

BRUCE POWER SUBMISSION

Pathways to Decarbonization

COMMERCIAL CONFIDENTIAL

Executive Summary

As our understanding of the rapid evolution of climate change grows, the global community's response to combat and mitigate its impacts is also evolving at an equally quickened pace. A watershed moment in this response was the Intergovernmental Panel on Climate Change (IPCC)'s finding that a credible path to net zero emissions by 2050 needs nuclear power. Since then, countries around the globe have re-evaluated nuclear technology as part of their clean energy mix in a bid to reach our collective emissions reduction goals. Canada and Ontario, long-time leaders in nuclear innovation and power generation, are among those leading this effort.

In December 2022, Ontario's Independent Electricity System Operator (IESO) released its Pathways to Decarbonization (P2D) report, which outlines the need for 17,800 MW in new nuclear capacity to help the province reach its electrification and net zero goals. And in March of this year, the federal government recognized nuclear as key to Canada's green energy future, including the technology in several proposed tax incentives to assist the industry in helping the country achieve its net zero targets.

Bruce Power has and is ready to continue to play its part in achieving these goals. We are Canada's only private sector nuclear generator, annually producing 30 per cent of Ontario's electricity. Ontario is counting on Bruce Power to provide a reliable and carbon-free source of affordable energy through 2064 while also generating cancer-fighting medical isotopes. We employ thousands of people directly and through our supply chain in high-skilled jobs and contribute \$4 billion in GDP each year to Ontario's economy. We were also responsible for 70 per cent of the electricity needed to phase out coal-fired generation in Ontario, one of the largest greenhouse gas emission reductions ever in North America and producing an electricity grid that is 90 per cent clean. We thank the provincial government for the stable policy environment it has provided to enable us to achieve these benefits for the people of Ontario.

The IESO's P2D report highlighted "no regret actions" the government can take now to start down the path to net zero by 2050, including beginning the planning, siting and environmental assessment work needed for expanded nuclear generation, and galvanizing collaboration amongst stakeholders and Indigenous communities. We are ready to work with the government to implement these actions. The Bruce site can be expanded to accommodate more nuclear generation than exists today, but unlocking that optionality is contingent on an extensive federal regulatory process. Already heavily studied, regulated, and reviewed by multiple agencies

on an ongoing basis, there are many other advantages when considering the site for further expansion, including available land and transmission capacity, supportive host communities in Grey, Bruce and Huron counties, and active and ongoing Indigenous engagement.

For the IESO to achieve its "no regret actions" Bruce Power makes the following recommendations:

- Enable cost recovery for siting to enable the impact assessment process to begin
- 2. Prioritize long lead assets that are of strategic importance to the province by leveraging existing infrastructure and brownfield sites
- Optimize the level of coordination between various utilities, communities, and Indigenous communities in support of sites

The rationale for moving to enable optionality of the Bruce site is multi-faceted. Ontario's nuclear sector supports most of the industry's 76,000 good-paying, highly skilled jobs in Canada. Refurbishment programs at Darlington and Bruce Power to safely extend the life of operating units another 30 years or longer represent two of the largest clean energy infrastructure projects in Canada. Investments have been and continue to be made to modernize the existing nuclear fleet and include innovations to reduce operating costs and enhance safety and efficiency.

To align policy and regulatory processes, steps must be taken, however, to streamline the federal approval process, specifically for brownfield sites like Bruce Power. This can be done by accepting previously approved environmental studies and assessments, avoiding duplication from the current licensing process, and/or adopting a tailored impact assessment process for the site.

Bruce Power is ready to step up and play an even more integral role in Ontario's clean electricity grid today and for the future, creating and sustaining thousands of high-skilled jobs that support economic prosperity across the province, helping generate emissions-free electricity in the fight against climate change, while also producing cancer-fighting medical isotopes to improve global health. The following submission will outline how the government can work hand-in-hand with us to do this.



Introduction

Bruce Power is pleased to have this opportunity to respond to the Ministry of Energy consultation on the findings of the Pathways to Decarbonization (P2D) study and the IESO's "no-regret" recommendations. The report envisions a decarbonized supply mix by 2050 with contributions from nuclear, conservation, demand response, renewables, and storage.

Ontario is on the road to a net-zero future, and the nuclear sector has a key role to play in this energy transition. It is increasingly well recognized that new nuclear is necessary for Canada to meet its immense climate change and energy security challenges. Ontario is a leader in nuclear innovation, and with many promising new energy technologies on the horizon, it is important to recognize that large-scale nuclear continues to do the heavy lifting for the province's clean energy needs.

The IESO's Pathways to Decarbonization document revealed the potential need for 17,800 MW of new nuclear generation capacity by 2050, sending a clear signal that nuclear power is essential to building an achievable path to net zero. Given that recognition and growing political and public support, the focus now for the nuclear sector must shift to how much additional nuclear is practically achievable, and how that can be realized.

The IESO also identified several "no regret" actions that can be taken to help meet growing demand, address retirements of existing generation and ensure a state of readiness to manage any future decarbonization policy. Bruce Power is committed to helping the province achieve these actions in a meaningful way. Siting electricity generation is becoming increasingly challenging, and existing footprints backed by supportive communities provide opportunities that should be fully prioritized when planning for future needs.

Overall, the P2D Report emphasizes the important role nuclear can and must play in the future of the energy system. To follow through on these "no regret" actions and achieve the ambitions set out within the report, work must begin now. This consultation response lays out several areas of action, which include:

- Capitalizing on Ontario's nuclear advantage
- Financing a sustainable future
- Regulatory modernization
- Harmonization of energy infrastructure planning and implementation
- Active Indigenous participation
- Unlocking the potential of nuclear innovation

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 provide reliable, affordable, emissions-free electricity for decades to come.

Bruce Power stands ready to move forward with significant investments and work projects to help achieve a cleaner future, while providing economic growth opportunities at the same time. Our actions demonstrate our commitment to our local community, as well as our province and country.







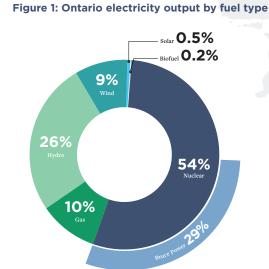
Capitalizing on Ontario's Nuclear Advantage

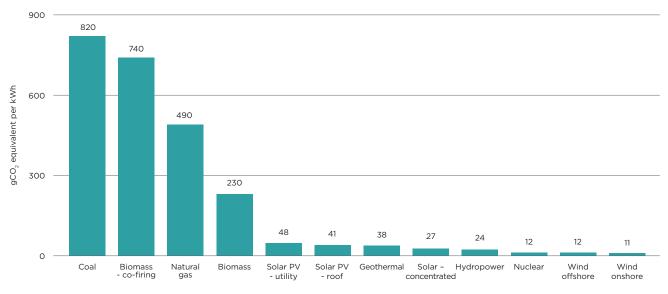
A carbon-free source of energy

Zero-emissions nuclear power is the backbone of Ontario's clean electricity system, providing reliable, carbon-free power for the dynamic needs of our province.

Nuclear power plants produce no greenhouse gas emissions during operation, and over the course of its life cycle, nuclear produces about the same amount of carbon dioxide-equivalent emissions per unit of electricity as wind, and one-third of the emissions per unit of electricity when compared with solar.

Figure 2: Average life-cycle carbon dioxide-equivalent emissions for different electricity generators





Average life-cycle carbon dioxide-equivalent emissions for different electricity generators (Source: IPCC)



The scientific consensus is clear — net zero needs nuclear.



Nuclear energy has shown that it can be the catalyst for delivering sustainable energy transitions, long before climate change was top of mind. Successfully reaching net zero by 2050 will require a clean energy supply mix and will rely on a strong baseload supply of stable nuclear power.

As a reliable source of clean energy, nuclear helps avoid 80 million tonnes of carbon emissions per year in Canada (equal to removing 15 million cars from the road) while generating electricity at a low cost, second only to hydro and below the average cost of production in Ontario.

Less nuclear means higher emissions

In 2019, Ontario produced 26 per cent of Canada's overall electricity generated; however, total GHG emissions from energy generation in Ontario was 3.9 Mt CO2e, or only 6 per cent of Canada's total emissions from electricity generation.¹ This is largely the result of Ontario nuclear resources, providing 60 per cent of Ontario's energy needs daily.

The IESO forecasts there will need to be an increase in electricity generation/output from the existing natural gas generation facilities to balance the rising electricity demand with reduced nuclear supply because of the ongoing refurbishment projects. While natural gas is an important part of a diverse supply and critical to providing system reliability during peak hours it does have a greater GHG intensity then other non-emitting resources.

As a result of this increased proportion of natural gas generation, annual emissions from electricity generation are forecasted to increase this decade from a recent average of 5.4 megatonnes (Mt) CO2e to 11.9 Mt CO2e in 2030, an increase of 120 per cent.² Figure 3 shows how GHG emissions from electricity generation are expected to rise from now through to 2042.

Figure 3: Ontario electricity sector GHG emissions (historic and projected)



GHD Limited (2022) The Energy Sector's Role in Net Zero p. 6

² GHD Limited (2022) The Energy Sector's Role in Net Zero p. 11



Considering these rising emissions from Ontario's electricity sector, the value of incremental and refurbished nuclear becomes even more clear. Using 2019 electricity generation intensity data available from the National Inventory Report (NIR) (as shown in Table 1) every additional kWh electricity generated in Ontario from low carbon sources such as nuclear instead of carbon emitting resources avoids on average 406 g CO2e.³

Bruce Power is producing more clean energy from its existing infrastructure, resulting in avoided emissions from carbon-emitting sources. Through a series of incremental power recovery projects under Project 2030, Bruce Power will support Ontario's climate change and future clean energy needs by targeting a site net peak capability of upwards of 7,000 megawatts (MW) for the 2030s.

The avoided emissions from the initial investments in Project 2030, which will target site net peak output of up to 6,750 MW, are estimated to avoid almost 450,000 metric tonnes of CO2e annually, the equivalent of taking approximately 100,000 cars off the road.



This additional generation will be equivalent to adding about a ninth large-scale reactor to our site without the need to build additional infrastructure. By building flexibility into the **Project 2030** implementation plan, Bruce Power is enabling the option of production of large scale low-carbon hydrogen when long-term market conditions warrant investment.

Table 1: Electricity generation GHGi by energy source

Electricity Generation Energy Source	Ontario 2019	Ontario Average 2015-19	Canada	Ontario 2020	IPCC	UNECE
gCO2e/kWh						
Coal	0	0	955	0	860	753 to 1,095
Natural Gas	406	411	475	472	490	403 to 513
Other Fossil Fuels	80	130	656	0		
Nuclear	0	0	0	0	12	5 to 6
Hydro	0	0	0	0	24	6 to 147
Other Renewables	0	0	0	0	11-48	8 to 21 (wind) 7 to 83 (solar)
Other Generation	0	0	0	0	-	
Average	30	29	120	-	-	

GHD Limited (2022) The Energy Sector's Role in Net Zero p. 8



Financing a sustainable future

When it comes to financing, it is important that utilities seeking to build new nuclear plants both have access to sufficient funds to build the units and at the lowest possible cost of funds.

Nuclear plants are capital intensive requiring large up-front investment with relatively low operating and fuel costs once in operation, which provides a competitive cost profile over time.

As a solid first step the Canadian government announced a series of incentives in its March 28, 2023 Budget. These include a 15 per cent clean electricity investment tax credit, a 30 per cent investment tax credit for clean technology manufacturing, and a series of other initiatives that are inclusive of nuclear. The next step is to ensure a clear understanding of each incentive and how it works. Also, while governments continue

to modernize their own green bond frameworks, both OPG and Bruce Power have led the way by successfully issuing hundreds of millions of dollars of green bonds and receiving a "greenium", i.e., a lower rate on these bonds as a result of them being green.

Time is of the essence to start the Impact Assessment (IA) process to ensure that the recently announced Clean Electricity Tax Credit remains available for the design and construction of new assets. The tax credit is currently set to expire in 2034.

Bruce Power Impact Assessment cost recovery

IESO's Pathways to Decarbonization report has identified the need for a significant increase in nuclear capacity to enable a net zero electricity system in Ontario by 2050. To achieve this, the IESO has indicated that Ontario must begin regulatory and siting approval processes now to maximize future optionality for clean electricity production in the province.

The Bruce site can accommodate expansion in order to generate more nuclear power than it does today, but unlocking that optionality is contingent on an extensive federal regulatory process. The Bruce Power site holds many advantages making it a prime candidate for further expansion to help meet IESO's no regret actions.

- Available land Bruce Power's 6,550 MW represents
 the largest electricity generating facility in Canada and
 the largest nuclear power station in North America.
 The energy density of the Bruce site is extremely high,
 producing nearly one-third of Ontario's electricity
 on fewer than 1,000 hectares of land much of
 which remains available for incremental infrastructure
 development and site expansion.
- Available transmission zone The Bruce transmission zone produces significantly more electricity than it currently consumes and would be able to support additional generation.
- Supportive host community Across the Clean Energy Frontier (Bruce, Grey, Huron Counties) the support for nuclear and Bruce Power is the highest in the country. Through ongoing community outreach, citizens across the region stay informed and remain engaged.
- Heavily studied The Bruce Power site is heavily studied, regulated, and reviewed by multiple agencies on an ongoing basis. The Bruce Power site also features previous Environmental Assessment (EA) work dating back to the early 2000s.
- Active Indigenous participation Bruce Power remains committed to fostering a strong connection with Indigenous communities through meaningful partnerships, employment for skilled workers, and training opportunities.

Given the nature of Bruce Power's contract with the IESO, taking on additional risk for investment is not feasible through any current mechanism. The Bruce Power Impact Assessment (IA) project would create flexibility for Ontario by starting an extensive regulatory process required to maintain incremental nuclear energy as a strategic option for the province as it plans for the next two decades and beyond. The P2D Study by the



IESO highlights the need for maximum planning flexibility if Ontario is to pursue a lower-carbon electricity future and meet net zero goals.

The Bruce Power IA undertaking would seize the opportunity to, at minimum, preserve an important option to sustain Ontario's nuclear workforce and economic benefits for generations while addressing undeniable electricity supply needs with cost-effective, emissions-free power, and reduce long-term ratepayer risk exposure by hedging supply and procurement.

For these reasons Bruce Power recommends:

Enable cost recovery for siting to allow the impact Assessment process to begin.

A directive to IESO to make accommodations for predevelopment costs associated with the planning for incremental, emissions-free nuclear generation at the Bruce site is consistent with the findings of the Pathways to Decarbonization report and is in the prudent interest of Ontario electricity consumers.

Regulatory modernization

Time is of the essence to start the IA process to ensure that the recently announced Clean Electricity Tax Credit remains available for design and construction of a new asset. The tax credit is currently set to expire in 2034. The Bruce site can accommodate more nuclear generation than exists today, but unlocking that optionality is contingent upon approval from the province to move the project forward now. To facilitate the necessary changes to the IA process, the province must move forward expeditiously on its no regret actions, and signal its approval for the cost recovery process so that improvements can be made to the federal IA process explained below.

This can be done by moving forward on the no regret actions and adopting the following recommendations:

- Enable cost recovery for siting to enable the impact assessment process to begin
- Prioritize long lead assets that are of strategic importance to province by leveraging existing infrastructure and brownfield sites

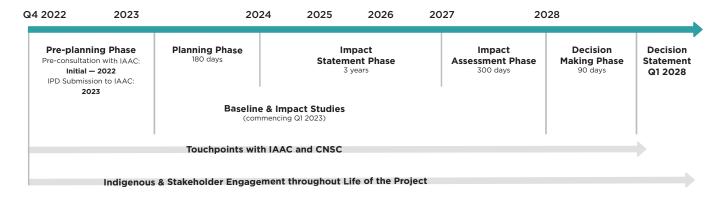
The path to net zero will require a dynamic regulatory environment that is more flexible than current standards. Currently on licensed sites, construction of new nuclear reactors with output greater than 900 MWt is currently subject to IA, as specified in federal legislation adopted in 2019. The estimated timeline under the current IA process when Bruce Power will receive a Decision Statement (i.e., a determination that the project is in the public interest and may proceed under certain conditions) is six years and will involve intensive stakeholder, community, and Indigenous engagement at every stage.







Figure 4: Timeline of current Impact Assessment process



There is an opportunity to tailor the current IA process to aid the federal government to meet its own stated targets for decarbonization. In fact, many global jurisdictions (France and UK) are introducing new legislation to accelerate the process for brownfield sites.

The Bruce Power site is heavily studied, regulated, and reviewed by multiple agencies on an ongoing basis. The Bruce Power site also features previous Environmental Assessment (EA) work dating back to the early 2000s. Together these factors must be considered for any new possible expansion which may be needed to achieve our emission reduction objectives.

To align policy and regulatory processes, steps must be taken to streamline this process, specifically for brownfield sites like Bruce Power. This can be accomplished in the following ways:

- Acceptance of previous studies Any previously approved environmental studies/assessments (i.e., recently approved Environmental Risk Assessment for the site and approved Environmental Assessment for the Refurbishment of Bruce A Units 1-4), which were subject to public consultation and verified through follow-up activities, be accepted for the baseline studies for an IA at the Bruce Site.
- Avoid duplication from current licensing process —
 Any previously approved supporting studies (i.e., emergency preparedness, security, safety assessments) which are part of the current licensing basis and are subject to periodic update and inspection by the CNSC be accepted as components for an IA at the Bruce site. This will allow for existing safety programs to be accepted as appropriate for new generation on the Bruce Power site.
- Adopt a tailored IA process Allow the IA process to utilize two existing approved elements that will determine the potential effects of a expanded nuclear development that have been previously reviewed and approved by the federal agencies such as the CNSC, Environment Canada, Health Canada and a range of other organizations. The tailored IA approach would require concurrence from the CNSC and IAA for the bounding plant envelope that factors in the improvements and updates the one that was reviewed and approved as a project for the Darlington New Nuclear Project (DNNP). This bounding envelope should apply because the Bruce Power project will be the same 4,800 MW project that was assessed for EA purposes in the Darlington Environmental Impact Statement (EIS).







In order to meet the federal government's aggressive decarbonization targets, previous work at brownfield sites cannot be ignored. Failing removal from being a designated project, this existing work from the Bruce Power site should be recognized under the current IA process, reducing costs to both government and industry.



Harmonization of energy infrastructure planning and implementation

Ontario's electricity sector is committed to continue building the electricity grid needed to support a strong economy and enable the growth of Ontario's clean energy advantage for future generations. Ontario's electricity system is presently anchored around large, clean, dependable and reliable sources of energy like nuclear, supported by smaller, intermittent/distributed resources to address the needs of the province. This will continue to be important. The grid of the future will need to further enable the development of clean energy sites for reliable baseload nuclear and renewable generation.

The IESO Pathways to Decarbonization report signaled that a range of large, new infrastructure projects will be required to meet the forecasted gradual increase in generation capacity and load growth between now and 2050. To build the infrastructure required to advance decarbonization, the electricity sector must work in lockstep to ensure coordination and alignment. Expansion of the electric generating capacity based on clear assumptions, will have implications for the adequacy, reliability, affordability, economic growth, and security of the interconnected grid. Building critical transmission infrastructure to enable economic growth, generation capacity and load growth requires proactive planning and coordination, along with meaningful partnerships with Indigenous communities and municipalities.

Optimized and cost-effective deployment of this new infrastructure will require alignment on consistent assumptions for electrification and decarbonization and decisions to prioritize key projects. The delivery of those projects will require cross industry and sector collaboration to avoid the pitfalls of fragmented, reactive energy system planning. When the nuclear units were originally constructed on the Bruce, Pickering, and Darlington sites, the infrastructure decisions were made under the purview of one company. This allowed

for line of sight and alignment across planning, generation, and transmission, which today is divided between multiple generators, transmitters, and the Independent Electricity System Operator.

Each of these parties recognize the important role they play and are committed to helping build the electricity system of the future. However, to successfully enable the energy transition, we need to align on core infrastructure projects and coordinate implementation. This is why Bruce Power, Hydro One and OPG are working to align on infrastructure investments that are essential to enabling Ontario's path to decarbonization. Only through collaboration based on consistent assumptions and project goals will Ontario be able to achieve the pathway to decarbonization.

With alignment from key stakeholders and strategic industry collaboration, we can ensure that prioritized projects will proceed in a coordinated manner, to build the needed infrastructure and enable long term provincial energy goals.

Now more than ever before, stakeholders must work together, with support from government to prioritize long lead-time, strategically important infrastructure projects. This is essential to meeting the future needs of Ontario customers and the clean electricity system.

For this reason, Bruce Power recommends:

Optimize the level of coordination between various utilities, communities, and Indigenous communities in support of sites.

Active Indigenous participation

The Bruce Power site is located on the eastern shore of Lake Huron near Tiverton, Ontario, within the traditional lands and treaty territory of the people of the Saugeen Ojibway Nation (SON), which includes the Chippewas of Nawash and Saugeen First Nation.

Bruce Power remains committed to fostering a strong connection with Indigenous communities including SON, the Historic Saugeen Metis and the Metis Nation of Ontario through meaningful partnerships, employment for skilled workers, and training opportunities.

In regard to Indigenous communities, consultations should be held early and often, in a manner consistent with the Truth and Reconciliation Commission's Calls to Action.

Bruce Power believes partnerships should also be pursued with Indigenous communities on major infrastructure projects. Meaningful partnerships ensure projects are developed around Indigenous principles of land stewardship, with continuous engagement throughout the life cycle of projects and long-term benefits in line with economic reconciliation.

For example Bruce Power's collaboration with SON will see the partners jointly marketing new isotopes in support of the global fight against cancer while also working together in creating new economic opportunities within the SON by establishing new isotope infrastructure.

The partnership, which includes a revenue sharing model for SON, is named Gamzook'aamin aakoziwin, which means 'We are Teaming up on the Sickness' in the traditional Anishinaabe language.

Among these no regret actions are:

- 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; and
- Galvanizing collaboration amongst stakeholders and Indigenous communities.

The IESO's Pathways to Decarbonization document revealed the need for potentially 17,800 MW of new nuclear by 2050, sending a clear signal that nuclear power is essential to building an achievable path to net zero. The IESO also identified several "no regret" actions that can be taken to help meet growing demand, address retirements of existing generation and ensure a state of readiness to manage any future decarbonization policy.

The Bruce Power IA process (noted above) would help to achieve both actions in a meaningful way. Specifically, the importance of early and consistent engagement with the SON be overstated. Bruce Power's partnership with the SON is of the utmost importance as we embark on this process.

We are committed to meaningful engagement with the SON, and we will continually seek opportunities to expand our partnership throughout the IA process in a way that reflects the community's unique needs and interests and that is consistent with the path of reconciliation. They will guide their participation in the process and identify ways they would like to be engaged and involved.

Opportunities to unlock this collaboration were announced by the federal government in Budget 2023 which through the Canada Infrastructure Bank (CIB) enables loans to Indigenous communities to support in purchasing equity stakes in infrastructure projects in which the Bank is also investing. This type of action is necessary to help solidify Indigenous participation in major infrastructure projects and Bruce Power intends to work with the SON to fully leverage these opportunities.

For this reason, we recommend:

Optimize the level of coordination between various utilities, communities, and Indigenous communities in support of sites.







Unlocking the potential of nuclear innovation

Ontario is fortunate to be a global leader in nuclear energy. Nuclear power is a safe, reliable and clean source of electricity essential to reaching our emissions reduction goals and supporting Canada's energy transition. Ontario has been at the forefront of nuclear technology innovation for 75 years, and seizing Ontario's nuclear advantage by leveraging the industry's world-class supply chain is critical to developing the next generation of clean electricity technologies and assets.

Ontario's nuclear sector supports most of the industry's 76,000 good-paying, highly skilled jobs in Canada, generating billions of dollars in GDP annually. It also is an innovation leader in the production and export of cancer-fighting medical isotopes which support global health care, and in potential new applications including low-carbon hydrogen production.

Investments have been and continue to be made to modernize the existing CANDU nuclear fleet. Refurbishment programs at Darlington and Bruce Power to safely extend the life of operating units another 30 years or longer represent two of the largest clean energy infrastructure projects in Canada. The programs include a series of innovations to reduce operating costs and enhance safety and efficiency. The nuclear industry in Canada has a domestic supply chain of more than 250 companies who have been supporting reactor refurbishment programs in Ontario and stand ready to help the industry meet the growing demand for clean power.

Ontario has a strong recapitalized supply chain with expertise in the innovative design and production of components for current nuclear refurbishment programs and has the capacity to undertake new large-scale builds. The opportunities to further advance this technology are boundless. When it comes to deploying nuclear power as a key part of the solution, Ontario is ready.

There are ongoing efforts to modernize reactor design that will enable nuclear power to be adopted as a best fit for best need. This includes everything from micro SMR's to next generation large scale reactors. Additionally, nuclear energy is well placed to produce zero-carbon hydrogen as an emerging energy carrier with a wide range of applications. Essentially when it comes to nuclear potential the opportunities are endless.



Conclusion

Ontario's energy system is about to undergo tremendous and possibly unprecedented transformation in the years ahead on the path to net zero and to meeting Ontario's increasing electrification demand.

If the province is to achieve the goals, it has set forth proceeding with the IESO "no regret actions" must occur in a timely process. For that reason, Bruce Power makes three recommendations:

- Enable cost recovery for siting to enable the Impact Assessment process to begin
- 2. Prioritize long lead assets that are of strategic importance to the province by leveraging existing infrastructure and brownfield sites
- 3. Optimize the level of coordination between various utilities, communities, and Indigenous communities in support of sites

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



The scientific consensus is clear — net zero needs nuclear.