce litter and waste, while lowering greenhouse gas emissions and helping communities prepare for climate change. Nuclear power has been at the forefront of

fig.4 **Changes in electricity supply and GHG emissions**

(Production change in TWh vs. emission reduction in CO₂ in Mt; Indexed to 2003)



Source: IESO data; Strapolec, Extending Pickering Nuclear Generating Station Operations, 2015; Strapolec analysis.

Note: After coal was fully retired, Ontario power sector GHG emissions only reduced by 0.5 Mt from 2014 to 2016 as renewables were rolled out.

tackling this challenge before and will do so decades into the future.

As we look over the next two decades as Ontario prepares to simultaneously tackle the challenges of electrification of transportation and heating, deeper decarbonization, successfully executing the refurbishment of 10 nuclear units, all while improving reliability and ensuring ratepayers see value for money, the importance of appropriate planning will be critical.

Bruce Power's vision for Ontario's energy system respects the challenges of today, but embraces the changes necessary to create the energy system of the future. We believe that the long-term planning process currently being reviewed by Ontario must:

1. Recognize the importance of a holistic planning process;
2. Focus on the long-term sector needs;
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4. Plan for and embrace innovation



Priorities of new planning process

1. Recognize the importance of a holistic planning process

Energy policy has considerable downstream effects on the province's economy. Not only is it undeniably linked to environmental targets, it is also a significant determinant of economic development. The energy planning process must sufficiently incorporate climate change objectives and targets, protect public health while also encouraging investment, job creation, and economic growth across the province. Clean air and cancer treatments better the lives of all Canadians, which is why these considerations need to be factored into energy decision making and credited appropriately to ensure a sustainable industry.

Energy planning is undoubtedly a complex process. Climate change, air pollution, economic development, technological change, and political mandates are all just a few of the considerations necessary with energy system being at the heart of many of these issues. Weighing these variables with affordability must be addressed in modern energy planning. Affordability is, and always should be, the paramount consideration in energy planning.

Another consideration in this planning process should be the inclusion of our Indigenous communities. Bruce Power has fostered strong, meaningful relationships and is committed to consulting with the Indigenous

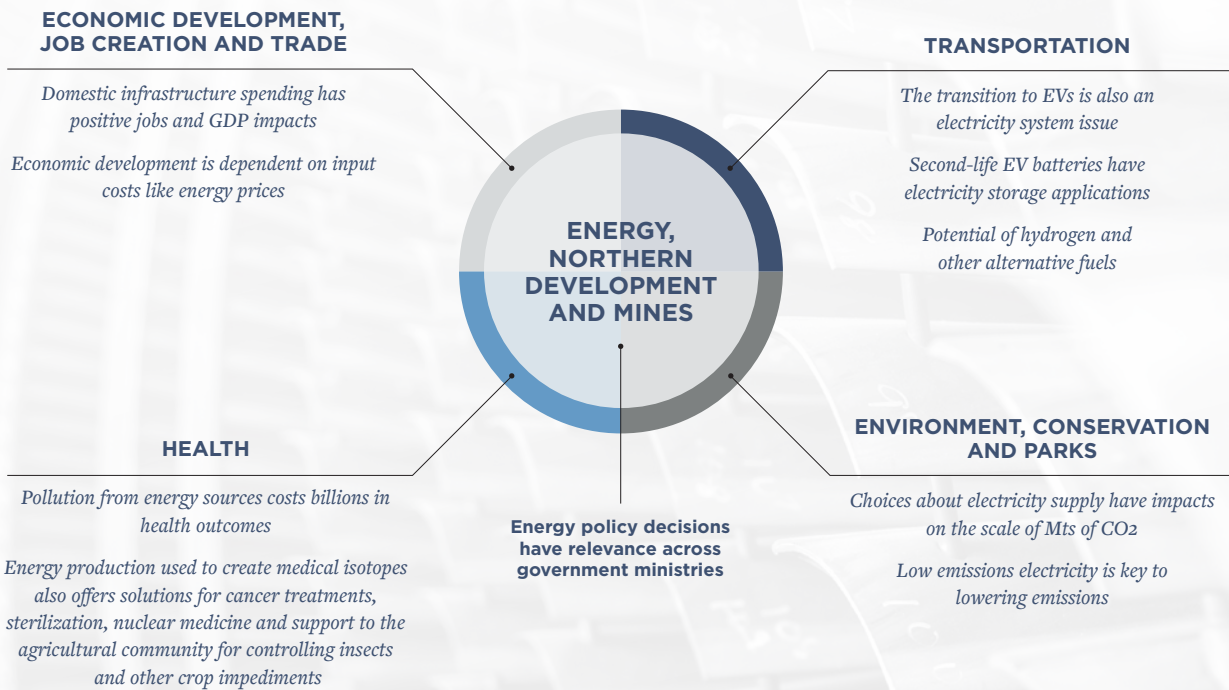
communities in our area. For example, Bruce Power has partnered with the Saugeen Ojibway Nation (SON) to explore ways of jointly marketing new isotopes in support of the global fight against cancer, while also working together to create new economic opportunities within the SON territory.

The partnership will use the made-in-Ontario Isotope Production System installed into Bruce Power's nuclear reactors to produce Lutetium-177 and other isotopes used in the diagnosis and treatment of cancers in hospitals around the world.

Today's climate realities and economic imperatives require a much more holistic planning and procurement process. The entire value, economic, environmental and reliability of a generation source must be variables that enter the modern procurement equation. An effective balancing of this equation can help to mitigate these challenges and must be the model moving forward.

To begin to address this reality, long-term planning requires direct co-ordination between the Ministries of Environment, Conservation and Parks, Ministry of Economic Development Job Creation and Trade and Energy, Northern Development and Mines. Planning must consider how Ontario will achieve its 2030 emissions targets as well as respect the interests of the customer.

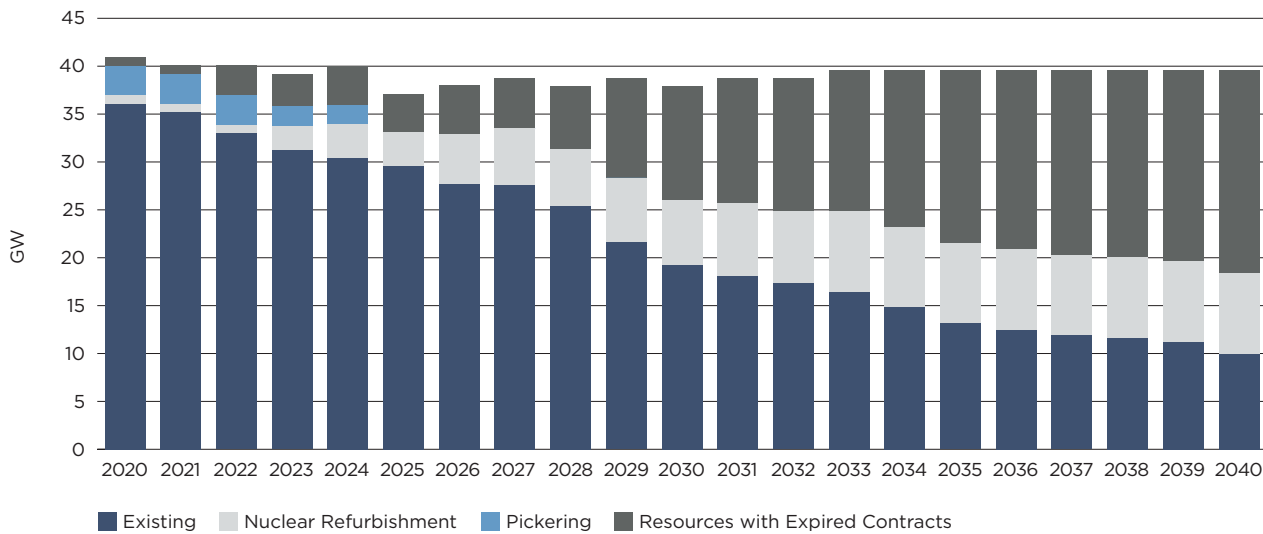
fig.5 **Energy and related government industries**



The key is a holistic approach to energy planning, one that ensures the pillars of reliability, affordability and stability are maintained while accounting for modern challenges and objectives. Energy, economic development and climate policy can no longer be viewed as separate planning processes aimed at picking winning and losing companies or technologies. This approach has only contributed to increased costs for customers, increased debt load and fragmented system reliability. System planning now needs to be a more inclusive process than ever before.

Thankfully, Ontario has a head start with a broad base of electricity supply options, anchored by nuclear power that provides reliability day-in and day-out for Ontario consumers. As we look forward and consider the opportunities a clean electricity system can help develop such as electrification of our transportation sector, the production of green hydrogen, and the potential of new nuclear and small modular reactors (SMRs) to help remote and Indigenous communities reduce their reliance on diesel generators, it is imperative that energy planning adopts a holistic approach.

fig.6 Installed capacity by commitment type 2020-2040



Source: IESO Annual Planning Outlook

2. Focus on the long-term sector needs

Energy planning necessitates that we look out over longer time periods and begin to act and plan now for the decades ahead. Long-term climate change reductions policies, such as Ontario's 2030 emissions targets or the possibility of reaching a Net-Zero future, must be incorporated into energy planning.

Looking over the long-term time horizon, new needs will emerge, and resources may be required. Thankfully, the Independent Electricity System Operator (IESO) is well positioned to provide this information and does so through its annual planning and capacity outlook documents. The IESO indicates that Ontario is expected to have enough of a supply of energy in the near term, but energy needs in the late 2020s and early 2030s appear driven by resources with contracts expiring (figure 6).

Adequate planning to meet this need happens now and requires flexible procurement methods that capture the full value chain of a technology. A process in which the

total value chain of a technology, its potential to reduce GHG emissions, the ability to create and support jobs and export opportunities are now arguably as fundamental to energy planning as cost per megawatt hour (MWh). Nuclear power offers many unique values not captured in modern energy planning, such as generating innovations such as medical isotopes, creating thousands of jobs and helping the province achieve its decarbonization targets

A careful balancing of costs with the potential to reduce GHG emissions is important, but it is also imperative to account for the total net value of a technology. Positive job growth and increased export opportunities can lead to positive returns on our gross domestic product (GDP) and help grow our economy.

Moving forward, it is critical that the planning looks over the term, is adaptive to innovation, supports Ontario businesses, captures the full net value of a technology and continues to recognize the important role nuclear power will play in helping Ontario meet its energy needs.

3. Leveraging Ontario's advantages

With a wide variety of clean energy options at its disposal, Ontario is in a strong position to meet the coming challenges, but only through a holistic and long-term planning process as referenced above will the province be able to capitalize on these advantages.

Our resources include zero-emitting nuclear and hydro facilities that provide us with flexible baseload supplies that meet our needs through all four seasons. We have non-hydro renewables in the form of solar, wind, and biomass that help thin out the use of natural gas to help reduce emissions. Biomass is a low-emission alternative for performing similar functions to natural gas, such as providing peaking supply. Combined, 94 per cent of Ontario's electricity system is emissions-free. With our unique low GHG-emitting energy mix acting as a base to build upon, a suite of technologies offer promise in providing clean solutions to Ontario's energy needs.

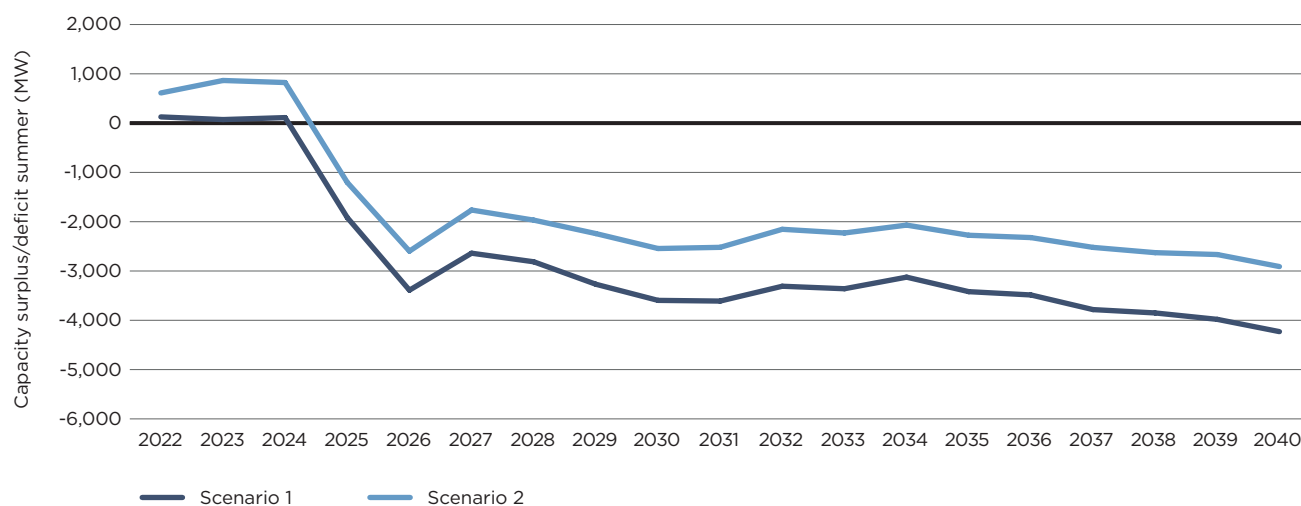
Branding Ontario as a decarbonized electricity sector, so firms based here can declare their operations in the province as 'clean', is a major economic development opportunity. This clean brand is already being supported by major organizations in Ontario making significant pledges to achieve Net-Zero.

In October 2020, Bruce Power announced 'NZ-2050,' the company's strategy to contribute to a Net Zero Canada, while growing the economy and supporting innovation. In April 2021, we took another leap forward with that agenda by announcing our commitment to achieve net zero carbon emissions from our site operations by 2027 – the first nuclear operator in the North America with such an ambitious commitment.

Ontario will need to harness all its electricity assets in a careful, thoughtful and well-co-ordinated way to have a realistic hope of meeting its ambitious climate goals. This includes ensuring that we are maximizing the value of our existing infrastructure. For example, Canada's nuclear industry, through its refurbishment, has enabled new production milestones; in February, Ontario Power Generation (OPG) set a new world record for continuous operation of a nuclear power reactor at 1,106 days, Bruce Power's Unit 1 also setting a site record operating for 694 days and through our life extension we believe that we will be able to incrementally increase the output of our site.

This output will be available at a time when renewable contracts begin expiring in the late-2020s and Pickering nuclear units are removed from service in 2024, and will avoid the cost of new generation and infrastructure from being constructed.

fig.7 Summer capacity surplus/deficit, with continued availability of existing resources



Source: IESO Annual Planning Outlook, December 2020



Leveraging an investment in existing infrastructure at the Bruce Power site will secure much-needed capacity in the short term, reliable baseload supply in the long term and result in significant ratepayer benefits.

Any new planning process must consider not only new infrastructure but seek to maximize the value of our existing infrastructure. Opportunities like these to cost-effectively increase our clean electricity capacity must not be overlooked, regardless of the technology type.

The completion of pumped hydro in Ontario would be a good choice to balance production needs of our grid, and optimizing other assets will help mitigate capacity lost from Pickering. As the critically enabling foundation, operators of existing large nuclear and hydroelectric facilities should be requested by the system operator to determine incremental investment and innovation opportunities for additional generation from existing assets. This should include optimizing existing assets

from the perspective of output, performance, capabilities/applications and long-term asset life management. Such an approach would place a priority on existing assets and their optimization, given the long lead-time for new infrastructure projects, especially at a time when demand due to zero-emission vehicles (ZEV) and electrification is expected to increase.

Transport Canada has set ambitious new zero-emission vehicles (ZEV) sales targets, which would translate into 100 per cent of new vehicle sales being ZEVs by 2040. This would significantly increase the amount of energy required by Ontario's energy system. While Investments in strategic industries such as nuclear, hydrogen and ZEVs will facilitate new products and enable growth, catalyzing a lasting competitive advantage, the planning process to create the environment for future electrification begins now.

4. Planning for innovation and the unknown

Long-term planning requires assumptions about future demand, supply and resource costs. Projecting what electricity demand will be is no easy task. Nor is understanding the pace and direction of innovation or knowing what external challenges or opportunities may be presented by domestic or international policy changes. However, what we can plan for is ensuring that our frameworks and models are flexible by also placing consideration for other societal needs like medical isotopes or alternative fuels as part of the decision making process. This will enable a more diverse/inclusive look at sector and societal needs. This guarantees that Ontario can respond to changing market conditions, allowing the province to balance electricity demand and supply effectively.

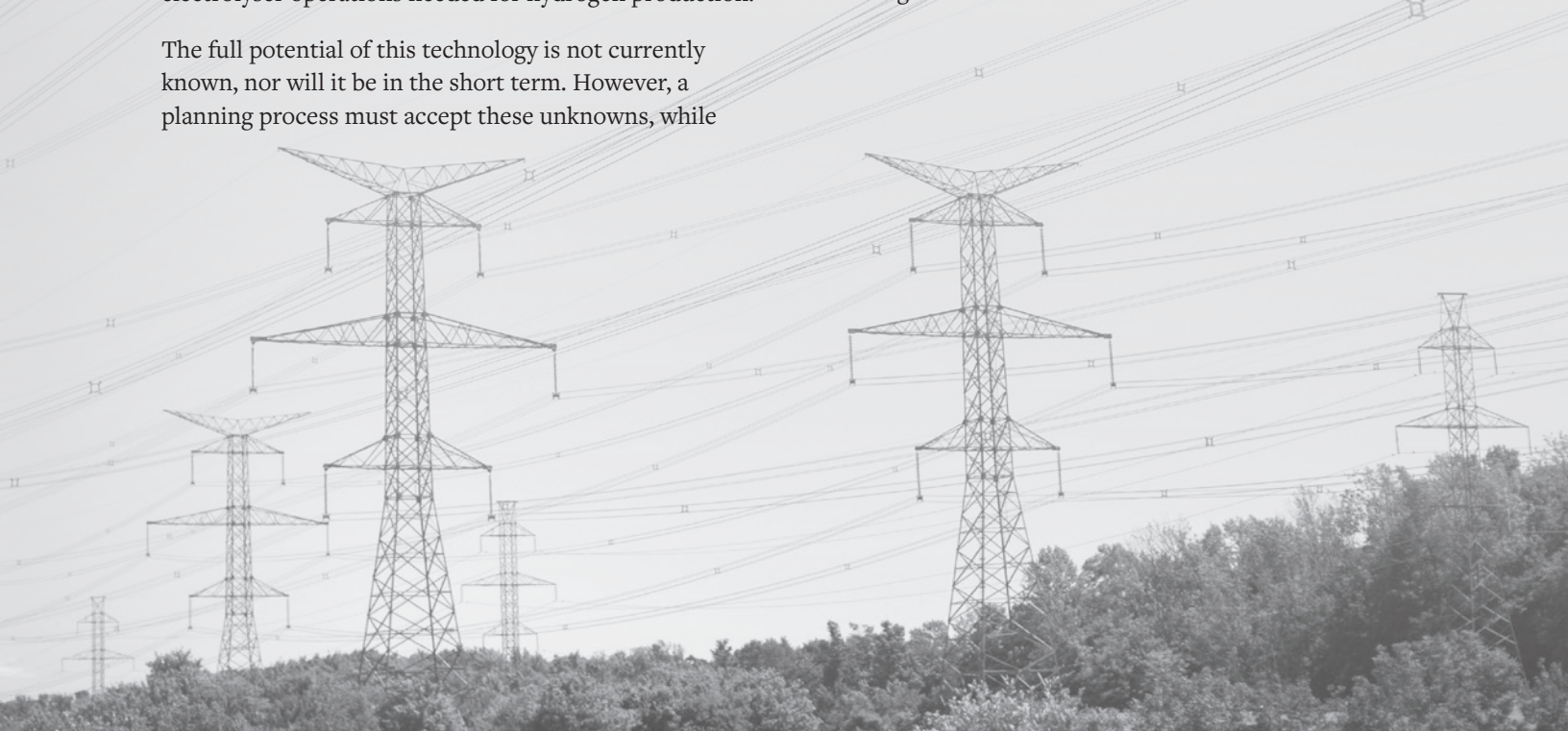
As Ontario and the world look to satisfy increasing energy demand with lower environmental impact, hydrogen is an example of a technology that is once again attracting serious attention. With the launch of its Hydrogen Discussion Paper and subsequent formation of a working advisory group, Ontario recognizes the potential of this technology, and there is no doubt that nuclear power will be a critical component in unlocking hydrogen's potential. Hydrogen performs best when matched with a reliable baseload supply for electrolysis, such as nuclear power. Ontario's nuclear generation operates 24/7 and it is this consistency that would enable the high-capacity factor electrolyser operations needed for hydrogen production.

The full potential of this technology is not currently known, nor will it be in the short term. However, a planning process must accept these unknowns, while

simultaneously laying the foundation to capitalize on this technology and others in the future. Enabling innovation will also require government to use all the tools at its disposal. The sheer amount of clean electricity needed for success demands a full array of reliable, powerful and proven generating sources capable of providing large quantities of clean electricity and heat on a 24/7 basis for residential, industrial and transportation use.

To meet these needs, government should seek additional opportunities to partner with the private sector through the enhanced use of P3s and Green Bonds to invest in provincially-owned infrastructure. Including nuclear technology in the clean technology/clean energy/clean infrastructure categories and recognizing the technology as green would unlock the potential funding, support program and fiscal incentive through Green Bonds. These Green Bonds would allow nuclear power to qualify for investment as an environmental and sustainable solution. These measures would go a long way to supporting the business innovation climate needed in Ontario today to encourage clean energy generation.

Fundamentally, the government needs to create long-term policy that is flexible, but also provides the clarity and consistency needed to create private sector confidence to invest the considerable sums of capital that are necessary to realize innovation. Policy stability can be entrenched in energy planning to provide the long-term time horizon needed to create the environment that enables technological innovation.





Conclusion

Ontario's energy market has undergone significant transformation over the past decade and it will no doubt undergo tremendous transformation in the years ahead. However, as the government stated in its 2021 budget, nuclear power is vital to Ontario's clean energy advantage.

Bruce Power and nuclear power have been the stable backbone of Ontario's electricity system for decades. Thanks to investments being made into the Bruce Power site today, we will continue to reliably provide reliable, affordable, emissions-free electricity for decades to come.

Bruce Power's Life-Extension Program will ensure Ontario families and businesses have long-term price stability and we have, without a doubt, cemented ourselves as an essential resource for the province, using existing infrastructure to deliver a third of Ontario's electricity safely and reliably, 24 hours a day, 365 days a year.

This planning process review provides Ontarians the opportunity to offer input into arguably the most

important economic development-, environmental-, and innovation-defining policy process of a generation. The outcomes of this process will need to empower independent, agency-led planning that will protect the interests of customers, improve investment certainty, and restore confidence in energy decision-making, all while creating a concrete understanding of the relationship between energy, climate change, transportation and the economy.

Bruce Power stands ready to move forward with significant investments and work projects to help meet those challenges, while providing economic recovery opportunities at the same time. Our actions demonstrate our commitment to our local community, as well as our province and country.

We would welcome the opportunity to discuss these priorities and opportunities with you, your Cabinet colleagues or members of your staff in more detail at any time.



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