

We Power the Future of Electricity Generation

*Ontario*  
ENERGY  
REPORT

ONTARIO ENERGY REPORT — WE POWER THE FUTURE OF ELECTRICITY GENERATION

  
BrucePower™





Powering Today for Tomorrow

# EXECUTIVE SUMMARY

At Bruce Power, our core business is supplying safe, reliable electricity to the people and businesses of Ontario, and medical isotopes globally. Our business relies on our dedicated workforce of engineers, technicians and operators to use creativity, attention to detail and innovation in achieving continuous improvement in our goal to power Ontario's future for decades to come.

This year, as the world faced unprecedented challenges due to the COVID-19 health crisis, Bruce Power turned its innovative firepower into initiatives to help our communities and the Province of Ontario in our collective fight against the pandemic.

As the realities of the pandemic hit, Bruce Power sprung to action to implement proactive health and safety measures at the plant site, to ensure continued safe, reliable, low-cost electricity would be produced to meet the demands of the province of Ontario. Utilizing an extensive network of procurement and manufacturing resources, Bruce Power secured and donated more than two million pieces of personal protective equipment (PPE) to the province and local communities in the fight against the pandemic. The launch of the COVID-19 Retooling and Economic Recovery Council (RERC) by Bruce Power and its nuclear supply chain partners leveraged the robust resources of the industry to assist the

province in the fight against the virus and to help aid economic recovery post-pandemic.

Now, as we look to the future, this same innovative spirit at the heart of Bruce Power's operations continues to drive us forward as we face challenges of climate change head on as a part of the global community. The announcement of Bruce Power's Net Zero 2050 strategy builds off of the company's clean energy infrastructure, and provides a pathway for continued contributions to a Net Zero Canada. With nuclear power as the backbone of Ontario's low-carbon electricity system, Bruce Power will continue to support good jobs and economic growth as we emerge from the pandemic. Through innovation and made-in-Ontario solutions we can tackle the environmental challenges of our generation. Bruce Power is here to lead our future decarbonization efforts for a cleaner greener future.





# 867,810

3-ply masks donated

700,650

surgical masks

39,870

N-95 masks

11,299

face shields

564,470

bottles of hand sanitizer

94,625

pairs of nitrile gloves

25,895

gowns and coveralls

Bruce Power and COVID-19

# WE'RE HERE FOR YOU

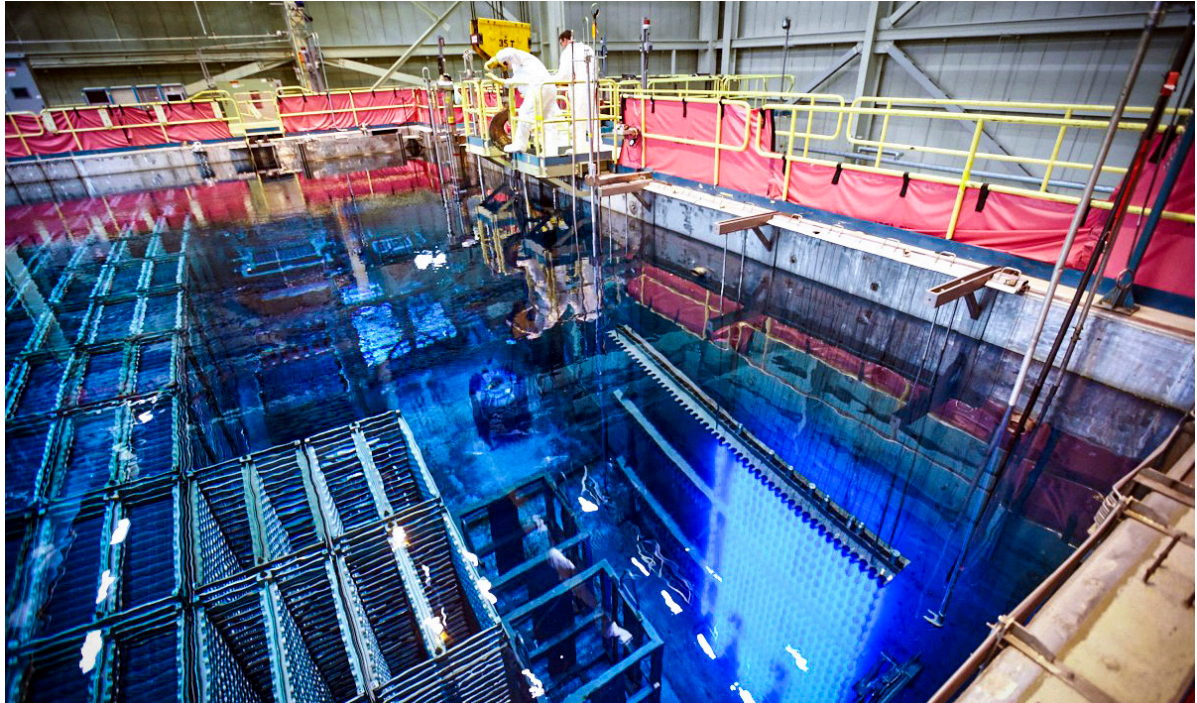
Beyond providing reliable electricity to the hospitals and people of Ontario, Bruce Power has been proud to play an active role in Ontario's fight against COVID-19.

Bruce Power's commitment to supporting communities through the pandemic and recovery efforts resulted in donations to front-line organizations across the province of over two million pieces of personal protective equipment (PPE). This represents the largest private-sector donation of PPE in Canada.

Bruce Power's efforts assisted all levels of government during the pandemic, supporting initiatives all across Ontario. In Bruce Grey, in the community which Bruce Power calls home, we worked hand in hand with crucial organizations to make sure that Bruce County and the surrounding areas had the extra help they needed.

Recipients included front-line organizations such as:

- Health Care Services: Ministries of Health, hospitals, long-term care facilities, medical clinics, midwife services, home care services.
- First Responders: Police departments, fire departments and paramedics.
- Dozens of food banks and non-profit organizations through Bruce, Grey and Huron counties.
- Indigenous Communities: Saugeen, Nawash, Métis Nation of Ontario, and First Nations communities in northwestern Ontario.
- Schools in Bruce, Grey and Huron.
- Small businesses in Bruce, Grey and Huron.



Keeping medical equipment clean and safe in the ongoing fight against COVID-19

# COBALT-60

Cobalt-60 has been used for more than 30 years to sterilize syringes, gowns, gloves and sutures, and Cobalt-60 from Bruce Power helps to sterilize about 40 per cent of the world's single-use medical devices.

Ontario's reliable supply of Cobalt-60 provided by Bruce Power and Ontario Power Generation (OPG) has been critical through 2020 as health-care systems across the world have been under significant pressure due to COVID-19.

Due to high demand, the need for single-use medical equipment has increased over the course of the pandemic and subsequent health crisis.

While other sterilization methods take up to seven days before products are available for use, gamma irradiation technology using Cobalt-60 can process such materials within a day. Cobalt-60 irradiation sterilizes equipment faster and in

larger volumes than other forms of sterilization, ensuring more supplies can get to the front-line health-care workers and hospitals, even as demand for these items has increased.

In 2020, Bruce Power supplied enough Cobalt-60 to sterilize between 20 and 25 billion pairs of gloves or COVID-19 swabs.

Bruce Power will continue to play a critical role in ensuring the lights stay on for Ontario's hospitals, operating rooms and life-saving equipment, while also providing a reliable source of Cobalt-60 to keep medical equipment clean and first responders safe.





## COVID-19 Retooling and Economic Recovery Council

# RERC

In April, Bruce Power launched the Retooling and Economic Recovery Council (RERC) as a way to bring together Ontario's nuclear supply chain, and focus efforts on the fight against COVID-19. The council is comprised of a diverse group of organizations across the nuclear sector, with a common goal of leveraging their collective assets, resources and knowledge to assist in the fight against the pandemic and to help economic recovery in the province.

Ontario's nuclear supply chain is well-positioned to assist in the fight against the pandemic, and the council has had a number of notable accomplishments in the short time since the group began.

- Facilitated a collective shift in production to support Ontario's fight against COVID-19, leading efforts to build new ventilators, assisting testing efforts, and supplying medical gowns among other needed supplies to fight the pandemic.
- Provided emergency response capabilities for mobile hospitals across Bruce, Grey and Huron counties, as well as deploying 150 pop-up hospital beds in Windsor-Essex.
- Raised over \$500,000 for 38 food banks in our communities, and distributed care packages for those in need and front line workers.
- Distributed 50,000 litres of hand sanitizer to small businesses, community organizations, first responders and Indigenous communities across Ontario.
- Assisted public health officials in Grey-Bruce and Huron-Perth by hosting Virtual Town Halls and live information sessions that reached over 250,000 people.

The council has continued to focus its efforts on the critical needs of Ontarians as we battle the pandemic, and look forward to meaningful paths to economic recovery.

The COVID-19 pandemic has changed the world. Fighting COVID-19 can be achieved along with retooling and lasting economic recovery. The Bruce Power Retooling and Economic Recovery Council has committed to exploring ongoing opportunities for enhancing global health through isotopes, leveraging the nuclear supply chain to be self-sufficient with PPE and furthering opportunities to expand sterilization using Cobalt-60.

“There’s no path to netzero without nuclear power.”

— SEAMUS O’REGAN, MINISTER OF NATURAL RESOURCES

Bruce Power’s Plan

# NET ZERO 2050

In October, Bruce Power unveiled its strategy to contribute to Net Zero Canada. The plan, NZ-2050, builds off the strong foundation of the Bruce Power revitalization project, the largest clean energy infrastructure program in Canada, and positions clean energy at the centre of a plan to grow the economy and support innovation in the province of Ontario.

The NZ-2050 strategy consists of five pillars:

1. Optimize and leverage existing investments in Canada’s largest private-sector infrastructure project to drive further decarbonization.
2. Foster innovation in new energy technologies including new nuclear and fusion energy.
3. Utilize nuclear power generation to produce clean fuels and electrify industrial processes and transportation with a historic opportunity to contribute to a national hydrogen and clean fuels strategy.
4. Create an ecosystem of “green collar” jobs including the nuclear, manufacturing, and energy development sectors with a focus on diversity and more representation from women, visible minorities and Indigenous peoples.
5. Inspire innovation by supporting strong social responsibility and sustainability, and providing contributions to global health such as life-saving medical isotopes as the world battles COVID-19.

**NETZERO** **2050**  
 BRUCE POWER’S PLAN  
 TO CONTRIBUTE TO  
 CANADA’S PROSPEROUS,  
 CLEAN ENERGY FUTURE



Moving towards Net Zero

# INNOVATION AND POWERING THE FUTURE

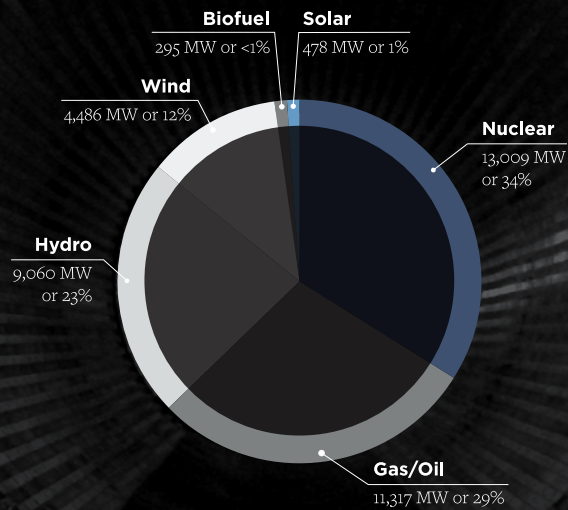
Bruce Power has already started to put in the work to achieving its NZ-2050 goals. In November, Bruce Power announced several initiatives with the joint Nuclear Innovation Institute/Bruce Power Centre for Next Generation Nuclear. These initiatives are underway, and will continue through 2021 to provide a backbone for the NZ-2050 program.

**Projects underway include:**

- A study into the next 50 years of the Bruce Power site. As the world's largest operating nuclear facility with assets that can be optimized, enhanced, leveraged and life extended, Bruce Power can have a profound impact on Canada's clean energy future. This study will be released in 2021.
- *The Hydrogen Unity Project.* Hydrogen can be used in conjunction with nuclear to perform electrolysis and generate power. The Hydrogen Unity Project will evaluate mass production of hydrogen using nuclear technology, and opportunities to align with the oil and gas, transportation, and electricity generation sectors.
- The NII will examine the role of new nuclear and fusion energy technology as part of a clean energy future alongside existing Bruce Power nuclear production. This will include grid-scale small modular reactors, and build off an announcement with Westinghouse in October 2020 on the potential for these micro-reactors to provide flexible power for the future of Ontario.

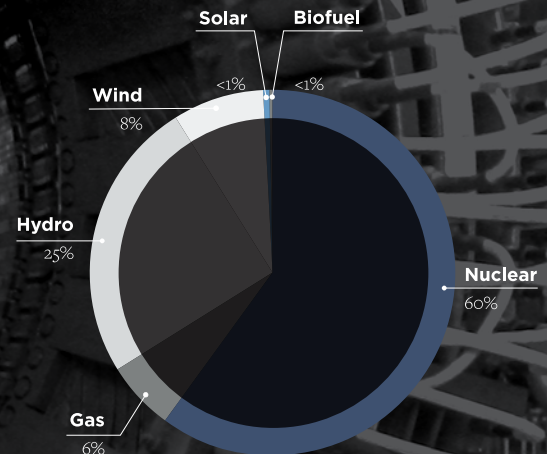
Innovation is at the heart of Bruce Power's business. Bruce Power's Net Zero 2050 strategy builds off of Bruce Power's clean energy infrastructure, and provides a pathway for continued contributions to a net-zero future. Bruce Power's vision of a clean future is one that will continue to support economic growth as we emerge from the COVID-19 pandemic, and supports the continued innovation and made-in-Ontario solutions to drive lower Green House Gas (GHG) emissions in the province.

fig. 1 Ontario's Electricity Supply Mix



Source: IESO Reliability Outlook, 2020

fig. 2 Ontario's Electricity Production in 2020



Source: IESO

Electricity supply in Ontario comes from a diverse mix of different fuel types: Wind, solar, hydro (water power), natural gas, and nuclear. Managing a balanced supply stack which is flexible, reliable, affordable, and low-emitting as possible ensures Ontario always has the electricity it needs to keep the lights on.

While nuclear generation is only 34 per cent of the total generation capacity available in the province, nuclear power accounts for over 60 per cent of the total power generated to meet the province's needs. This is because other forms of generation are highly variable (such as wind or solar power) or are more expensive (such as natural gas).

Nuclear electricity is a crucial component of the electricity supply stack in Ontario. The nuclear industry continues to provide over 60% of output to the province, with Bruce Power contributing 30% of the electricity needed to keep the lights on, at a cost 30% below the average cost of residential power.

Reliable, low cost power to meet Ontario's needs through uncertain times

# ENERGY OVERVIEW

2020 has been an unprecedented year for every person, family, business and organization across the world. Bruce Power is no different, and as the pandemic unfolded in March of 2020, the company took proactive steps to mitigate the risk to the health of our employees and the safety of our facility, to ensure we could continue to provide a reliable supply of electricity to homes, hospitals and businesses across Ontario when they need it most.

Electricity demand in 2020 was impacted significantly due to the COVID-19 pandemic. Typically, Ontario is what is known as a “dual-peaking market,” which means that demand in Ontario is highest in the winter and in the summer. On a day-to-day basis, demand is also highly variable but in general it peaks during the day and is lower at night. While there is variation from year to year in the demand patterns of the province, these are largely predictable and take into account factors such as weather, commercial and industrial load, and population growth.

The COVID-19 pandemic created unusual and unexpected patterns in demand, as it impacted all businesses in unexpected ways. Demand was much lower than usual through the spring due to the pandemic and decreased industrial and commercial load. Year over year, average demand in Ontario fell through the Stage-1 pandemic closures in the spring by an average of 10 per cent as compared to 2019 figures. This trend was offset by increased demand through the summer months, which coincided with hot weather and increased residential air conditioning load throughout the hottest months of the year as more people worked from home. This summer included some of the highest demand days Ontario has seen since 2003, with peak demand over 24,000MW in July hitting a high of 24,226MW on July 9.

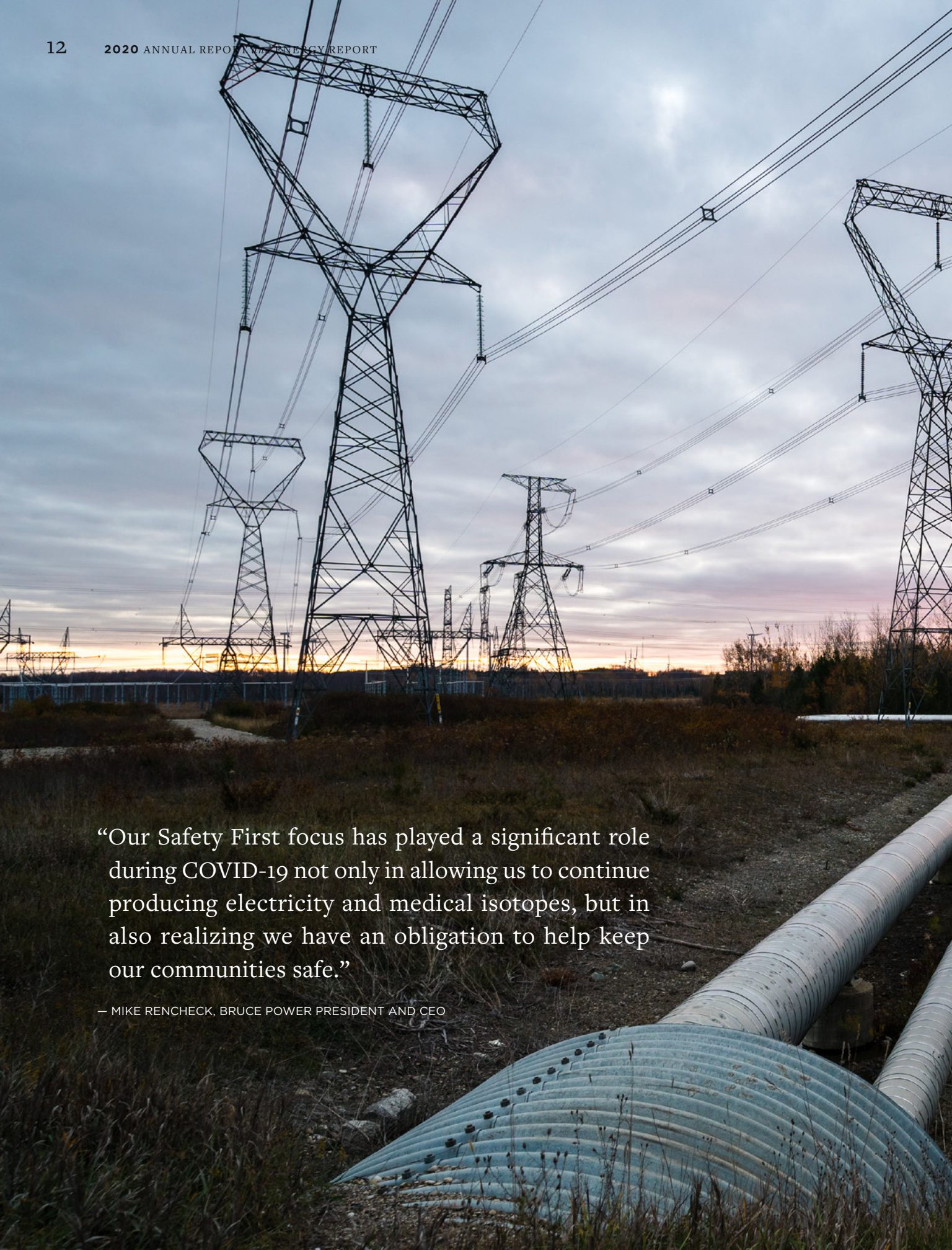
Through this uncertainty and the peaks and valleys of a roller-coaster demand profile, Bruce Power helped to keep the lights on for the businesses, hospitals, and homes in the province. Thanks to a strong proactive response, the nuclear industry worked together to quickly change protocols in order to maintain production, accounting for over 60 per cent of the output in the province even through the highest demand days.

Bruce Power's reliable, stable nuclear power helps to ensure Ontario always has the electricity it needs to keep the lights on through these uncertain times.

Nuclear power is the backbone of Ontario's electricity system and plays a critical role in helping keep costs down for Ontario residents and business. Over the past year and through the pandemic that critical role has been more important than ever. The cost of Bruce Power nuclear remained stable through 2020, even as those associated with other forms of generation fluctuated and increased due to the demand and operational challenges exacerbated by the COVID-19 pandemic.

Bruce Power continues to produce 30 per cent of Ontario's power at 30 per cent less than the average cost to produce residential power and is the source of half of Ontario's nuclear generation.





“Our Safety First focus has played a significant role during COVID-19 not only in allowing us to continue producing electricity and medical isotopes, but in also realizing we have an obligation to help keep our communities safe.”

— MIKE RENCHECK, BRUCE POWER PRESIDENT AND CEO



fig.3 Demand through 2020

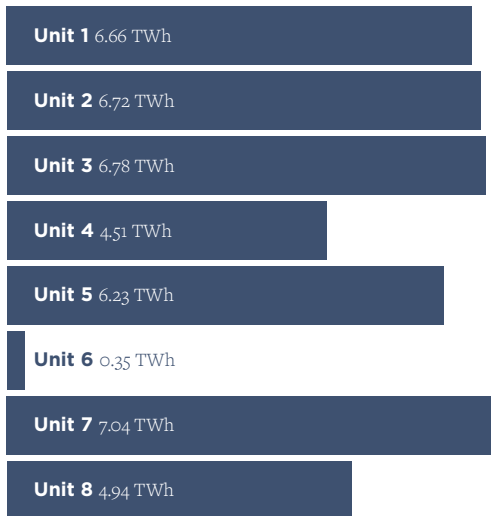


Source: IESO

Average demand in 2020 fell by 2.3 per cent year over year.

The Covid-19 pandemic impacted demand from commercial and retail load. Looking forward, the situation due to COVID-19 remains fluid and demand in the short term could see similar uncertainty as we emerge through lockdown protocols in 2021.

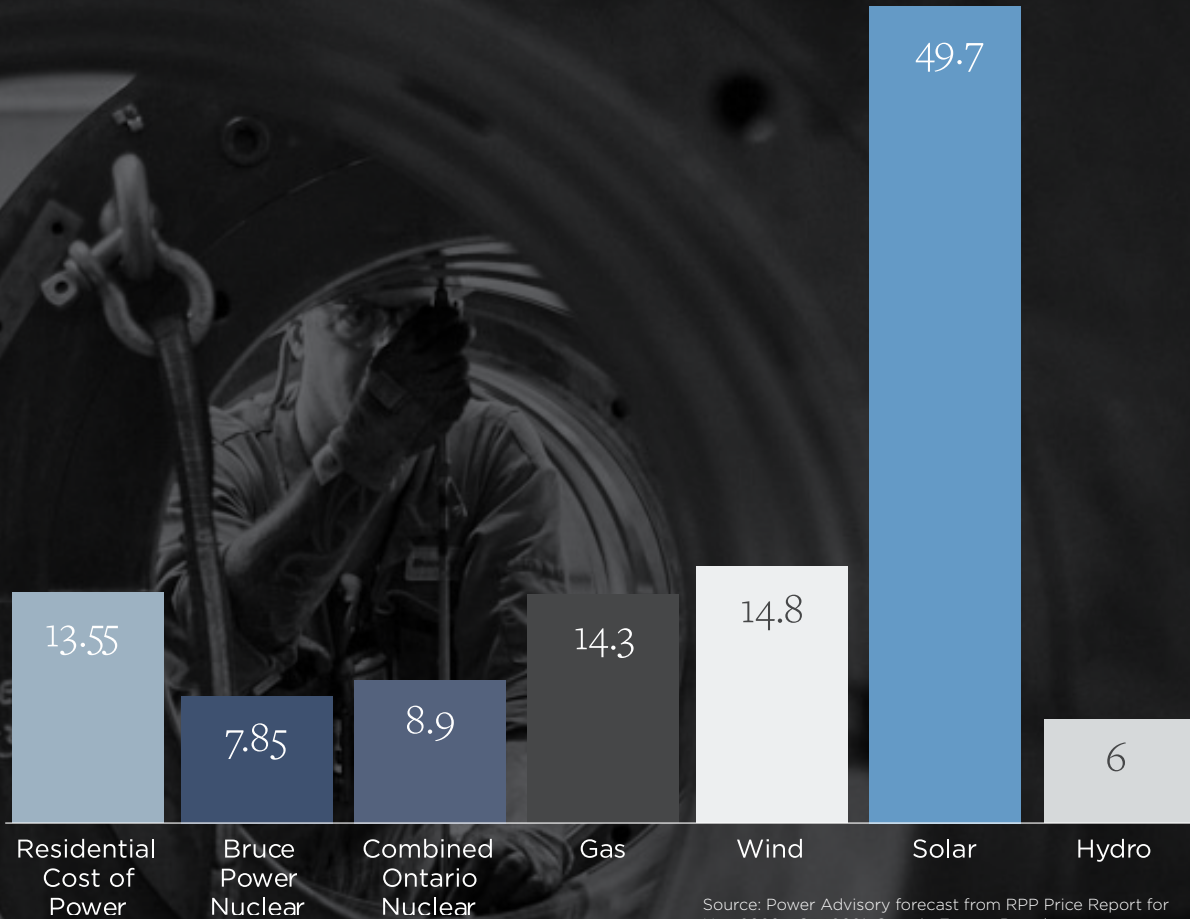
fig.4 Bruce Power 2020 Output



Source: IESO

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.

fig. 5 Cost of Electricity in Ontario - 2020 (cents per kWh)



Bruce Power nuclear is vital in keeping prices low for all consumer categories. The Bruce Power Life-Extension Program will ensure site operations through 2064 to help provide price stability for businesses looking to invest and grow in Ontario.

In Ontario, residential and small business customers can choose to pay either time-of-use or tiered electricity pricing. These fixed-rate tiers recover total system costs for generating the electricity of residential customers.

On an average annual basis, residential electricity customers pay 13.55 cents per kilowatt-hour (kWh) in electricity costs in 2020.

Some generators, like Bruce Power and hydroelectric, cost less to generate electricity per kWh than others, such as solar and wind.

When compared to other resources Ontario nuclear and specifically Bruce Power continue to deliver value for customers, producing 30 per cent of the power for the province, at a price 30 per cent lower than the average cost of residential power.



Bruce Power's role in a

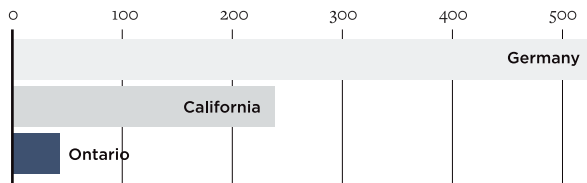
# LOW-CARBON FUTURE

Ontario's energy market has undergone significant transformation over the last decade. The province was the first jurisdiction in North America to lead the way in ending its use of coal-fired electricity, a milestone that was achieved in 2014. This could not have been accomplished without Ontario's nuclear industry.

Between 2003 and 2012, Bruce Power brought four nuclear reactors back to life. This revitalization generated 70 per cent of the energy needed to phase out coal in Ontario and allowed the province to shut down all coal plants.

Closing Ontario's coal-fired power plants represents one of the largest greenhouse gas and pollution reduction initiatives worldwide, and Ontario is a leader in low-cost, low emissions electricity. Compared to California and Germany, both of which have made massive investments in low-carbon energy sources, Ontario still leads these jurisdictions with the lowest emissions intensity by the electricity sector. Due to the reliable electricity output and low-emissions of the nuclear industry, Ontario has been able to cut emissions from the electricity sector while also maintaining a low-cost system for consumers.

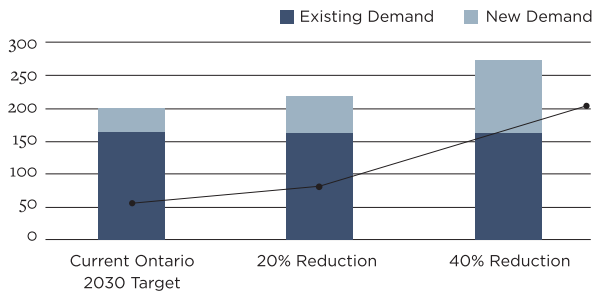
fig. 6 Emission intensity from the electricity sector by jurisdiction (gCO<sub>2</sub>e/kWh)



Ontario must do more. To meet Ontario's emission-reduction goals, Ontario must use its clean electricity to reduce emissions again.

Ontario's climate objective is to reduce emissions by 30 per cent below 2005 levels. In order to achieve this goal, Ontario will need to increase electricity production by 25 per cent compared to what we use today. Ontario's existing clean-energy supply, built on the backbone of nuclear power, is well-positioned to meet these challenges and build a world-class clean electricity system.

fig. 7 Electricity required by GHG emissions reduction objective



Source: IESO

As we look to the future, Bruce Power's Net Zero 2050 plan will build on low-emission nuclear power to provide the backbone of a clean energy infrastructure to power Ontario's future. Through continued innovation and made-in-Ontario solutions, we can support good jobs and economic growth as we emerge from the COVID-19 pandemic.

Ontario innovation at work

# LUTETIUM-177

In 2019, Bruce Power announced its partnership with Isogen to undertake a first-of-its-kind solution to produce urgently needed medical isotopes leveraging Bruce Power nuclear infrastructure as the backbone.

The project will utilize a made-in-Ontario Isotope Production System (IPS) installed in Bruce Power's nuclear reactors through the course of the Life-Extension Program currently under way at Bruce Power.

Construction began in January of a dedicated mock-up of the IPS, which was used to complete engineering, testing and design of the system. The final detailed design of the system was completed in late 2020, and the design facility will now transition to building systems for the Bruce Power reactors and serve as a training site over the coming year for operators of the system.

Pending final regulatory approvals, the first IPS will be installed into a Bruce Power reactor in late 2021.

The IPS will be used to produce Lutetium-177, a medical isotope which is currently used to treat neuroendocrine tumours and has potential future applications for prostate and breast cancer treatments as well. Cancer treatments using Lutetium-177 allow doctors to target and destroy cancer cells, while leaving healthy tissues unaffected.

The isotope project is under way and on-time. Bruce Power expects to begin to supply the world market with Lu-177 in 2022.

**Bruce Power has been proud to engage meaningful partnerships in the pursuit of innovation in the Canadian isotope supply chain.**

#### **The Saugeen Ojibway Nation**

A historic partnership to produce and market medical isotopes was launched between Bruce Power and the Saugeen Ojibway Nation, comprised of the indigenous communities of the Chippewas of Nawash Unceded First Nation and the Chippewas of Saugeen First Nation. The project name, "Gamzook'aamin aakoziwin" translates to "We are teaming up on the sickness." The Anishinaabemowin (Ojibwe or Anishinaabe language) name was developed through consultation with SON Knowledge Holder Polly Keeshig-Tobias and her collaboration with other SON Community knowledge holders and elders.

#### **McMaster University**

In July, Bruce Power signed a Memorandum of Understanding with McMaster University, an established leader in nuclear and medical isotope science and home to a suite of world-class nuclear research facilities. A study of potential applications of both established and emerging isotopes will elevate the capacity to develop Canadian solutions for the global supply chain.

#### **BWXT ITG Canada, Inc.**

Bruce Power's partnership with BWXT ITG Canada, Inc. is focused on a feasibility study for the production of additional isotopes using Bruce Power's Isotope Production System.







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