Ontario Nuclear Collaboration

Report 2020

Bruce Power™
Innovation at work

ONTARIO POWER GENERATION

Filed: 2021-04-19
EB-2020-0290
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We're all in this Together

More than a decade ago, when Bruce Power and OPG began planning our individual nuclear refurbishment programs, neither organization could have foreseen the world-wide disruption to lives that would be caused by the COVID-19 pandemic. Like most companies around the world, we had to respond swiftly and effectively to ensure the health and safety of our workers while continuing safe power generation and maintaining momentum on critical projects underway.

The results of our actions were work environments with increased safety and health precautions and the continued and steady generation of electricity for the province. With Darlington Unit 1 setting a world record for continuous operations over 1,000 days and Bruce Power Unit 1 setting a site record of 694 days of continuous operations.

This agile and immediate response was enabled by our robust individual business continuity plans and by the on-going spirit of collaboration between our two organizations — a collaborative approach that has been central to our various efforts over the years and continues to drive success during our refurbishments.

In this report, along with highlighting our responses to the pandemic, we detail how Bruce Power and OPG continue to work in alignment to meet our commitments on the Major Component Replacement Program and the Darlington Refurbishment Project through an established practice of knowledge-sharing, applying lessons learned and leveraging economies of scale. We also highlight our work in areas that will have a positive impact on the collective future of Ontarians. Notably, our individual agreements with BWXT Canada and ISOGEN to harvest Molybdenum-99 and Lutetium 177, life-saving radioisotopes used in diagnostic and medical treatments around the world each year, helping to detect illnesses such as cancer and heart disease.

We're all in this Together.

This is a sentiment that has been echoed around the world as we all seek to recover from the dual health and economic crises brought on by COVID-19. It's also a sentiment that has been shared by our two organizations long before the pandemic and prior to our refurbishments.

Our economic development impacts are unparalleled in Ontario, so as we continue to implement Canada's second and third largest infrastructure projects, this economic engine will continue to support thousands of jobs across Ontario and produce billions of dollars in economic activity. These highly-skilled jobs in the STEM fields and trades are providing the people of Ontario with the ability to work in an innovative and technical field, tackling today's biggest challenges like climate change and decarbonization, right here at home.

As Ontario rebuilds its nuclear fleet in the years ahead, Bruce Power and OPG will continue to work together to support our communities and deliver on our commitments on the Major Component Replacement Program and the Darlington Refurbishment Project, generating decades more of low-cost, reliable and clean energy for the province of Ontario.

Ken Hartwick
OPG
President and
Chief Executive Officer

Michael W. Rencheck
Bruce Power
President and
Chief Executive Officer

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By the Numbers

The COVID-19 pandemic was a call to community action for Bruce Power and OPG. In addition to the continued safe operations of our plants, ensuring the well-being of our host communities remained one of greatest priorities. Our organizations each responded with several individual initiatives, the impact of which has been far-reaching and has inspired on-going community support.

As at September 30, 2020

Ontario Power Generation

Personal Protective Equipment (PPE) donations

- 1 million surgical masks
- 75,000 N95 masks
- 17,500 Tyvek protective suits
- 9,000 cloth masks
- 10 Power Assisted Air Purification Respirators to Sunnybrook Health Sciences Centre;
- 22,000 face shields (built in partnership with others)

Emergency support

- $500,000 to Feed Ontario to help launch their province-wide emergency food box program
- $250,000 to the Regional Food Distribution Association of Northwestern Ontario to distribute emergency food support to First Nations
- $150,000 to Feed the Need to buy and distribute food to organizations across Durham Region;

- $150,000 to 15 other partner and neighbour First Nation communities
- $250,000 to Jack.org to promote the *Be There* mental health online program to youth (year-long campaign)
- $200,000 to TVO to promote online children's education programming to help engage and educate kids at home, during the pandemic
- $10,000 to support teacher recruitment and training for First Nations communities
- $200,000 to the Prosperity Project, as lead sponsor of the campaign encouraging women, who have been disproportionately impacted by COVID-19 job losses, and girls to consider careers in STEM and the skilled trades

Bruce Power

Personal Protective Equipment (PPE) donations

- 2.5 million pieces of PPE to front line workers
- 21,550 pieces of PPE for recovery centres in Grey and Bruce Counties.
- Enough isotopes in 2020 to sterilize between 20-25 billion pairs of surgical gloves or COVID swabs

Emergency support

- $120,000, raised by employees, present and past, to support 38 local food banks
- $1 million to food banks in the Grey-Bruce County region
- 3,000+ care packages distributed within the Grey-Bruce County region
- 50,000 litres of hand sanitizer distributed to local businesses, community organizations, food banks and Indigenous communities
- $400,000 from Bruce Power and the Power Workers' Union to the University Health Network to accelerate research in COVID-19 prevention, diagnostics, anti-viral therapies and cures.
- 190,000 community updates issued, in partnership with local health units, to raise awareness and stop the spread of the virus.
- Formed the 101-member Retooling and Economic Recovery Council (RERC), of which OPG is a member. RERC is committed to leveraging the province's robust nuclear supply chain to continue to assist in Ontario's fight against COVID-19 and to aid in economic recovery.

Bruce Power's role in helping Ontario during the fight against the COVID-19 health crisis was recognized by Canadian Manufacturing magazine as the Services award winner of the Responding to COVID-19: Industry Leadership Honours.

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Ontario's Nuclear Fleet

Bruce Power

Bruce Power is a Canadian-owned public-private partnership of TC Energy, Ontario Municipal Employees Retirement Systems (OMERS), the Power Workers' Union and The Society of United Professionals. The company employs more than 4,000 people and, over the past 15 years, has been one of the largest investors in Ontario's electricity infrastructure, providing billions in private dollars to the Bruce Power site — which continues to be owned by the province.

Major Component Replacement Program

In December 2015, Bruce Power reached an agreement with the Independent Electricity System Operator (IESO) to advance a long-term investment program which would refurbish its nuclear fleet and help secure the site's operation until 2064. Bruce Power's Life-Extension Program started in 2016, enabling the completion of asset management and maintenance outages. The program has been executed on plan with over $2 billion invested, creating and sustaining 22,000 jobs annually and contributing over $4 billion per year to provincial GDP. 90% of Bruce Power's spend on this project is in Ontario and 98% in Canada, making it truly a Canadian-led infrastructure project. Over 250 supply chain companies across Ontario and hundreds more across Canada are supported through this initiative.

As part of the Life-Extension Program, Bruce Power began its intensive Major Component Replacement (MCR) Program in January 2020. This program focuses on the replacement of key reactor components in Units 3 to 8 and enables the completion of asset management and outage maintenance on a range of nuclear and non-nuclear

systems during the shutdown period. A number of key vendor partners were awarded contracts to complete various scopes of work including Black & McDonald, SGRT — a joint venture formed among AECOM, Aecon and Framatome, Shoreline Power Group - a consortium of Aecon, AECOM and SNC-Lavalin, and Nuvia Canada Inc.

The first MCR in Unit 6 is scheduled to be completed in 48 months with each subsequent refurbishment taking less time and costing less money.

Ontario Power Generation

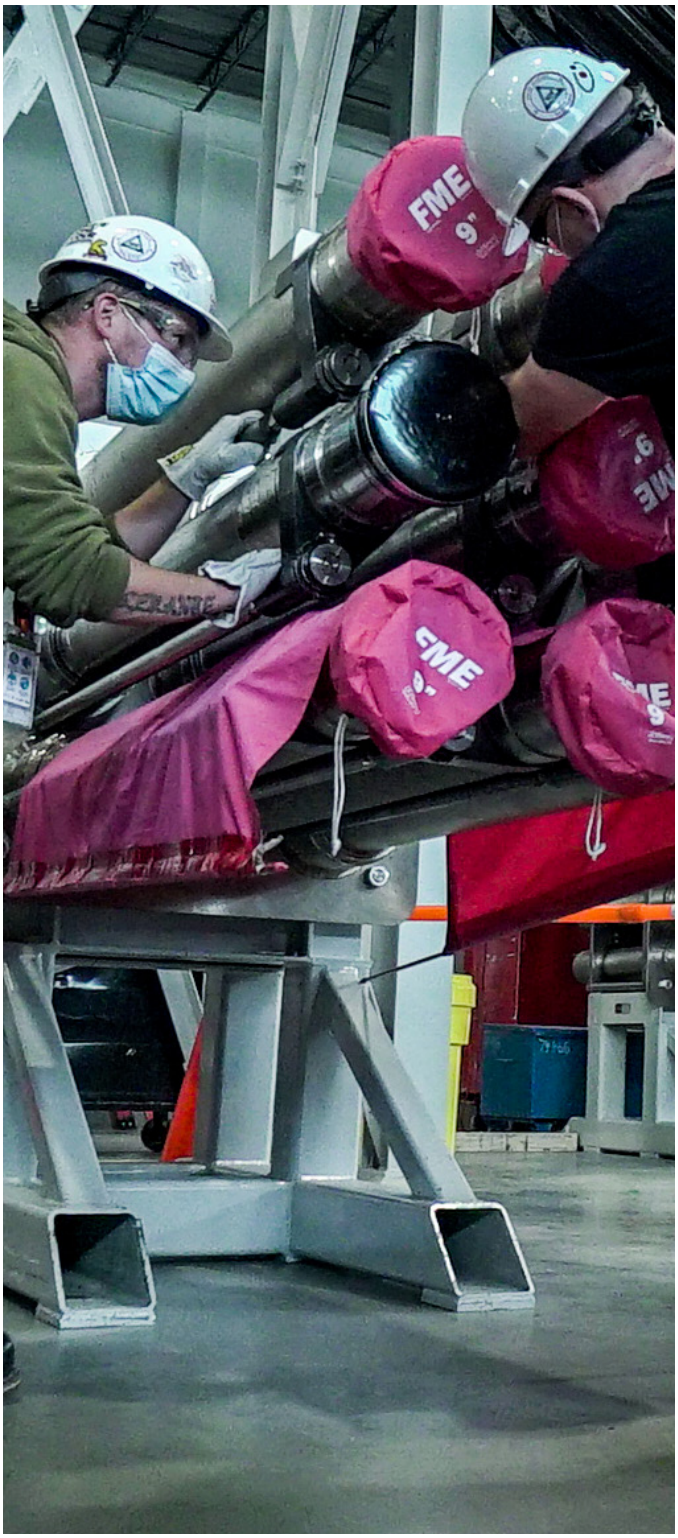
Ontario Power Generation produces about half of the electricity Ontarians rely on every day. Our power is clean, reliable and costs an average of 40 per cent less than other generators. With operations that span the province from Cornwall to Kenora, we value the safety and health of our communities and 9,000+ employees above all else.

Darlington Refurbishment Project

One of Canada's largest clean energy projects, the Darlington Refurbishment Project will extend the operating life of OPG's Darlington Nuclear Generating Station and generate another 30-plus years of clean energy for the province. The four-unit refurbishment is a $12.8 billion project that is expected to generate nearly $90 billion in economic benefits for Ontario by its completion in 2026 and from a clean energy perspective take the equivalent of two million cars off Ontario's roads, per year.

OPG has been executing a large number of refurbishment related projects since 2010. Since 2016, with our project partners, OPG has shut down Unit 2, refurbished the reactor and returned it to commercial service on June 4, 2020 - on time and on budget. Following a brief delay due to the global pandemic, OPG took Darlington Unit 3 offline on July 30, 2020 and began the first stages of reactor disassembly on September 3, 2020.

The four-unit Darlington Refurbishment Project is scheduled for completion by 2026.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Areas of Nuclear Collaboration

Pandemic Response Alignment

When COVID-19 brought global activity to a pause in March 2020, Bruce Power and OPG were at critical points in our individual refurbishment programs. OPG was nearing the completion of refurbishment of Darlington Unit 2 and Bruce Power had just begun execution of its Major Component Replacement (MCR) Program on Unit 6. In order to mitigate the pandemic's impact on these projects, our two companies established several virtual forums for knowledge-sharing and alignment.

One of these initiatives was a joint committee with Commercial Management and Supply Chain team members, which met on a biweekly basis between March and June to review common supplier concerns, discuss mitigating strategies and help ensure our pool of nuclear suppliers were engaged and supported by both organizations during the early months of the pandemic.

Topics at these meetings included suspension of non-critical construction, at-risk suppliers and the implementation of increased health and safety measures across the projects.

At the beginning of June, the focus of these meetings shifted to return-to-work plans and best practices for restarting suspended work.

Bruce Power and OPG Collaborate on new Dosimetry Tool

Managing worker radiation dose is vital to ensuring worker safety at our nuclear power plants. To monitor worker dose limits during parallel refurbishments at Bruce Power and OPG, our two organizations have worked together to develop a dosimetry tracking tool to monitor workers' one- and five-year dose histories across both sites, and in accordance with governing privacy requirements.

The new tool will provide the most up-to-date and accurate reporting of dose accumulation while continue to keep workers safe.

The tracking tool was rolled out in June and the confidential dose information is being stored in a secured digital location with limited access, and oversight provided by Bruce Power and OPG.

Improved efficiencies through document and information sharing

Continual improvement and process efficiencies continue to be a focal point between Bruce Power and OPG.

Through Executive weekly calls between Bruce Power and OPG, information was effectively and efficiently shared to address and mitigate any concerns or risks to the project schedules.

Both companies were able to leverage one another to improve efficiencies across our individual projects.

Collective interactions during 2020, (as of September 30):

- Documents requested by Bruce Power: 135. Out of these requested documents 108 were disclosed by OPG. 27 Documents are pending or non-releasable.
- Documents requested by OPG: 85. Out of these requested documents 52 were disclosed by Bruce Power. 33 documents are pending or non-releasable.
- Via weekly calls between the OPG and Bruce Power Project teams, information was effectively and efficiently shared, including lessons learned and addressing threats to the projects.

Sharing Assets

In the spirit of collaboration, Bruce Power and OPG have gone beyond sharing lessons learned and documents and established a process to share critical resources, subject matter experts, tooling and equipment.

In 2020, Bruce Power and OPG developed a Secondment Program between two of our primary contractors CanAtom Power Group (supporting Darlington Refurbishment) and Shoreline (supporting Bruce Power, MCR Program).

The Secondment Program was used earlier in 2020 when Shoreline leveraged the knowledge from the CanAtom Power Group to support Bruce Power's MCR Program. Leaning on previous experience and lessons learned through Darlington, employees of CanAtom were temporarily transferred over to Shoreline to share expertise and lessons learned to work alongside and support Bruce Power's MCR feeder platform installation, fuel channel installation, tool testing and other refurbishment critical tasks.

Shared tooling was also jointly developed to optimize feeder replacement. Since the original development of the tooling set, Bruce Power took the initiative to make further enhancements to the tools which resulted in a 50 per cent reduction to welding time, reduced cutting and fitting process time, and provide visual control of the welding process through the addition of cameras.

A Welding Centre of Excellence was established in 2020 to improve the welding programs at both sites. As a critical process used during both refurbishment programs, it was essential to establish a solid program that focused on commonalities between projects so Welders had an understanding of excellences for both sites. Through this program, Welders are qualified at the centre prior to executing work for each refurbishment and understand the tooling, supplies and procedures that are specific to each project. The Centre of Excellence program provides the hands on learning for this group to practice and ensure readiness prior to execution.

Another efficiency realized through our sharing of assets was demonstrated through the exchange of operating experience on reactor tooling to progressively improve the tooling unit over unit. This ultimately reduced the total duration of each unit's refurbishment and improved overall tool performance.

This was demonstrated through the successful refurbishment of Darlington Unit 2 and applying the lessons learned with Bruce Power to support Unit 6 Major Component Replacement.

These arrangements have proven key to reducing duplication of effort and increasing cost and time efficiencies for both projects.

OPG and Bruce Power agreed to share in the latest enhancement costs and coordinate their efforts for the upcoming planned outages, leveraging economies of scale and resulting in significant costs savings for both companies.

These joint collaborative arrangements have proven to be a success to reduce duplication of effort and increase cost and time efficiencies for both projects.

Moving forward in 2021, Bruce Power will provide both technical support and the feeder replacement tooling set needed to support for the planned Pickering outages throughout the year.

Supply Chain

Supply Chain departments from both OPG and Bruce Power have worked in close collaboration on a number of large open market sourcing competitions as well as in the sharing of information about scopes of work, forecasts and Operating Experience. The collaboration programs cut across nuclear and conventional materials and services and are intended to drive value for the rate payers of Ontario by ensuring safety, reliability, quality and sustainable commercial terms for major materials and services procurement at both companies. The largest of these opportunities currently include contaminated laundry, high voltage electrical services, valves, and turbine and generator program collaborations.

Waste Management

OPG and Bruce Power have been working together on a number of waste management initiatives to ensure efficiencies between our organizations.

- Under our Heavy Water Management collaboration, OPG loaned 80 mega grams of primary heat transport heavy water from Bruce Power's MCR to OPG's Darlington Station to support operations to mitigate impact to their nuclear operations.

- Through the companies engineering collaboration, it was determined that MCR waste can be stored in OPG's existing Waste Storage Buildings, thereby, avoiding the need to build another storage building; maximizing the use of OPG's facility ultimately reducing the waste management environmental footprint and lowering the overall caretaking cost for Bruce Power.
- Bruce Power and OPG continue to work collaboratively to ensure Ontario's supply and inventory of heavy water is optimally managed to provide an adequate supply and storage capacity during the MCR and Darlington Refurbishment Projects.
- OPG and Bruce Power collaborated on the development of a Hybrid Construction Island concept that will enable Bruce Power to store their removed Unit 6 steam generators at OPG's Waste Storage Building. By using OPG's facility, our organizations will reduce efforts caused by multiple vendor/owner hand-offs and increase cost-savings.

Labour, Training and Schedules

To ensure workers on both refurbishments have the necessary credentials to work safely and effectively between sites, Bruce Power and OPG are driving initiatives to share training credentials and reduce the duplication of training time, effort and cost.

One example of these initiatives is the Job Ready Dispatch Program, which was launched by the organizations in January 2020. As of October, the program facilitated a total of 20 training courses for which credits were transferred between sites, allowing both companies to take advantage of overlap between training and avoid a significant amount of cost. OPG and Bruce Power are expanding this cost avoidance by working with third-party training vendors so the training they are already delivering to trades will be credited as part of this program, if applicable and to the correct standards. The program is expected to avoid millions in training costs at both sites each year.

Additionally, as part of ongoing energy sector collaboration, OPG, Bruce Power and the Electrical Power Systems Construction Association (EPSCA) started to review the industry-wide demand for trades in 2018 and have started to work with trade unions to ensure skilled tradespeople are available for nuclear work programs, including refurbishment and MCR. To date, work has largely focused on ensuring boilermaker capacity as this group is considered to be the skilled trade of highest demand. In 2019, OPG and Bruce Power worked with the boilermakers union on the development of a pre-apprentice program, which resulted in over 100 new apprentices entering the union to support nuclear work.

Bruce Power and OPG are working together in partnership with the Independent Electricity System Operator (IESO) to ensure optimal scheduling of outages between Bruce Power and OPG to safeguard against any reliability issues and help manage costs for the Ontario consumer.

This coordination has helped address future scheduling concerns that might have arisen during peak refurbishment outages and are critical in maintaining system reliability to keep costs down.

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The Future of Ontario

Throughout the unprecedented circumstances of this past year, Bruce Power and OPG have remained focused and aligned in our commitment to the future of Ontario. In addition to our refurbishment programs that will generate decades more of clean and reliable energy for the province, we continue to work on innovative initiatives leading toward a brighter tomorrow for all.

The next evolution in nuclear power is the Small Modular Reactor (SMR). These nuclear fission reactors are designed to be smaller than traditional reactors, yet will be built in larger numbers than most of the world's current nuclear fleet. A key action in Canada's efforts to combat climate change, SMRs can replace diesel and provide safe, reliable and low-carbon baseload power to remote, off-grid communities, mines and heavy industry.

OPG's new partnership with Ottawa-based Global First Power and Ultra Safe Nuclear Corporation (USNC) will build, own, and operate a proposed Micro Modular Reactor™ at the Chalk River Laboratories site, northwest of Ottawa. This ground-breaking joint venture, equally owned by OPG and USNC, represents the first commercial partnership on an SMR in Canada.

Bruce Power is a founding partner of the Nuclear Innovation Institute (NII), which seeks to accelerate the pace of innovation in the Canadian nuclear industry, embracing new thinking, new technologies and new business opportunities that can drive the shift to a low-carbon future. In August, the NII launched the Centre for Next Generation Nuclear Technologies to identify post-COVID economic, environmental and health-care opportunities. The new centre will focus on next generation nuclear technologies by advancing the existing expertise of suppliers, regulators and operators to support future economic, environmental and export opportunities.

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Innovations

Innovations in nuclear energy will help support new technologies like SMRs, cancer-fighting isotopes and hydrogen development by using infrastructure investments that will drive the economy now and power the world of the future. It will also look at how the current Bruce Power site output can be further enhanced with new technologies and as foundational enablers.

Our initiatives go beyond nuclear to support people in Ontario and around the world.

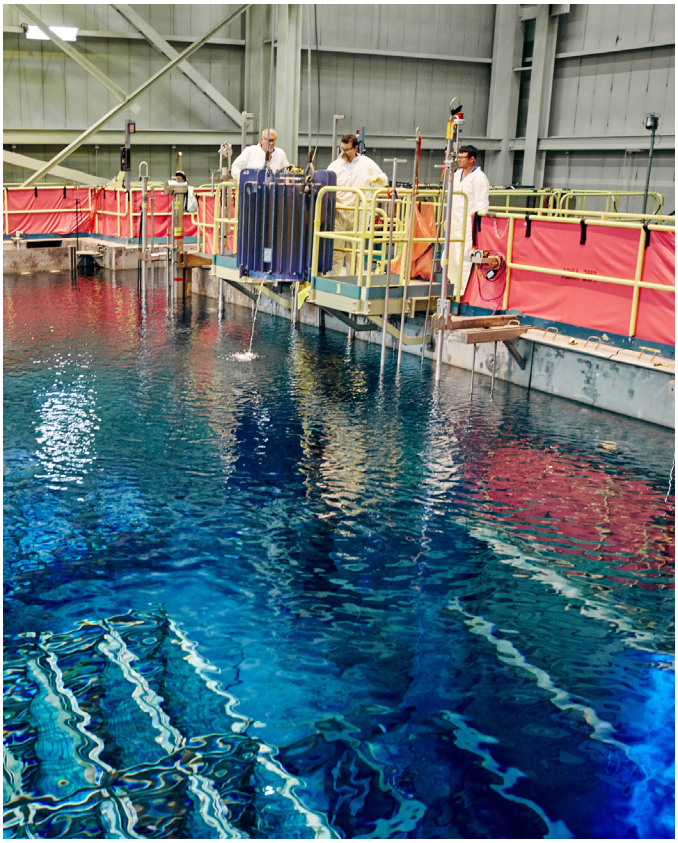
We have also entered into individual agreements to harvest Molybdenum-99 and Cobalt-60, helping to keep millions of people around the world healthy and safe. These life-saving isotopes are used to provide essential health care services such as cancer treatment, sterilization of medical devices and equipment, and self-powered luminescent emergency lighting.

Medical Innovation

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.

Both Bruce Power and OPG 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.

Individually, our organizations are driving innovations that will help ensure a more sustainable future for all. Together, we're continuing to deliver on our commitments to the province.

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