

COGNIZANT

COVID-19 RESPONSE

Unfailing electricity, isotopes, research
RTS Darlington Unit 2, SMRs, community support

The beat goes on



*The COG Operations
and Maintenance
Pandemic Team*

CANDU Owners Group Inc.



"Excellence Through Collaboration"



**CANDU Owners Group
President and CEO Fred Dermakar**

The best of journeys

Life at COG, like the industry itself, is a gift of constant opportunity

For anyone deeply passionate about nuclear technology and operation, getting the keys to the CANDU Owners Group is akin to being gifted a rocket idling on the launchpad; the opportunities for exploration and innovation are seemingly endless.

That is how it was for me, at least, in 2014, when I was appointed COG's eighth president. Now in its 36th year, COG has been the vehicle for industry collaboration that has achieved some of our greatest technological advances, as well as significant strides in more grounded tasks like human performance, regulatory effectiveness and greater reliability and efficiency in our operations. It is the two-sided coin of innovation and continuous improvement that COG is uniquely-suited to facilitate amongst its members and the industry.

Most worthwhile creativity has a purpose and much of our work as a COG team over the past six years, has been shaping the endless possibilities into purposeful accomplishments most meaningful to COG's members and the community of suppliers, partners and stakeholders in Canada and worldwide that comprise the COG community.

In my time at COG, we have continued the tradition with great strides in research and joint projects, breaking new ground in fuel channels, safety margins, obsolescence management and strategic R&D for the longer-term needs of the industry.

We have also gained greater engagement from our international members, so valuable to collaboration today and important to ensuring a sustainable model for future CANDU research and development.

The list is longer than the length of this column. But, I want to focus instead on another achievement. In the past six years, we have made COG a more relevant

organization capable to serve as an industry leader during a critical transition phase both in technology and business direction. We have shaped COG into an organization befitting a trailblazer like Stephanie Smith who will become COG's ninth president, later this summer.

Shaped by many thoughtful people on COG's board, management team and staff during my tenure, we have created a resilient and modern COG with deep diversity of skills, age, race and gender; today, COG's diversity is something we see as our greatest strength.

When Stephanie assumes her new role, she will lead a management team of five women and two men; a dramatic shift from the almost all-male team I led on my first day. This did not happen by selective hiring practices but rather by building a culture that left room for capable people of all backgrounds to join and grow within COG.

Stephanie will also inherit an organization that has done the hard work to strengthen governance, business efficiency and human resource as a foundation to better serve its members. More mundane to be sure but no less important.

This issue is largely a celebration of the industry's, and COG's, response to COVID-19 and the work we achieved this year despite it.

As I depart, I do so, knowing COG has what it needs to weather the challenges of pandemics and industry winds of change and to seize the opportunities that come from them to the benefit of our members. I leave knowing COG is in good hands with Stephanie as CEO.

And, I look forward to new pathways we will build together as I set out on the next part of my own journey.



Keeping Canada's nuclear plants generating during the pandemic p. 8

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For more information, visit us online.
www.COGonline.org (member site)
www.CANDU.org (public site)

Stephanie Smith appointed as incoming COG President and CEO



Becomes first female CEO in organization's history

On June 25, COG announced the appointment of Stephanie Smith to the role of president and CEO, following a transition period with COG's outgoing leader Fred Dermarkar, later this summer. Dermarkar announced his retirement from COG in February.

Smith is deputy SVP of OPG's Darlington Nuclear Station, a role she assumed in 2019 after a secondment at the World Association of Nuclear Operators. She is the first female president and CEO in COG's history, following a 30-year career at OPG that was marked by firsts.

As OPG's first female maintenance manager, she was responsible for 800 maintenance staff and 200 contractors. In 2016, Smith continued to make history, becoming OPG's first female director of Operations and Maintenance, overseeing

all maintenance activity at the plant, from fuel handling to safety systems.

Smith's career started at Darlington in 1990 as a graduate engineer-in-training. She spent eight years working in engineering, earning her PEng in 1994, before moving to the chemistry lab at Pickering Nuclear. In 2006, she became the first female licensed shift manager overseeing Pickering Units 5-8 (the units commissioned between 1983 and 1986).

Smith will take over from current President and CEO Fred Dermarkar, who joined COG in 2014, after a 30-plus year career with OPG. He departs having advanced the COG collaboration model and strengthened the organization through enhanced program delivery, continuous improvement in services and improved business efficiency. In 2019, Dermarkar received the Ian McRae Award given to an individual for substantive contributions, other than scientific, to the advancement of nuclear energy in Canada. The same year, COG received the John S. Hewitt Team Award.

[Click here](#) to read the full announcement.

The COG team is excited to welcome their new CEO later this summer.

Watch for a full interview with Smith in the fall-winter edition of COGnizant Magazine.



Photo courtesy of NB Power

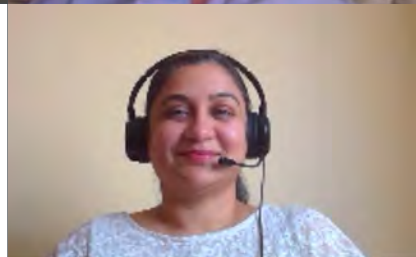
A nuclear response Keeping lights on was just the beginning

For CNNO, the CANDU Owners Group member in China, 2020 came in with news of a virus that would quickly put the country on alert. From there, it would ripple around the globe over a two-month period eventually finding its way to Canada and touching other COG member countries along the way. CNNO was quick to respond and to share its OPEX with COG, helping to inform and prepare other COG members for what was to come.

COVID-19 is now a household word, globally. Almost every person has been impacted by the virus or its effect on our way of life. And, almost every country, region, organization and person has been forced to respond.

Just as trained and practised to do, the entire nuclear community stepped up. It did much more than keep the lights on.

In the pages to follow, read stories of how the COG community answered the call.



Answering the call

COG members and suppliers are leading in COVID-19 response; COG is there for the assist

Left to right, first row: Valentin Nae (SNN), Chris Bacskai (BP), Kerry Clemen; second row: Michael Hare (NBP), David Dickey (OPG), Fred Dermarkar, Hector Hidalgo (NA-SA), George Dolinar (CNL); third row: Esther Sun-Lee, Rick Manners, Ron Hamann, John Sowagi, fourth row: Nidhi Gaudani. Other members of the team included Mark Slade (BP) and Jason Stevenson (BP).

When the pandemic hit, CANDU Owners Group (COG) members, suppliers and partners continued to deliver safe, clean and affordable electricity to meet the demands of daily life and essential services. Collaboration through COG helped make it happen.

COG: There for the assist

Through COG, the Canadian and international community of member operators created an Operations and Maintenance Pandemic Planning Group consisting of station leadership from utilities in Canada and internationally as well as Canadian Nuclear Laboratories (CNL). The regular connection via COG Webex has allowed real-time information exchange to assist with response to emergent technical issues arising from the pandemic and increasingly, a proactive response to anticipated next steps.

The collaboration includes development of protocols and workforce management. It is ensuring critical programs and supply chain are maintained despite the complications created by COVID-19. Immediate operating experience is shared twice weekly via teleconference and through a team site on the secure COGonline platform. The group is also connected into the World Association of Nuclear Operators Atlanta Centre (WANO-AC), the International Atomic Energy Agency (IAEA) and the Nuclear Energy Institute (NEI).

From human performance to technology solutions

By the end of April, more than 30 different issues had been examined by the O&M group members, ranging from use of masks as a barrier to COVID-19 to enhanced cleaning techniques. As well, a myriad of workforce management policies, such as protocols for on-site visitors and considerations for managing shift crews have been reviewed.

Early on, the group looked at best practices for temperature monitoring as employees came on site. The team has also reviewed how to apply human performance tools in a time of physical distancing and protocols for staff in the station and working from home. New technologies and innovative processes that can be applied to improve plant performance and reduce any pandemic-related risks have been investigated.

As the plants considered how to bring back their workforces, a special team was created to review and recommend best practices that could be adopted at all stations. The team holds bi-weekly calls to share information on topics like staged return-to-work and building preparation.

As a new normal set in, the team has been used for more advanced initiatives including development and delivery of virtual training; development of a phone app for COVID pre-screening and contact tracing; processes to allow outside contractors to safely enter facilities for outage execution; and changes to mask policies based on OPEX at the various sites.

Beyond operations: Regulatory and communication co-operation

In addition to the O&M Peer Team initiative, COG has been a collaboration vehicle for other workgroups tackling COVID-related issues at the utilities.

The existing Regulatory Affairs Vice Presidents' Forum held virtual meetings to examine potential implications and strategies for meeting regulatory requirements during the pandemic and to provide a coordinated response to the Canadian Nuclear Safety Commission.

Nuclear communicators from 10 organizations — including operators and several other industry organizations — shared best practices and examples of communications during the initial days of the COVID-19 response as all utilities were reacting in real-time to set and re-set protocols as the situation rapidly evolved.

COG also linked into an International Atomic Energy Agency (IAEA) initiative to share experience amongst operators across all nuclear technologies, worldwide. This initiative, with 50 participants from 21 member states is helping countries, including those with smaller nuclear programs to benefit from knowledge that exists across the broader international community.

More collaboration, not less

Since COG halted face-to-face meetings and instituted work-at-home policies, the COG team has used the company's well-established meeting systems and well-formed network to bring information to our members and to help them connect with each other. The roster of peer team meetings and workshops continues as does important research, joint projects, OPEX sharing and other forms of teamwork. In fact, with travel removed from the equation, some international members have found it easier to participate. Since April, COG has hosted an average of 20 meetings and about 150 participants, daily.

A virtual laboratory to learn from experience

There is no question that some of the practices that have been put in place in response to COVID-19 will become the new norm as we emerge from the pandemic. Given COG's role enabling collaboration, COG is examining and experimenting to strengthen learning on how to run on-line meetings most efficiently.

We are striving to achieve our mission of Excellence through Collaboration by achieving excellence in collaboration.

-- A longer version of this article appeared on COG channels on April 24. It has been shortened and updated for COGnizant Spring/Summer 2020.

A full-court press

*From incident command to emergency response, cleaning staff to communicators
— in the station or working from home —
everyone had a job to do to keep Canada’s nuclear plants generating during the pandemic*

Ontario Power Generation



Members of the Pickering COVID Command Centre. Pictured left to right: Brendon Ramdoo, Rob Davidson, Sara Rasouli, Phil Ross, Karen McDougall, Jeff Ross.



Members of the COVID Command Centre at Darlington. Pictured left to right, Pieter Den Decker, Heather Rambukkana, Alain Levesque, Marlene Ramphal, Jason Price, Matthew Mairinger.

Examples of COVID-19 response initiatives by Canadian Nuclear Laboratories, including the continued work of their burst testing program and CNL’s contributions to an international collaborative low-cost ventilator project, see pages 14, 32 and 45.

Across OPG’s operations, operators, technicians, and trades at the nuclear, hydro and thermal stations worked diligently to ensure units generated power safely and reliably; nuclear and dam safety workers are protecting the community and our operations; advisors worked to assess employees’ health; and security teams, emergency response personnel, and cleaning staff kept the sites safe.

In keeping with advice from the Public Health Agency of Canada and the Ontario Ministry of Health, OPG took a number of actions to ensure safe, reliable electricity generation while protecting the health of our employees and the public. The utility activated the Crisis Management Communications Centre, which provides executive level oversight, along with the Infectious Disease Incident Response Team and activated business continuity plans. It launched a “Solutions Team” mandated to collect, evaluate, and quickly implement ideas to help ensure safety for essential employees and to further support front-line health care workers and supplied critical staff with surgical masks or half-face respirators for extended close contact work.

As well, OPG implemented a work-from-home policy, closed public access to visitor facilities and identified areas for access by critical staff, only. OPG also implemented hygiene protocols and products along with site hygiene teams to ensure safe work planning and training protocols for cleaning were in place.

Bruce Power



Members of the Bruce Power Emergency Management Centre, left to right: Dean Burleigh, Lisa Clarke, Crystal Roote, Tim McKay, Zafar Hussain, Christian Morton, Mark Slade, Kevin Schmidt, Mikael Davaze, Jason Bloomberg, Chris Allen, Dave Batte, Sarah Foster, Natasha Boucher.

Bruce Power formally stood up its Emergency Management Centre (EMC) on March 13, four days before the Province of Ontario declared a state of emergency in response to the COVID-19 outbreak.

Two crews rotated through the EMC to maintain a level of consistency, while two separate locations were utilized to allow for sanitation between shifts. After the initial response, the EMC moved to a one-crew system in March and was stood down in June after long-term planning teams were established.

Bruce Power’s EMC was successful in helping to implement several safety enhancements during its COVID-19 response as the situation evolved, including minimizing staff on site, sanitation protocols and the implementation of mandatory face mask use.

New Brunswick Power

Within 24 hours, on March 16, Point Lepreau’s Incident Command Structure (ICS) was set up and protocols established to ensure essential staff could safely access the site and continue to produce electricity. At the same time, workers whose presence on site was not essential were given instruction to ensure they could continue to support the site effort while working from home.

In the months that ensued, Point Lepreau continued to adjust its protocols and standards as the circumstances evolved, responding to new information with additional measures, as required. Like other utilities, this included mask, face shield physical distancing, hygiene protocols and new pathways for regular communications with employees. The local and First Nation communities and stakeholders were kept abreast of the plant’s measures to ensure everyone knew what to expect and how Point Lepreau was responding to ensure safe, reliable service during these most uncertain of times.

One of the early activities the plant had to undertake was work to successfully postpone the spring outage to the fall, allowing more time to ensure the pandemic situation was well understood and workers, both from NB Power and external contractors, would be well protected during these maintenance activities.

On Friday, June 19, 2020 the ICS stood down and through vigilance and new heightened safety processes, life at the plant has begun a path back to a new normal. The Station Health and Safety team will continue to monitor and respond to COVID-19 Station related issues.



NB Power’s Incident Command Structure, left to right: Wade Greenlaw, Kathleen Duguay, Chris Wilson, Zach Beauchemin, Rob Stears, Halley Mawhinney, Corinne Braam, Nick Reicker. Absent from photo: Daphne Thorne, Patti Wiggins, Eric Gardner, Michael Hare, Tim Harrigan.



CNNO Third Qinshan Plant staff in the control room where masks were required and access restrictions were in place during the COVID-19 pandemic.

COG International Members rise to the COVID challenge

Around the world, COG member utilities responded to the COVID-19 pandemic with initiatives designed to ensure employee safety and continue the reliable delivery of clean electricity when it was needed most

CNNO completes outage ahead of schedule with COVID safety measures in place

Through the pandemic, CNNO rolled-out various measures to control the spread of COVID-19 at its Third Qinshan Plant and continued with some plant maintenance activities.

Response measures included creation of an Epidemic Prevention and Control Group looking at all aspects of pandemic management affecting plant operations as well as employee health and safety. The group also developed initiatives to curb COVID-19's spread.

Other COVID-19 response initiatives included:

- Tracking of employee travel and movement including limited access to control room and other sensitive areas as well as daily reporting and completion of epidemic prevention and control checklists;
- Employee temperature checks and personal health

coding (different codes signify different states of employee health e.g. only staff with green "good health" coding were permitted on-site);

- Strengthened personal protection protocols such as wearing of masks in work environments and other personal protective equipment (PPE); and
- PPE training and post-quarantine employee certification ensuring staff who completed a home quarantine period were granted clearance to return to work.

By early-March, CNNO gradually resumed normal plant operations. A planned maintenance outage of Qinshan Unit 2 went ahead on May 1, after a one-month COVID-related delay, and was completed on June 2, five days ahead of schedule.

During the pandemic, no COVID-19 infections were reported at the Qinshan Plant.

KHNP follows government's lead with multi-faceted COVID response

At Wolsong Nuclear Plant, KHNP restricted all international travel for employees and visitors, during the pandemic. Employees and visitors coming from other countries were isolated for two weeks and tested within three days of arriving in Korea. These individuals were then tested again at the end of the two-week isolation period. All KHNP meetings, involving visitors, were moved to teleconference or virtual meetings.

On April 25, KHNP completed a 228-day outage of Wolsong Unit 3 and on July 22 will start a Unit 4 outage until October.

Korea became a world-leader in COVID-response as one of the first countries to introduce mass testing, contact tracing and tracking technology to control the outbreak. Because of this comprehensive approach and KHNP's own enhanced safety, hygiene and physical distancing measures, staff were able to return to the office once Korea's outbreak situation had stabilized.

NA-SA develops exclusive protocol for international inspections during pandemic

In Argentina, NA-SA launched several health and hygiene protocols and preventive measures across its facilities including Embalse Nuclear to protect employees and contractors.

Suppliers and contractors signed a sworn statement of health, employees were required to use private vehicles and most meetings were moved to teleconference and virtual environments with strict exceptions.

An exclusive protocol for international nuclear inspections was developed for the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and the IAEA to ensure compliance with its international commitments.

As with other international utilities, remote work policies supported by an employee information safety campaign were instituted. For on-site staff, body temperature checks and

control room access restrictions were also implemented.

NA-SA reported five COVID-19 cases across its sites with none reported at Embalse.

NPCIL India continues safe operations at its plants

At NPCIL's seven nuclear sites, plants operated safely and as normal, through the pandemic. NPCIL head office staff worked-from-home which continued into June. Some staff returned to the head office but only when required to.

At the height of the pandemic, some NPCIL plant staff lived in secluded townships with strict physical distancing rules imposed and no visitors permitted from outside the townships. The Government of India also issued pandemic guidelines and NPCIL complied with required preventive measures.

NPCIL continues to comply with the government's evolving pandemic policies.

SNN Romania applies learning from SARS in its pandemic response

In the early stages of the pandemic, SNN identified essential staff they needed to be able to properly operate Cernavoda Nuclear Plant. Approximately, 500 staff were isolated on the campus, close to the plant, for 72 days. SNN also established a list with backup personnel for emergency scenarios.

Transportation was provided by SNN busses between the plant and the campus. Food was provided on the campus via the cafeteria. A new store was also opened for essential items employees needed.

The planning SNN had previously done for SARS was helpful as it developed protocols and procedures in response to COVID-19.

On June 20, SNN began a 43-day outage at Cernavoda which had been delayed by the pandemic. Regular office staff returned to work in early June, with mandatory mask wearing, while those at greater health risk continued to work remotely.



NA-SA Embalse Plant employees enter the site during the COVID-19 pandemic. NA-SA implemented a number of preventive health and hygiene measures across its facilities in Argentina.

Supplier participants innovate, repurpose through pandemic

Through the COVID-19 pandemic, COG's supplier participants repurposed their operations, as needed, in response to the health-care crisis, to develop new innovations and to achieve some notable business milestones.

The nuclear supply chain continued to deliver materials for development of nuclear medical diagnostics and industry members partnered with other companies, research organizations and universities to move into new areas of design and manufacturing to help supply ventilators and face shields.

Their achievements benefited communities across North America and around the world during challenging times.

Below are some examples of supply chain contributions to the efforts to fight COVID-19, shared by COG's Supplier Participants.



ATS Automation

ATS Automation used its specialized life sciences capabilities to support the production of medical equipment, such as ventilators and respirators, to address the COVID-19 pandemic across North America.

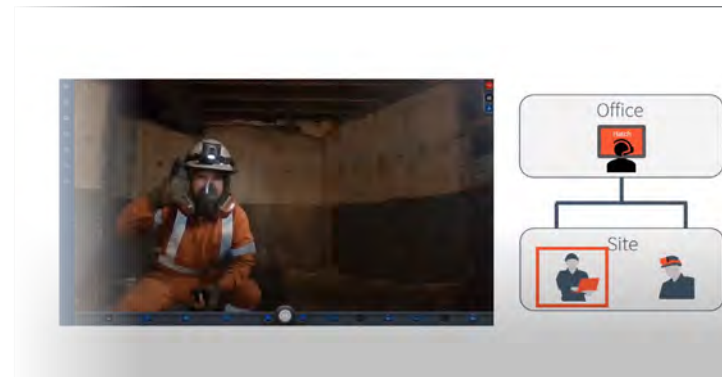
Photo: ATS Automation

Hatch

Hatch offered its clients practical and cost-effective virtual approaches using innovative digital collaboration technologies to tap into expert skills and knowledge remotely.

This included technology to remotely complete on-site inspections, which would have normally required a visit to the site. This allowed maintenance staff to continue to perform asset maintenance and diagnostics, walkthroughs, inspections and training, while keeping everyone safe.

Photo: Hatch



Kinectrics

Kinectrics adapted its test capabilities normally used for testing of HEPA filters and respiratory PPE for the nuclear industry towards medical needs. This "Made in Ontario" model ensured a long-term stable supply of testing to the province and to the rest of Canada.

The organization also made a financial and business commitment to put into service the full suite of testing required for surgical masks in compliance with the ASTM F2100 standard, based out of its facilities in Toronto.

Photo: Kinectrics



NUVIA

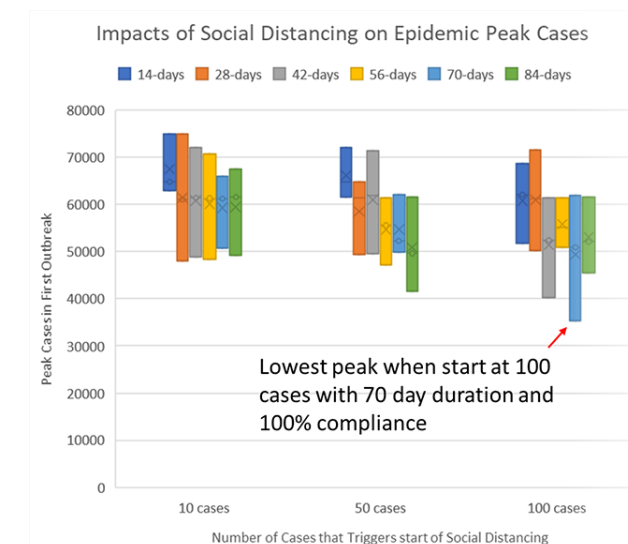
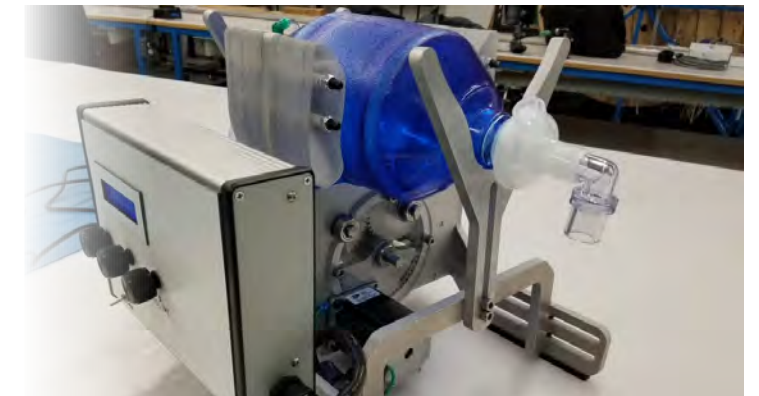
NUVIA won a place on a four-year contract to deliver engineering design support to the U.K.'s Radioactive Waste Management as part of that country's High Activity Waste Framework.

Illustration of proposed U.K. waste disposal facility. Photo: Radioactive Waste Management

Promotion

Promotion developed low-cost ventilator prototypes, which it provided to Toronto's University Health Network, in response to the sudden surge in demand due to COVID-19 and other future health emergencies.

Photo: Promotion



SNC-Lavalin

SNC-Lavalin announced its subsidiary Candu Energy Inc. was awarded two additional five-year vendor-of-record agreements by OPG to provide specialized engineering and nuclear engineering services.

The firm will deliver nuclear engineering services for the Darlington and Pickering sites and the Western Waste Management Facility including design support for nuclear plant modifications and balance of plant engineering.

SNC's Smart City simulator

SNC-Lavalin's U.S.-based Atkins business used its City Simulator, map-based software tool, to model epidemics to explore how communities can restart their economies while keeping residents safe.

SNC's Lavalin's map-based software modelling tool. Photo: SNC-Lavalin

Westinghouse

Westinghouse unveiled a first-of-a-kind installation of a 3D-printed thimble plugging device at Exelon's Byron Unit 1 during the plant's scheduled spring refuelling outage.

Photo: Westinghouse



Giving back in a time of need

#ExcellenceThroughCollaboration became #AssistanceThroughCollaboration for the nuclear industry during the COVID-19 pandemic. From initiatives to give back to the most vulnerable in our local communities and those on the health-care frontlines to the creation of crucial personal protective gear and medical equipment, nuclear utilities and suppliers together made a difference as we all kept physically apart. Some of the stories of generosity and innovation are captured throughout this issue of COGnizant.

Here are five ways the nuclear community went beyond keeping the lights on to help in the fight against COVID-19.

1 Supporting those in need

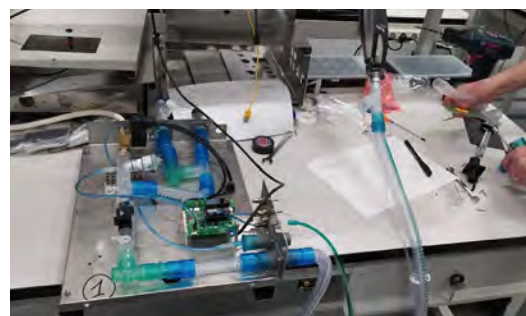
[Ontario Power Generation \(OPG\)](#) and [Bruce Power](#) made donations totalling more than \$1 million to approximately 40 community food programs across the province.

New Brunswick Power created provisions for customers having difficulty paying their bills due to illness, job loss or requirements to self-isolate. In addition to suspending disconnections for non-payment, the company deferred bill payments for residential and small business customers and waived late payment charges.



2 Developing medical innovations

[Canadian Nuclear Laboratories](#) collaborated on the design of a new easy-to-produce ventilator as part of an international team working on a solution that could be manufactured with off-the-shelf parts from established supply chains.



3 Sharing knowledge

Bruce Power supported an [information sharing campaign](#), created in tandem with local public health officials, to protect residents in Grey, Bruce and Huron counties. The multi-platform campaign included 100,000 newsletter mailouts, a #StayAtHome video ad spot and a series of virtual town halls and Q & A sessions, including one featuring NASA astronaut Captain Scott Kelly, sharing his experience of self-isolation aboard the International Space Station.



4 Strengthening communities

Many in the nuclear supply chain responded to the crisis with generosity and creative solutions.

COG supplier participant, Cameco, the Saskatchewan-based mining and fuel services company, launched a \$1 million relief fund for Saskatoon and northern Saskatchewan charities, municipalities and First Nation band offices impacted by COVID-19.

SNC-Lavalin's Infrastructure team built a drive-through screening clinic outside the Montreal McGill University Health Centre, as part of its multi-faceted response. With two evaluation and testing booths, the clinic served Health Centre staff. The clinic's booths were equipped with heat, electricity, light and WIFI.

PCL Construction coordinated financial contributions and donations of N95 masks and negative air filtration machines to health-care facilities where its construction sites were located. It also helped supply laptops to students learning remotely during the pandemic.

[Read more](#) on the COVID-19 responses of COG's Supplier Participants.



5 Creating and donating PPE

WIN Canada members along with [OPG staff hand-sewed nearly 9,000 cloth masks](#) for the community.

NB Power partnered with the University of New Brunswick to 3D-print approximately 5,000 ear savers for frontline workers designed to make wearing face shields more comfortable. The organization also worked with local Indigenous and surrounding community members to make cloth face masks to increase the stockpile of protective equipment available to staff at Point Lepreau.

Combined, [OPG](#) and [Bruce Power](#) provided over 100 front-line organizations and Ontario's Ministry of Health and Ministry of Long-Term Care with nearly 2.3 million pieces of medical equipment including N95 masks and Tyvek suits. Bruce Power's personal protective equipment (PPE) donation, alone, was the largest announced private-sector donation of PPE in Canada. The Cobalt-60 harvests of both organizations were also used to sterilize medical devices.

Both organizations were involved in the production of 3D-printed face shields.



Revisit how COG members and suppliers responded to the COVID-19 pandemic in March and April, making a difference in their communities and around the world:

[COG member response stories – April 24](#)

[COG member response stories – April 9](#)

[COG member response stories – March 30](#)



COG's Charity Committee supports several causes, like Daily Bread Food Bank, throughout the year. The food bank reports demand has increased 20 per cent. Photo: Daily Bread Food Bank.

Support for an urgent cause

The COG team raised more than \$5,500 for Toronto's Daily Bread Food Bank and food banks in COG member communities, coming together even when physically apart.

CANDU Owners Group (COG) team members have responded to the COVID-19 pandemic by collaborating to support our community's most vulnerable people.

COG's Charity Committee organized a two-week virtual raffle campaign to support Toronto's Daily Bread Food Bank pandemic response efforts. The campaign raised \$5,560 for one of the country's largest food-based charitable organizations and for local food banks in COG member communities. Money was raised through bids by COG staff on electronic gift cards for various retailers with an added contribution from Querencia Partners, COG's communication consultant.



COG's charity committee is comprised of employees: Sonia Qureshi, Rachna Clavero, Kelsey Rodger, Esther Sun-Lee, Jullaine Hardinge, Donna Tuck, Amanda Nascimento, Anjana Mistry and Tania Rose.



"In these uncertain times, COG staff feel very grateful to be employed by a company that enables us to work-from-home and keep safe," says Tania Rose, COG Fuel Channel Project Coordinator. "We know there are many people who are not as fortunate. Many people are now facing financial challenges and food insecurity. We felt raising funds for the Daily Bread Food Bank would have an immediate and real impact, locally, for those people affected by this pandemic."

Sonia Qureshi and Tania Rose, members of COG's Charity Committee, which organized the staff donation to the Daily Bread Food Bank in response to the COVID-19 pandemic.

In the months since the pandemic was declared by the World Health

Organization, Daily Bread reports food bank demand has increased 20 per cent. The number of families seeking food each day has risen from 120 to more than 300, an increase Daily Bread CEO Neil Hetherington called "completely unheard of." According to Food Banks Canada, food bank use across the country is expected to "keep going up and up and up."

COG's Director of Joint Projects and Services Sonia Qureshi says she has been impressed by the commitment to citizenship initiatives by COG staff in their personal lives as well as through COG initiatives such as this one.

"A donation like this, and our support for charities throughout the year, shows the generosity of our staff and great work of the charity committee. It also shows COG's ongoing commitment to give back and support our community, in the spirit of collaboration."

Daily Bread Food Bank provides people living on low incomes with food support through its 130-plus member agencies' food banks. It also offers homemade meals to agencies that operate shelters or drop-in programs and its kitchen feeds up to 5,000 people across Toronto, weekly.

COG's Charity Committee plans events throughout the year to raise funds for various organizations. In February, the committee presented a cheque for more than \$2,000 to the Canadian Red Cross resulting from a COG employee campaign. Last year, COG staff helped raise more than \$8,000 for charitable causes in Durham Region and across Canada.

[Click here](#) to donate to Daily Bread Food Bank's pandemic response efforts.

To find a food bank to support in your local community (within Canada), [visit the Food Banks Canada website](#).

With files from Global News Toronto.



Photo: Ontario Power Generation

Unstoppable

The COG community didn't just respond to COVID-19, it got work done despite it

Across the nuclear industry, around the world, COG members got work done despite a pandemic for the ages.

From the Ontario Power Generation Return to Service of Unit 2 at Darlington to continued leadership by Bruce Power in forwarding the nuclear isotope industry to CNNO's outage completion, as OPG so aptly put it, the industry did indeed #PowerOn.



Photos courtesy of Ontario Power Generation

Darlington Unit 2 powers ON

The return-to-service of OPG Darlington's refurbished Unit 2 is an achievement a decade in the making, one many across the CANDU industry helped make possible.

Notable milestones from the Darlington Unit 2 return-to-service

Year	Milestone
1990	Darlington Nuclear Unit 2 is constructed. Unit 2 is the first of Darlington's four reactors to come online in the 1990s.
2007	Darlington Refurbishment early scoping work gets underway.
2010	In February 2010, OPG announces it will proceed with detailed planning for the mid-life refurbishment of Darlington Nuclear.
2011	Construction of the Darlington Energy Complex gets underway in July. The facility would support training for the refurbishment project with a full-scale mock-up reactor and a tool testing centre. The complex opened in 2013.
2012	Contract awarded to the SNC-Lavalin-Aecon joint venture group for retube and feeder replacement work.
2013	Refurbishment project's environmental assessments were approved by the CNSC in March and July.
2016	OPG receives approval from Ontario government to begin the \$12.8 billion Darlington refurbishment project servicing all four of its CANDU reactors – it becomes Canada's largest clean energy project. In October, Unit 2 is disconnected from the grid, safely shut down and later defueled.

Said it, did it and now, celebrating it!

Ontario Power Generation (OPG), along with its project partners and vendors, completed the refurbishment of Darlington Nuclear's Unit 2 and reconnected it to the province's electricity grid at 100 per cent full power, June 4.

Its success paves the way and provides a blueprint for refurbishment of the remaining three units at Darlington.

The execution of the Unit 2 return to service began in October 2016 when the unit was taken offline following several years of planning, preparation and construction of ancillary buildings to support the four-unit refurbishment. OPG has committed to completing the four units by 2026.

The Unit 2 refurbishment project involved contributions from across the CANDU industry, and especially supply chain leadership from the EPC contractors, a joint-venture of SNC-Lavalin and Aecon.

From safely defuelling the reactor to its dismantling and reassembly the reactor, approximately 765,000 hours of training and 24 million hours of work by staff from OPG and nuclear industry suppliers went into returning the unit to service. Project partners GE Power, ES Fox, Black and McDonald Limited and BWXT Canada (a COG supplier participant) were crucial to Unit 2's construction and reconnection. They will continue to play a significant role in further planned refurbishment work at Darlington. The project was also

supported by innovative technology and precision tooling delivered by hundreds of Ontario-based manufacturers.

The project included safety improvements such as the installation of a third, emergency power generator to provide multiple layers of back-up in case of power loss. The extra generator also allows existing generators to be taken off-line for maintenance, further strengthening reliability and adding new layers of safety-based redundancy.



[Click here](#) to read OPG's story on Unit 2's return-to-service and [its safety enhancements](#).

[Click here](#) for OPG's brief history on the Unit 2 refurbishment project.

Year	Milestone
2017	OPG begins removal of key components of Darlington Unit 2 reactor. Reactor disassembly gets underway in July.
2018	Darlington Unit 2 enters final phase in reactor disassembly. Disassembly work requires more than 1,600 people to complete. Workers remove the last pressure tube from Unit 2 on March 3, completing the safe removal of all 480 pressure tubes. In September, the work to rebuild Unit 2 reactor gets underway. In February, OPG receives provincial approval to begin work on Unit 3 refurbishment.
2019	In September, OPG and project partners install upper and middle feeder tubes on Unit 2, with the installation of lower feeder tubes completed in October. By late October, OPG completes the installation of all 960 feeder tubes. In December, OPG and BWXT Canada complete loading each of the 6,240 new fuel bundles into the reactor core. The fuel bundles needed to be loaded in the correct location and sequence within the core and the work required five-years of planning to execute.
2020	In March, construction of Unit 2 is completed and a month later, first criticality is achieved. In June, the unit returned-to-service at 100 per cent full power.
2024	Expected completion of Darlington Unit 3 refurbishment project.
2026	Expected completion of refurbishment of all four Darlington reactor units.

Congratulations OPG on Unit 2 Success!

From CANDU Owners Group to everyone involved, we congratulate you.

Way to go Darlington!

Congratulation on this great achievement. This happened with skills and support of many talented staff. All the best.
John Sowagi

Congratulations, OPG!

This amazing success is the testament of your hard work and dedication. Build many more stories of success in the next 30 years, not only for OPG but for the whole nuclear industry. Congratulations!
Carmen Trandafir

Well done OPG

Darlington and your many supplier support groups! It was important to show great team work and demonstrate the continued viability of nuclear power in Ontario.
John Krasznai

Congratulations!

Thank you OPG for your dedication and commitment to the success of this outstanding project. The benefits of your hard work are realized by the residents of Ontario, the nuclear industry, our economy, and the environment. All the best and thanks again!
Natalie Alderson

Congratulations...

To everyone who made this happen. Completing the final leg during a pandemic makes it even more amazing. A true testament to the dedication of all those involved. Looking forward to the next unit.
Harry Sherwood

Congratulations to OPG on their amazing achievement!!!

Amanda Debidyal

You make us all feel proud, OPG!

Congratulations on a tremendous accomplishment and an outstanding success from the perspectives of safety, quality, cost and schedule. It was more than ten years in the making, and the planning and preparation, together with a staff committed to excellent execution, have all paid off! You have demonstrated that when it comes to major nuclear projects, Canada is second to none!!
Fred Dermarkar

Congratulations!

Congratulations to OPG on this remarkable achievement! It is indeed an excellent success story and historic moment for the Canadian Nuclear industry. OPG staff have proven their expertise, dedication and commitment to achieve this milestone. A big thank you for providing clean energy and supporting the economy!
Usha Menon

Wishing the best for future projects!
Usha Menon

Congratulations!

Congratulations to OPG and the Refurbishment team for a job well done. You have shown that OPG has the skills, knowledge and project management expertise to continue to serve the province with excellence and attention to safety.
H.L. Anderson

Congratulations

Congratulations on your well-deserved success!
Taruna Matharu



Congrats OPG!

A testament to all your planning, execution - and hard work! A team effort that resonates across the entire industry and makes us proud!
K. Curtis

Congratulations!

Congratulations on your well-deserved success!
C.H. Kwon



Congratulations Darlington RTS Team!

Your dedication to ensuring this project stayed the course is something to be very proud of. This project is great example of the nuclear industry's ability to collaborate and innovate. Kudos to all those that helped with this historic milestone.
Sonia Qureshi

Well Done Darlington!

A significant achievement demonstrating that with the proper planning, people with the right capability, and the drive to succeed; can produce results worthy of admiration.
Ian D. Cruchley

On behalf of COG's Refurbishment Forum and Supplier Participant groups, we extend our heartfelt congratulations to OPG, particularly to the Darlington Refurbishment Team of OPG, AECON, SNC and many other suppliers who worked shoulder to shoulder to overcome the many challenges and paved the way for a brighter future for our CANDU industry.
M. Macit Cobanoglu

Congratulations OPG!

I remember planning for the very first Darlington Refurbishment announcement and the years of engineering, preparation and communications that followed leading to execution. There is a lot of well-deserved industry pride in Unit 2 RTS. Congrats to everyone involved.
#NuclearIsATeamSport
Jacquie Hoornweg

Congrats to OPG on completion of Unit 2 Refurb! This is a significant milestone and noteworthy achievement that will benefit all of Ontario! It demonstrates what is possible with sound leadership and tremendous team work! Well done and wishing you continued success with the remaining refurb! -
John de Grosbois

Great Teamwork!

Congratulations to OPG and the Refurbishment Team on the successful execution and completion of one of the largest, most complex projects in Ontario. You have paved the way for our industry to continue to demonstrate its commitment to clean, safe and reliable energy, today and into the future. Well done!
Rachna Clavero

Rachna Clavero



Congratulations OPG!

Thank you OPG for your commitment to clean air and smog-free summers. Your continued support of the industry further demonstrates nuclear energy to be a proven and reliable clean energy baseload for our GTA communities!

Some of the CANDU Owners Group team shared their memories and congratulations to our colleagues at OPG and the entire team.

Congratulations OPG and all the suppliers who made Unit 2 RTS a reality!



From rebuilding reactor chambers to installations of storage vessels, conduits and cooling systems, Ontario's Boilermakers and other skilled tradespeople, within the nuclear supply chain, played a significant role in the Darlington Unit 2 Refurbishment. Photos courtesy of Ontario Power Generation.

Nuclear is a #TeamSport

Darlington Unit 2's refurbishment journey is a story of industry and supplier excellence through collaboration

Ontario Power Generation (OPG) President and CEO Ken Hartwick had many people on his thank you list when he announced Darlington Unit 2's return-to-service, June 4.

The milestone didn't just belong to OPG and its nuclear team, but reflected millions of hours of work, 24 million to be exact, by suppliers and vendors whose contributions made this achievement possible. From defuelling to fuel loading to rebuilding Unit 2, many runners helped pass the baton in this relay race, bringing the first phase of the Darlington Refurbishment Project to the finish line.

The nuclear supply chain played an integral part in that race, which got underway in October 2016, when the reactor was shutdown and defuelling got underway. But the planning and work by the nuclear supplier community began long before that.

Organization of Canadian Nuclear Industries (OCNI) President and CEO Ron Oberth worked alongside dozens of his members who had some involvement in the project.

Reflecting on the effort by the supply chain, Oberth says, "I am especially proud of the many OCNI member companies that developed innovative and reliable tooling to remove and replace complex reactor systems and that supplied precision manufactured components used in the new reactor core."

One unanticipated challenge came in the final days as the team ramped up to return to service as the COVID-19

pandemic hit. "I would like to acknowledge the hard work and dedication of workers who, despite the current COVID-19 challenges, kept this vital project on track," he says.

Leading the way

There were hundreds of award-winning performances by suppliers across the supply chain who contributed to the success of Unit 2 RTS. Many of those belong to the CANDU Owners Group Supplier Participant (SP) program. The program ramped up significantly starting in 2015 as a venue for the suppliers to share and build best practices in nuclear and conventional safety and quality performance. It also provides a way for the supply chain/contract companies and utilities to stay connected on expectations and needs in the plant and in the suppliers' own facilities. The SP program representatives take back the learnings to their companies to apply on the Darlington refurbishment as well as Bruce Power's Major Component Replacement Project and project work at New Brunswick Power.

Read the story about this unique, globally-recognized program in this issue of COGNIZANT starting on page 40.

And the award for best supporting player goes to...

There are hundreds of companies that have contributed to the Darlington project. Here are a few of the key players whose work has been integral to project success.

Darlington Refurbishment Supplier Highlights

SNC-Lavalin and Aecon joint venture EPC contractor

In March 2012, SNC-Lavalin and Aecon were awarded a joint venture contract by OPG to handle the definition and execution phases of the Darlington Refurbishment Project. Under the joint venture agreement, Aecon provided construction and fabrication services while SNC focussed on specialty tooling and engineering. Project management was shared by both organizations.

This initial contract included a provision for the construction of a mock-up and training facility which was built at the Darlington Energy Complex in 2013. More than 750,000 hours of training and preparation, involving OPG staff and suppliers, took place at this site in support of the Unit 2 refurbishment.

In January 2016, SNC and Aecon were awarded a \$2.75 billion contract to complete the execution phase of the Darlington Refurbishment, including the rebuilding of reactor cores and replacement of critical components.

BWXT Canada

OPG worked with its long-time design agents for fuel handling at Darlington, BWXT Canada on the defuelling portion of the refurbishment project.

BWXT was involved in the defuelling initiative since 2013, with as many as 200 staff members working on the project. The company's work has included engineering and manufacturing components used in defuelling, as well as overseeing software changes needed to modify programs for the type of fuel removal involved. Their work helped ensure the defuelling portion of the project was completed ahead of schedule.

E.S. Fox

E.S. Fox set up a team of workers on-site at Darlington to support refurbishment processes and procedures, integrating



Workers celebrate the successful installation of Darlington Unit 2's 960 feeder tubes in October 2019. This was followed in December by the loading of 6,240 new fuel bundles into the reactor core.



Above, a workshop with COG supplier participants at the Darlington Energy Centre in 2016 was one of many visits COG supplier participants made to the site as part of on-going collaborative development, undertaken through COG. At right, Hatch's Ian Trotman, who served as the COG Supplier Participant Project Manager in 2016, now serves as the program's chair.

with OPG and joint venture staff to strengthen project collaboration and provide support as efficiently as possible. The company fabricated thermal insulation cabinets for the project to protect the refurbished reactor vault's concrete walls and feeder header frames from excess temperatures as well as reduce the load on the reactor vault cooling system.

E.S. Fox supplied 654 carbon steel support frames and 3,792 stainless steel panels as part of the Darlington Unit 2 refurbishment.

Black and McDonald

Black and McDonald Nuclear, which is headquartered in Clarington, Ontario near the Darlington plant, has long acted as an OPG vendor. It was also responsible for inspecting and maintaining 1,200 valves for the Darlington Refurbishment.

Approximately, 80 per cent of the nuclear project work the company does is focussed on Darlington with about 450 staff located on-site at the plant.

The company also worked on heat exchangers and piping modifications built at Black and McDonald's Scarborough facility for just-in-time delivery to Darlington. In 2017, its contributions were recognized by OCNI.

GE Power

OPG appointed General Electric as the project leader for the refurbishment of the steam turbines, generators, automation and controls for all four Darlington units.

GE Power manufactured a 350-tonne stator for Unit 3, a stationary part of a generator that converts the rotating magnetic field into electric current. It shipped the stator from its Poland factory to Darlington in May 2019.



Canadian Nuclear Isotope Council members Bruce Power, Framatome and Kinectrics join Ontario Premier Doug Ford to show off their socks which promote the life-saving power of medical isotopes in November 2019.

More than electricity

CANDU utilities continue their international leadership in medical isotope production

Nuclear plants are, not surprisingly, well associated with electricity production. But nuclear's essential service goes beyond keeping the lights on to saving lives through production of the materials used for live-saving drugs, medical diagnostics and treatments as well as food safety, worldwide.

In June, Bruce Power continued its medical isotope leadership announcing the launch of a Medical Isotope Advisory Panel consisting of experts and medical professionals to provide the company with an external perspective in the development of its isotope program and share emerging trends and solutions for a range of global health challenges. The panel will meet at an annual symposium with the first one scheduled later this year.

Bruce Power and OPG, along with New Brunswick Power and Canadian Nuclear Laboratories, are members of the Canadian Nuclear Isotope Council (CNIC), which seeks to strengthen Canada's leadership position on global medical isotope production and development. CNIC also has representatives from other industry organizations and various levels within the Canadian health-care sector as well as academic research bodies.

Bruce Power and Ontario Power Generation (OPG) produce approximately 50 per cent of the world's Cobalt-60 medical isotopes. Cobalt-60 is responsible for sterilizing approximately 40 per cent of the world's single-use medical devices, including syringes, gloves, implants and surgical instruments. This

medical equipment continues to be in high-demand as the second wave of COVID-19 impacts various countries.

Given that high demand, the need for irradiation increased during the COVID crisis and remains strong. Gamma irradiation technology can sterilize materials within a day, far faster than other methods.

OPG has been producing Cobalt-60 at Pickering Nuclear since the 1970s and last year announced it would expand production to Darlington as Pickering operations wind down.

OPG is also involved in an innovative collaboration between its subsidiary, Laurentis Energy Partners, and BWX Technologies (BWXT) which will see another medical isotope, Molybdenum-99, harvested at Darlington.

Molybdenum-99 is used in over 30 million diagnostic and medical imaging treatments around the world each year, helping to detect illnesses like cancer and heart disease. Darlington will be the only source of Molybdenum-99 in North America, ensuring a stable domestic supply of this critical product.

On July 10, the Canadian Nuclear Isotope Council (CNIC) released a video focused on how isotopes have played a critical role during the COVID-19 pandemic helping to keep hospitals clean and safe. [Watch it here.](#)



COG at work

Like the industry it represents, the CANDU Owners Group took up the challenge presented by COVID-19 and found a way to not just survive but thrive.

Ask COG team members to describe their work life working through the pandemic and you are likely to hear a one-word theme: BUSY.

With an average of 20 meetings that include about 150 participants on any given day, managed through COG's Webex system as well as research and joint projects going full steam ahead, #ExcellenceThroughCollaboration remains alive and well.

COG at work



Wherever their desk happens to be, the people on COG's team are working to advance the interests of members, participants and partners every day. Read some of the good news stories they shared at a recent COG Virtual Town Hall Meeting.

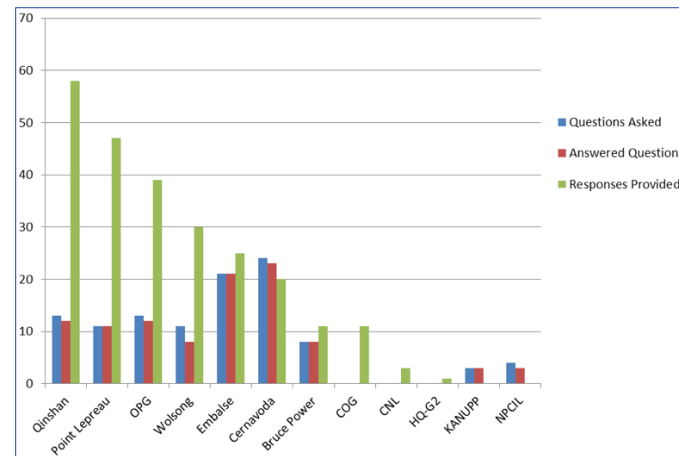
COG member OPEX Q&A participation remains strong

Member engagement with COGonline's OPEX Q&A forum has shown no signs of slowing down despite changes brought on by the COVID-19 pandemic.

From April to June, 100 per cent of forum questions received at least one reply, with an average response rate of 2.7 answers per question.

With the pandemic leading to operational changes across COG's membership, the commitment to collaboration and information exchange remains strong.

Contributed by Steven Prigge



COG focusses on strengthened corrective action processes

COG's Corrective Action Program (CAP), which launched in 2006, was established to ensure specific process improvement actions were being applied to COG work on behalf of its members.

Every month, the CAP team issues a status report to COG's lines of business in where in progress, overdue actions, and the owners responsible for addressing those actions are identified.

An increased focus by all COG lines of business on corrective actions, together with weekly dedicated meetings and enhanced documentation, has helped COG decrease the total amount of overdue corrective actions. This result has contributed to reduced costs and improved overall program performance leading to better value for COG members.

Contributed by Jennifer Benjamin

Advancing Canadian SMR collaboration

COG's Small Modular Reactor (SMR) Security Task Team, which launched in December 2019, works to develop recommendations to inform security regulations surrounding SMR technology. Since its inception, the group has been working on the development of its first SMR security paper, which was submitted by participating COG members to the Canadian Nuclear Safety Commission in April.

Input to the paper was provided by task team members, CNSC staff, the U.S.-Canada Task Force on SMRs as well as SMR vendors. The quick turnaround of the paper is an example of the speed COG collaborative work can generate results and engagement from members, industry stakeholders and the regulator.

Another task team has been formed to address SMR nuclear liability.

Contributed by Keith Garel



International engagement continuing through global pandemic

COG's international CANDU 6 (C6) members continue to virtually collaborate during the COVID-19 pandemic.

At a recent C6 Safety Analysis Application Task Team (SAATT) meeting, members discussed ways to improve safety and operating margins, tasks were identified for follow-up and consideration was given to a potential joint project. The meeting illustrates how COG's international member engagement has continued despite the global pandemic.

Contributed by Krish Krishnan

CIQB continues activities through COVID-19 pandemic

Despite COVID-19 related interruptions, the CANDU Inspection Qualification Bureau (CIQB) team was focussed on requalification updates to demonstrate continued compliance in the wake of changing procedures.

Through COG's network of qualified support reviewers, CIQB continued the processing of these updates during the COVID-19 pandemic despite remote working constraints.

Since April, eight updated certificates have been issued. This is aligned with licensee programs to execute inspections this year, and it ensures continued compliance with regulatory requirements.

Contributed by Jeff Weed

Enabling collaboration during uncertain times

In response to the COVID-19 pandemic, COG quickly expanded its virtual meeting capabilities. It also implemented new cloud-based and remote technologies to ensure continued information exchange and collaboration with members. This seamless transition to virtual meetings and remote work (for COG employees) reflects the investments made in recent years to strengthen COG IT's unified communications infrastructure.

COG's IT team reported between April and June, it hosted more than 1,300 virtual meetings with approximately 10,000 participants.

Contributed by Kelly Curtis

CNL re-starts critical burst testing program amid COVID-19 pandemic

In mid-March, CNL suspended the burst testing program due to the risks presented by the COVID-19 pandemic.

The program is critical for COG members, particularly, to maintain operating licences for CANDU reactors prior to planned refurbishments. It allows CNL to simulate radiation effects on fuel channel materials at various stages of their lives.

The results of this work can be used to improve component design as well as reduce operating and surveillance costs for post-refurbished units.

Recognizing the importance of the testing to CANDU utilities, within four weeks, CNL developed a plan and safely restarted the program. CNL added hygiene stations and modified procedures at its site entry gates and the exit radiation monitors. They launched new clean and sanitize routines for testing equipment and required PPE use for staff involved in testing.



Photo: Canadian Nuclear Laboratories

CNL also implemented site-wide physical distancing requirements, which reduced the number of employees on-site from approximately 3,000 to 300.

Contributed by Tony Tenev



Fueling nuclear's future

COG's Tony Tenev is overseeing the Fuel Channel Life Management program into its next phase to support CANDU operational excellence.

Less than a year into his CANDU Owners Group (COG) journey, Tony Tenev is using every tool in his toolkit to increase industry understanding of fuel channel material properties and validate predictive models used in the evaluation of fuel channel fitness-for-service.

Throughout his 13-year career in nuclear, Tenev has worked in many areas from fuel handling instrumentation and control engineering to marketing, business development, project delivery and plant equipment supply management. He has called on those diverse experiences while managing the 60+ projects he oversees in his role as COG Fuel Channel Life Management (FCLM) program manager.

Tenev joined COG in August 2019, from SNC-Lavalin's Candu Energy division, where he most recently served as power plant equipment supply portfolio manager. Tenev spent seven years at SNC, managing joint venture projects and major project proposals, with a focus on MCR. He earned his bachelor of engineering at Ryerson University and is both a certified project management professional and chartered professional accountant. In joining COG, Tenev was eager to transition into a role and be part of an organization where he could engage with industry in new and collaborative ways.

"I've been fortunate in my career to touch all facets of the business, from working on the NRU at Chalk River to leading bids for hundreds of millions of dollars in MCR projects," says Tenev.

"Joining COG has allowed me to put those experiences to good use and focus on common solutions for our members in an area that benefits the entire industry."

FCLM: A profile in excellence through collaboration

The CANDU industry's work on fuel channel development is an incredible success story built on collaboration. FCLM research has improved confidence in the fitness-for-service of CANDU pressure tubes and led to improvements in industry

standards used worldwide to confirm pressure tube integrity. The work includes accelerated aging and subsequent testing of actual CANDU reactor components that were removed to evaluate late-life material properties.

The Ontario electricity sector is a prime example of the exponential value received from FCLM and Spacer Life Management project efforts. The province's three nuclear plants have all benefitted from demonstrating fitness-for-service through the results of this work. The plants earned relicensing for operating beyond initial design-based estimates and, as a result, gained thousands of additional hours of generation.

For Ontarians, the result has been billions of dollars of additional revenue from the publicly-owned assets and a continued supply of low-carbon electricity even as refurbishment projects are underway.

The next phase

Tenev is overseeing FCLM at an interesting point in the program's development. He says it has matured and is now entering a "validation," phase where COG supports CANDU utilities with model development, CSA standard updates, data and test results about the "expected behaviour of CANDU fuel channels."

"These next stages of the FCLM program will provide our members and the regulator with greater certainty that

"Nuclear is a critical component to a clean energy future and while I think SMRs will have a huge impact on the industry, my experience has been in CANDU, and I believe it still has much to offer."

predictive models are validated and reactors operate within safety margin," says Tenev. "Through hydriding, burst testing and other experimental validations, we can simulate radiation effects on fuel channel materials and test annulus spacers at various stages of their lives."

One such experiment uses the High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory to prematurely age spacers. This is followed by an examination to see how the spacers perform, conducted by Canadian Nuclear Laboratories. The experiment is an example of how FCLM allows COG members to anticipate material behaviour and change, over time, under simulated operating conditions.

"Industry collaboration to understand annulus spacer and load expectations is critical for our members, particularly, as a pre-requisite for re-licensing and as CANDU utilities perform refurbishments," says Tenev. "The results of our work can be used to improve component design as well as reduce operating and surveillance costs. FCLM has a lot to give to the future of CANDU plant safety and operations."

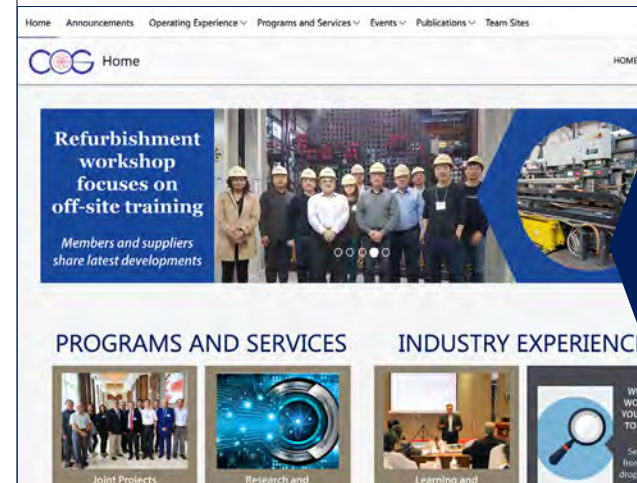
The value of the project extends beyond the existing fuel channels, Tenev adds.

"There's also a benefit for future new build stations and post-refurbishment life. These predictive models could be applied to support cost reductions in future reactor maintenance, operations and surveillance procedures," he says.

"Nuclear is a critical component to a clean energy future and while I think SMRs will have a huge impact on the industry, my experience has been in CANDU, and I believe it still has much to offer."



A CNL employee analyzes a sample of a bursted pressure tube as part of fuel channel research work for COG. The research has contributed to continued operation at Pickering and allowed for effective synchronization of the Darlington Refurbishment and Bruce Power MCR projects. Photo courtesy of CNL.



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www.COGonline.org



A champion of collaboration

As he enters semi-retirement, COG's Paul Lafrenière looks back on 42 years in the CANDU industry with a continued belief in the power of collaboration

In the earliest parts of Paul Lafrenière's career, he learned a key ingredient of the CANDU culture was problem solving.

Lafrenière started his journey in nuclear with Atomic Energy of Canada Limited (AECL), in the late seventies, working alongside "pioneers," of the Canadian industry including R.L. (Bob) Hemmings and, later, Ontario Hydro's Ray McDermott, individuals who, to him, personified the spirit of innovation and resourcefulness that defined the sector during that era. Hemmings led a career at the forefront of Canadian nuclear and fusion power development while McDermott served as an early Bruce B Station Manager and played a critical role in the plant's commissioning.

"It was the early days of the nuclear industry and you were there with the people who were involved with CANDU from the very beginning," says Lafrenière. "We didn't have the supports we have today, but we were very resourceful and there was a lot of problem solving going on. It really was a 'CAN-DO' culture."

One of Lafrenière's first roles was as a commissioning engineer at Bruce B.

"One of the innovative techniques we developed at the time was finger-printing the station," he says. "We set-up a program with additional instruments to capture all aspects of the station in its original state. We developed databases of this information and it proved valuable in monitoring and identifying changes and problems that arose as the station aged and allowed us to perform troubleshooting in an effective and rapid manner."

Even during this period of CANDU continuous improvement, Lafrenière observed that problem solving was typically centred at the stations themselves and there was a tendency for stations to work and operate independently rather than collectively.

"You quickly realized in talking with the other stations that everybody basically had the same problems and there was a lot of reinventing the wheel going on," says Lafrenière. "This

delayed the resolution of problems and made it a lot more costly."

After stints with AECL and Ontario Hydro, Lafrenière joined Hydro-Québec in 1988, where he spent a decade at Gentilly-2 Nuclear Plant, serving primarily as engineering manager.

It was during that time Lafrenière began to learn more about CANDU Owners Group (COG), which started in 1984. He recognized the tremendous potential of industry collaboration.

"My work at Gentilly contributed to improving the station's lifetime performance above 80 per cent and brought in a lot more cooperation from the [CANDU] fleet," says Lafrenière. "We were only beginning to recognize then that collaboration could be leveraged to the benefit of the industry as a whole."

A new journey in collaboration

The mid-to-late 1990s and early 2000s marked a period of transition for the Canadian nuclear industry. In 1995, the Canadian federal government completed a review of AECL's funding model, including its R&D expenditures, and the result was a significant reduction in nuclear investment.

By the end of 1998, changes in the Canadian energy landscape, combined with controversial policy and restructuring decisions in Ontario, including layup of several Ontario Hydro reactors, meant changes in industry funding and organizational structures.

From 1998-2006, Lafrenière spent much of his time at Chalk River Laboratories, serving as general manager of nuclear facilities, navigating tight operating budgets during a "difficult and trying time for the industry."

After his "first retirement," from AECL in 2006, Lafrenière joined COG as project manager in joint projects, invited in by Henry Chan, an original COG staff member, now himself retired.

"Henry recognized that I had always been a COG supporter and that I had unique design and plant operating experience

as an engineering manager," says Lafrenière. "Going back to 1984, COG had completed billions of dollars in joint projects work and was bringing the fleet together to solve complex problems."

Lafrenière is proud of his COG contributions, in particular, "getting the stations to see the power of working together."

"We launched joint projects in a number of areas. I was proud to lead the first COG benchmarking initiative in 2008, forming the COG member benchmarking team, and coordinating 16 CANDU station visits, around the world. This led to 20 or so member benchmarking joint projects and served as predecessors to initiatives like CCIV (COG's Continuous Collaborative Improvement Visits that identify member challenges and benchmark utilities who have successfully tackled them). It also led to streamlining of benchmarking visits and exercises being conducted electronically. This work became the main component of COG's Inter-station Assistance Program," says Lafrenière.

"We popularized peer-led technical site visits, brought in INPO, WANO and EPRI collaboration, increased focus on obsolescence and spare parts. We developed industry guidelines and best practice databases, including a treasure chest of approximately 700 CANDU benchmarking exercises that now benefit the entire industry."

Lafrenière also counts his work supporting international member performance improvement and calandria and

Paul, who loves Korean kimchi and food.

As a communication channel between international members, he played a very important role.

Understanding and supporting international members, he made a great contribution to COG excellence through collaboration.

Lovely and romantic engineer, Paul, your devotion to KHNP will remain in our memory for a long time.

Donghwan Park, Sr. Researcher, KHNP



Paul Lafrenière (far left) celebrates KEPCO becoming COG's first international supplier participant program member in 2017. Lafrenière, now semi-retired, strengthened international CANDU collaboration and improved station performance through his COG work.

internal conditions assessment as achievements that would not have been possible without CANDU fleet collaboration. He believes this is what makes the Canadian nuclear industry and COG such unique success stories.

"People just don't recognize that we're really inter-dependent," says Lafrenière.

"Mondays were never boring throughout my career; there was always a new problem to solve."

Lafrenière will use his recently announced semi-retirement, to spend more time with his family including his grandson, and to pursue interests like golf and ballroom dancing with his wife.

Paul's industry colleagues share their thoughts on his strengths and contributions to the industry

"I've always been impressed by Paul's breadth and depth of knowledge. He seems to know the most arcane details and could pull them out when they were most needed. I don't think we could find someone like Paul, and it's great that his retirement is only "semi"."

Fred Dermarkar, COG President and CEO

"Paul is extremely dedicated to COG and to the nuclear industry where he has served in many leadership roles across many organizations. He strives to solve any problem brought forth by our members and work in collaboration to provide them with the best possible solution. He loves the nuclear industry and the industry loves his enthusiasm and commitment."

Sonia Qureshi, COG Director, JP&S

"I will miss seeing Paul walking with a stack of folders in his hand through the office corridors. Those folders are a symbol of his extensive knowledge and brilliance. The pace of his walk, his enthusiasm and passion for the work, even after 35-years-plus in the industry, and the smile on his face are a reflection of his positivity and kindness."

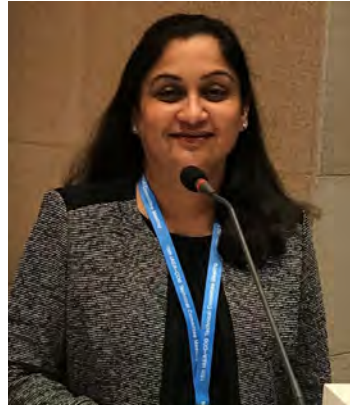
Nidhi Gaudani, COG Program Manager, JP&S

"When I think of COG's vision: excellence through collaboration, Paul's name comes to mind. I have worked with Paul from his days at AECL, to when he was technical manager at Gentilly-2, and, later, after he joined COG. Throughout that time, he has consistently demonstrated professionalism, energy, enthusiasm and willingness to share and to encourage collaboration for the betterment of the industry."

Paul Thompson, Sr. Strategic Advisor, NB Power

"Thank you, Paul, for your hard work and commitment to COG, to Embalse NPP and other COG members enabling us to achieve excellence through collaboration. You may be retiring from work but you will never retire from being a great person."

Carlos Moreno, Engineering Manager, and Sergio Battiato, OPEX Manager, NA-SA (Argentina)



CANDU Pride

In 2005, Nidhi Gaudani began her CANDU career when she joined COG, a year after immigrating to Canada. In doing so, she found a country and a company where diversity is a strength and people can reach their potential.

Like CANDU technology itself, Nidhi Gaudani's career with CANDU Owners Group (COG) is a Canadian success story strengthened by international connections.

Gaudani was born in India and immigrated to Canada in 2004. Like many new Canadians, Gaudani had difficulty landing professional roles upon her arrival, despite energy sector work experience and a bachelor's degree in mechanical engineering from back home.

"I was just like most new immigrants to Canada. I had a difficult time trying to figure out where I fit into the Canadian economy," says Gaudani, now a COG program manager in Joint Projects & Services (JP&S). "But I was lucky in joining COG, to have great mentors like [the late] Barry Collingwood and Ed Bennett, who recognized what I could contribute and gave me the opportunity to support hundreds of deliverables and allowed me to learn about CANDU technology and the industry."

"We are a small team [at COG] but we get to work with so many different partners across the CANDU industry."

"I believe in destiny. It's rare in a new country that the first place you land is the place where you grow and figure out your [career] direction."

Now in her fifteenth year with COG, Gaudani credits her mentors and colleagues for encouraging her to pursue her interest in project management.

Supporting the global CANDU community

Gaudani feels a great sense of pride in supporting COG's members and furthering CANDU technology.

As part of COG's Supply Chain, Obsolescence and Procurement (SCOP) program, Gaudani facilitates collaboration among members to lower supply chain costs using bulk procurement practices. In this role, Gaudani has been able to help COG utilities obtain spare parts in time to avoid plant shutdowns or outage extensions.

Gaudani believes COG is unique, both for the professional opportunities it offers and the sense of unity amongst the CANDU community.

"With CANDU being a Canadian design, and as a Canadian myself, I've felt and have seen others take ownership and pride in contributing to its development," says Gaudani. "We are a small team [at COG] but we get to work with so many different partners across the CANDU industry."

Those partners reach across the utilities and supply community in Canada, and also in six other countries worldwide, who share a common interest in strengthening innovation and on-going improvement within the CANDU reactors they operate.

Since 2019, Gaudani has served as the CANDU 6 Fleet Steering Committee facilitator and through that work has seen the contributions and collaboration amongst COG's international community. She also manages COG's CANDU quality assurance joint audit program (CANIAC) working with the CANDU supply chain.

Much like her adopted country, COG is strengthened by the contributions of a diverse community.

"They respect what COG does and recognize collaboration is important work. We have those days often and that's the best part of our work."



Gaudani supports collaboration amongst COG's international community in her role as CANDU 6 Fleet Steering Committee facilitator.

OPG leader shares a vision for Canadian nuclear industry in COG one-on-one



COG President and CEO Fred Dermarkar (left) chatting with OPG Nuclear President Dominique Minière at COG's General Business Meeting on Dec. 4.

At the recent COG General Business Meeting, President and CEO Fred Dermarkar spoke one-on-one with OPG Nuclear President Dominique Minière about the importance of on-time, on-budget performance, SMRs and the nuclear industry's role in addressing climate change.

Ontario Power Generation (OPG) Nuclear President Dominique Minière has spent nearly 40 years building, operating and refurbishing nuclear plants, worldwide. He believes the next decade will be critical to the future of nuclear in Canada.

At the CANDU Owners Group (COG) December 2019 General Business Meeting, Minière talked with COG President and CEO Fred Dermarkar about a range of issues affecting the nuclear industry from the need for new nuclear construction to the importance of industry collaboration. Minière, who previously served as Chief Operating Officer at Électricité de France (EDF), which operates one of the world's largest nuclear fleets, also weighed in on how the Canadian nuclear industry is well-positioned for growth in the next decade, and stressed the need for technological innovation and investment.

Minière links Canadian nuclear success to the construction of new and renewed nuclear facilities, delivered on-time and on-budget, by 2030. Following the shutdown of OPG's Pickering Nuclear Plant, there will be an increased need for electricity generation but fewer nuclear plants to address that demand. Minière says that new investment in nuclear is probably needed by 2022 to provide enough time to plan and build new nuclear facilities and respond to the coming need for new electricity generation.

"Showing that new nuclear can be delivered on-time and on-budget is key to future investment," says Minière. "Time is

of the essence and it will not be an easy journey. The financial community needs to believe in nuclear and we need to deliver a return on investment. We need to take advantage of our momentum and stay united as an industry. New [nuclear] technologies need to succeed, need to be completed and continue to be developed all in parallel."

According to Minière, OPG, in collaboration with Bruce Power, New Brunswick Power and COG, will do its part to help the industry to innovate and develop the technologies that will carry it forward into the next decade and beyond. He says OPG is continuing to work to advance small modular reactor (SMR) technology development and push for more action on the Canadian SMR Roadmap.

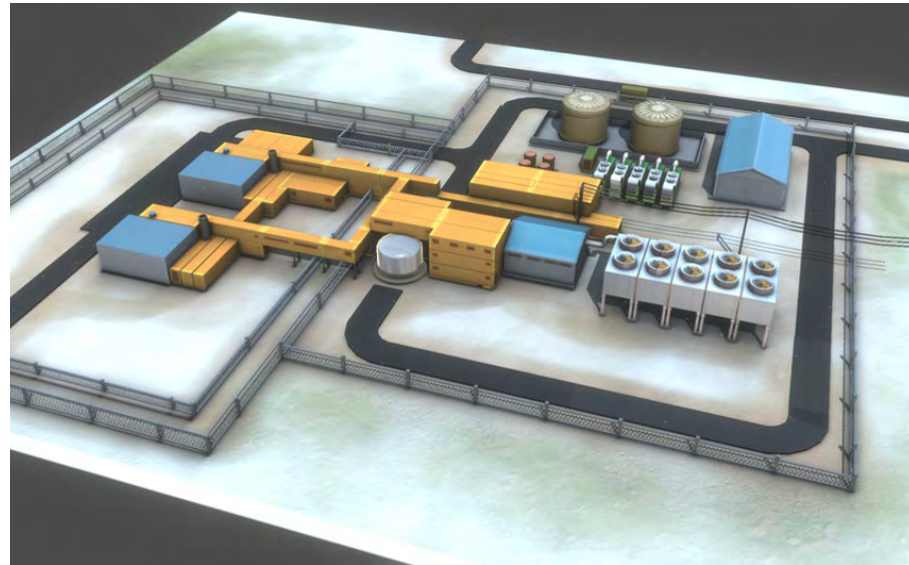
Minière also touched on the importance of building awareness of nuclear's critical role in addressing climate change through low carbon electricity generation and how nuclear and renewable technologies can work together as alternatives to carbon-generating competitors.

"New nuclear is still a future possibility in Canada and it can be part of the climate change solution, complementing renewables," says Minière.

He emphasizes that nuclear's role in Canada's response to climate change is contingent on the industry continuing to demonstrate continuous improvement, focusing on collaboration as well as delivering cost-effective, reliable electricity for Canadians in the next several years.

SMRs on the road to reality

COG's SMR program is contributing to Canadian and international collaboration, advancing SMR technology and strengthening industry alignment on deployment — a reality that's getting closer with a collaborative government and industry commitment



On June 29, OPG became the first utility in North America to take an ownership stake in an SMR project, a major Canadian milestone. Above, an illustration of Global First Power's proposed Micro Modular Reactor project, a joint venture for which OPG is part owner.

Canada pioneered the use of nuclear energy more than 70 years ago and today its federal government, some of its provinces and industry are poised to lead the world in the technology's newest transformation -- small modular reactors (SMRs).

SMRs offer new design features that can provide flexible energy solutions to support the transition to cleaner energy systems, in Canada's cities, remote communities and for export of clean, safe and easily-mobilized energy sources to people, world-wide.

CANDU Owners Group (COG), its members, supply community and other industry partners continue to make inroads in accelerating the development and implementation of SMRs in Canada and to international markets. The last year has seen significant progress towards that goal, despite the COVID-19 pandemic.

Most recently, on June 29, Ontario Power Generation announced it had become the first utility in North America to take an ownership stake in a small modular reactor (SMR) project (see full story to follow).

Through COG's Nuclear Safety and Environmental Affairs (NSEA) line of business, COG has taken a leadership role in facilitating information exchange and development on SMR activities. COG is working with the Canadian Nuclear Association on the Canadian Nuclear Industry SMR Secretariat to track progress on the pan-Canadian SMR Roadmap, published in 2018.

Canada's SMR Roadmap made over 50 recommendations, including that the federal government and partners finalize an SMR Action Plan, now out for input.

In February 2020, Minister O'Regan announced plans to respond with a launch this fall, stating "Together with our partners from across the country, we will launch Canada's SMR Action Plan – outlining the progress and ongoing efforts across Canada to turn our Roadmap into reality."

Through COG, a CEO SMR Forum was developed, comprised of industry executives focussing on development of a common industry framework and building an SMR case for support from the federal government. The Forum recently put forward an ask to the Canadian Government for economic stimulus. The CEOs outlined the strategy for pursuing SMRs, the opportunity for Canada and the role the federal government can play on the road to SMR deployment.

Meanwhile, the CEO SMR Working Group has focused on commissioning and completing an SMR market study and supporting the interprovincial MoU on SMRs between Ontario, New Brunswick and Saskatchewan.

International leadership

Beyond Canada's borders, COG is playing a role in international collaboration.

In June, COG Deputy CEO Rachna Clavero, served as a panelist for the International Framework for Nuclear Energy Cooperation (IFNEC) webinar on global SMR licensing challenges.

Clavero says COG plays an important role in developing a harmonized approach to SMR deployment in Canada and internationally.

"COG brings its strong Canadian and international relationships to the SMR work. With our Canadian and international members and agency partners, COG can facilitate a framework for a global SMR fleet model," she says. "We are seeing gradual progress towards this objective thanks to our experience bringing global nuclear industry stakeholders together."

The COG SMR program is working with international nuclear-focussed organizations such as the EPRI Advanced Nuclear Technology program, World Nuclear Association and the U.K.'s Office for Nuclear Regulation to share relevant information to and from COG's SMR Technology Forum (SMRTF) and its SMR Vendor Participant Program (SMR VPP).

The SMRTF and SMR VPP have inter-related objectives and jointly support advancement and deployment of SMRs in Canada and around the world (see full list of SMRTF and SMR VPP participants in sidebar).

In September, COG will host a joint webinar with EPRI focussing on establishing SMR owner-operator requirements and emerging areas for SMR collaboration.

Clavero says SMR development is expected to expand and COG has an active role to play.

"As COG members come to agreement on selection of an on-grid SMR technology for deployment, COG will support the vendors selected through related joint projects as well as research & development. This has the potential to bring clean, carbon-free SMR technology online to the benefit of Canadians and electricity customers around the world."

OPG marks major milestone in SMR development

On June 29, Ontario Power Generation (OPG) announced it had become the first utility in North America to take an ownership stake in a small modular reactor (SMR) project.

Ottawa-based Global First Power (GFP), U.S.-based Ultra Safe Nuclear Corporation and OPG jointly launched the Global First Power Limited Partnership which will build, own and operate a proposed Micro Modular Reactor (MMR) at the Chalk River Laboratories site. The Chalk River site is operated by COG member, Canada Nuclear Laboratories.

The joint venture, equally owned by OPG and USNC, represents the first commercial partnership on an SMR in Canada. OPG will help advance the project through the environmental assessment and licensing stages. USNC will be the designer and supplier of the technology.

In addition to committing funds, OPG and USNC will be providing their own staff and other resources to GFP, which will be overseeing the project.

Read the full announcement [here](#).

The COG SMR Technology Forum

The SMRTF, which launched in April 2017, consists of all the Canadian nuclear operators as well as key industry organizations leading in the areas of nuclear innovation and SMR development in Canada. The Forum promotes harmonized approaches to support SMR application. In February, the Forum identified strategic priorities focusing in on evaluation of the Canadian SMR supply chain; accelerating standards for advanced manufacturing and SMR nuclear liability insurance limits.

SMRTF participants

OPG*
Bruce Power*
NB Power*
CNL

Observers

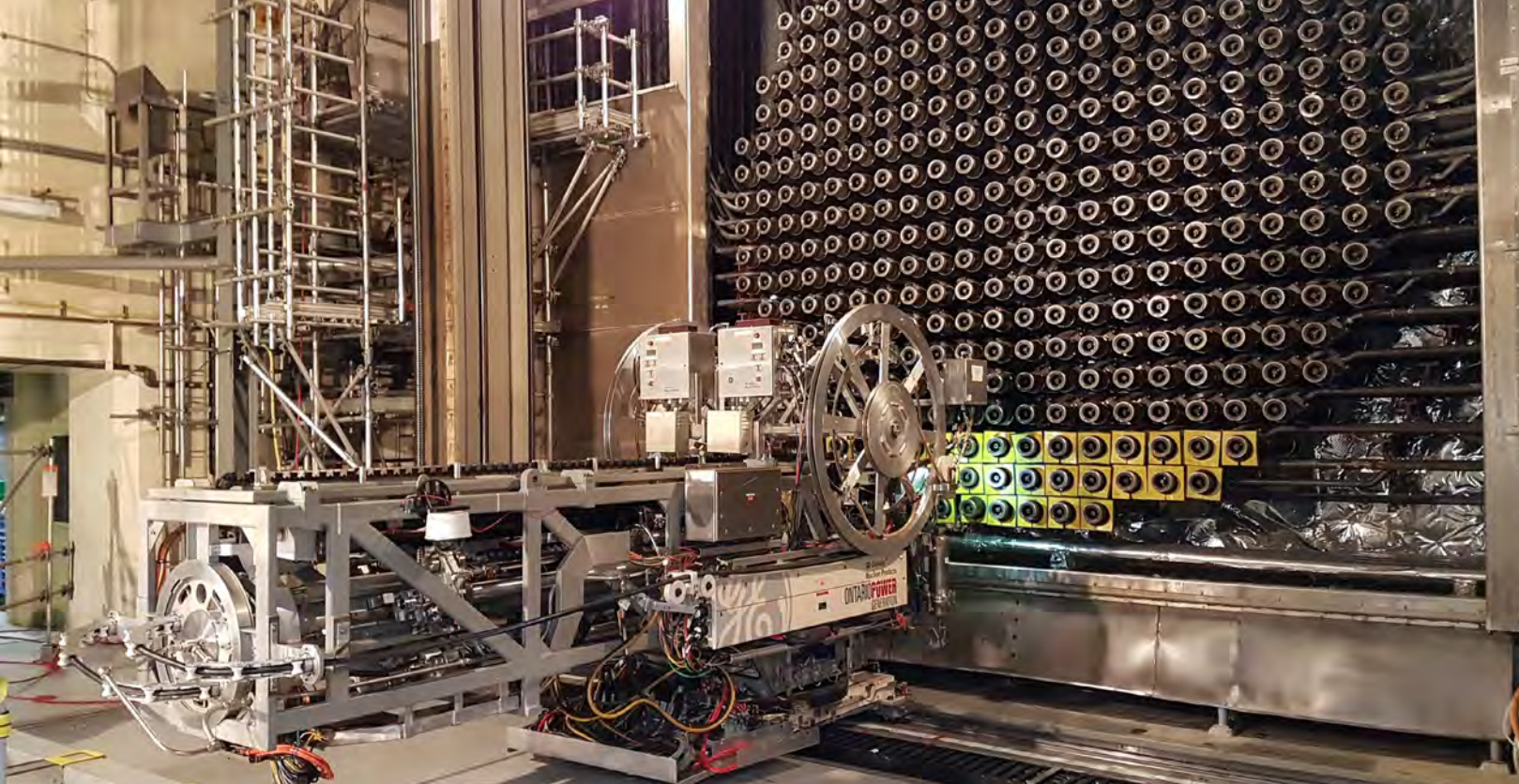
AECL
SaskPower*
CNA
CSA
CNS
OCNI
UNENE
NRCan

* Denotes member of CEO Forum

COG Vendor Participant Program

The COG SMR VPP, which was established last year, brings together vendors engaged in SMR design review or who are connected with a COG member on SMR development. As a group, vendors contribute to common technical positions, engage with industry on shared challenges, and participate in the development of solutions. The SMR VPP currently has 10 participating vendors.

ARC Nuclear Canada	Terrestrial Energy
GE Hitachi Nuclear Energy	U-Battery
Holtec	USNC
Moltex Energy	Westinghouse
NuScale Power	X-energy



The Universal Delivery Machine (above) is used for offline fuel channel inspection at the reactor face. Ontario Tech students presented an approach that could contribute to an eventual on-line inspection solution, reducing reactor outage time.

Students give fuel channel inspection a fresh look

Nuclear engineering students tackle industry challenges with a CANDU Owners Group capstone project

Ben Breeden, a recent Ontario Tech University nuclear engineering grad, says he and his classmates were excited but a little nervous about their final undergrad capstone project.

“This was our last project in our last year of engineering school,” says Breeden. “Our group had to put forward a project application to COG. If accepted, it was going to be a good experience to solve an industry problem and have our work looked at by industry experts for feedback. But we weren’t 100 per cent guaranteed this project.”

COG accepted the project application.

Breeden’s capstone team, which included classmates Sriram Saravanabavan, Michael Mai and James Liang, was one of a dozen Ontario Tech student-led projects supervised by professors from the school’s faculty of energy systems and nuclear science, as part of the annual nuclear engineering capstone course. One-third of the student teams are partnered with industry sponsors like COG, Ontario Power Generation

(OPG), Canadian Nuclear Laboratories (CNL) and Kinectrics looking at real issues faced by these organizations. This was COG’s second year sponsoring an Ontario Tech nuclear engineering capstone project.

The project teams are challenged to address a complex problem, develop a methodology and propose a solution, applying everything learned in their undergraduate studies. John de Grosbois, COG Program Manager, Research & Development and Ontario Tech Sessional Lecturer, co-supervised Breeden’s capstone project and challenged the students to come up with “strategic design improvements for sustainable long-term life of CANDU plants.

“As a group, they have to understand the problem domain, characterize the requirements, do the background research and analysis,” says de Grosbois. “It helps build graduates that have tasted the challenge and rewards of complex systems engineering in a nuclear environment. The benefit to industry is not necessarily in the project outcome but the fact that it’s

“Our intent with this capstone course and by having industry partners, like COG, is to hopefully deliver something meaningful for our industry partners, to really bridge the gap between academia and industry.”

forming competent professionals that will soon be employed in our various technical environments.”

As the project team’s main COG contact, de Grosbois provided the students with a list of potential areas for improvement in the current Canadian CANDU reactor fleet. They also consulted with industry representatives from OPG, Kinectrics, BWXT and Promation. Breeden and his classmates began looking at issues related to CANDU plant inspections.

“Currently, all inspection work is done off-line. We wanted to find a way to do it on-line,” says Breeden. “Reactors have to be shutdown, de-fueled and dried. It’s a big process to get these inspections done. Fifteen channels have to be inspected during each outage. You can only inspect one or two channels per day. The biggest challenge, for us, was coming up with a solution for this.”

The project team developed a design for an on-line pressure tube inspection device providing reactor safety data while reducing inspection outage time and decreasing lost revenues (stemming from the extended outages). Current pressure tube inspection processes involve sending an instrument down the tube to measure how much it has sagged. The project team developed a testing tool design that could be used while a reactor is operating, an approach which had previously been dismissed and wasn’t considered possible.

Markus Piro, Assistant Professor and Canada Research Chair in Nuclear Fuels and Materials, co-supervised the capstone project. He was joined by de Grosbois and Daniel Hoornweg, Associate Dean and Professor within the faculty of energy systems and nuclear science. Piro, who joined the university three-years ago, after serving as CNL’s head of fuel modelling

and fission product transport section, believes the capstone course helps respond to what he sees as a “disconnect between academia and industry.”

“The disconnect can happen when our students graduate,” says Piro. “We want to ensure they are practical and aware of industry best practices, they understand quality assurance and reliability. Our intent with this capstone course and by having industry partners, like COG, is to hopefully deliver something meaningful for our industry partners, to really bridge the gap between academia and industry.”

Breeden sees value for all sides in the capstone experience.

“The capstone let us touch all points in the engineering design process. [Students] can develop solutions from a fresh perspective,” says Breeden. “In other courses, no one other than your professor might look at your work. But for an industry project, it is much more meaningful, and if it works, it can have an impact in the real world. It’s not something that’s purely theoretical.”

Breeden and de Grosbois agree current technological limitations mean the on-line inspection solution the capstone project team developed for COG will remain theoretical, for now.

The experience gained could still benefit the nuclear industry. Breeden is pursuing a master’s degree, specializing in nuclear fuel safety under severe accident scenarios, in partnership with Sandia National Laboratories. He will be studying under Piro.

“I’d like to get into more research and potentially work for a lab,” says Breeden. “In the future, it would be interesting to tackle more problems.”



From left: John de Grosbois, COG and Ontario Tech University, Markus Piro and Dan Hoornweg, Ontario Tech University and Ben Breeden, recent Ontario Tech grad. Breeden and his fellow capstone students were supervised by de Grosbois, Piro and Hoornweg on their culminating project which blended theory with industry learning experiences.

Transforming research into results

Ontario Power Generation brings home pair of EPRI Technology Transfer Awards for collaborative R&D work supporting nuclear plant safety

An innovative online reactor monitoring tool and a fire probabilistic safety analysis (PSA) project helped Ontario Power Generation (OPG) land two Electric Power Research Institute (EPRI) awards when the 2019 Technology Transfer Award winners were announced in February.

For the fourth year in the past five, employees from a CANDU Owners Group (COG) member, won at the prestigious award ceremony, held during the Nuclear Power Council Advisory Week.

The OPG team awards recognized research and technology initiatives that contributed to improving plant safety and efficiency.

Innovative approach to fire safety analysis recognized

OPG's Shashank Gandhi was recognized for his role in adapting an EPRI, U.S. NRC methodology in a first-of-a-kind application to a fire PSA.

The fire PSA work allowed the company to demonstrate stronger alignment with regulatory safety requirements, improved plant operational efficiency and resulted in a regulatory hold-point release on OPG's Pickering plant.

As well, plans to further improve site performance based on the PSA will contribute to the safety case for extended plant operations to 2024. If Pickering operation continues



From left: OPG's Peigang Cao, Ranganathan Santhanam, Pam Woods and Anil Garg earned EPRI Award honours, in February, for their work installing and demonstrating SMART Chemistry Skids.

to 2024, it will mean a significant savings to the Ontario electricity system and ratepayers who can further benefit from the capital costs already invested in the plant while also pushing out the need for development of replacement electricity.

The research findings are believed to have applications across the CANDU industry.

Innovation in chemistry monitoring

OPG's Peigang Cao, Emily Cornthwaite, Anil Garg, Ranganathan Santhanam and Pamela Woods were recognized for their roles in EPRI's SMART Chemistry Pressurized Water Reactor Online Chemistry Monitoring Demonstration, which was co-hosted by Darlington Nuclear with Public Services Enterprise Group (PSEG) in Salem.

EPRI's Water Chemistry team wanted to demonstrate the capabilities and maintenance requirements for state-of-the-art SMART Chemistry technology for improved monitoring and analysis of reactor coolant, main feedwater and steam generator blowdown systems. In 2018 and 2019, Salem and Darlington plants hosted the demonstration skids. OPG and PSEG provided significant support to the global industry, as the demonstrations will lead to swifter improvements and implementation.

Specifically, OPG's SMART Chemistry PWR system allowed for almost continuous chemistry data monitoring and resulted in more accurate data readings over manual monitoring approaches. The demonstration results and the system itself were also implemented by OPG and other global nuclear utilities.

Online technologies can potentially provide continuous or at least hourly chemistry information. This improved granularity is likely to result in significant operational efficiency improvements and cost savings for the industry.

COG's partnership role with EPRI

CANDU operators hold membership in EPRI through COG providing a two-way information exchange that brings relevant information to and from the CANDU community to the global industry: Information is gathered and shared from the CANDU operators to EPRI. As well, COG identifies information and provides analysis from EPRI data relevant



From left: OPG's Tom Nushaj, Hamdi Seid and Shashank Gandhi, Ashley Lindeman, EPRI, Fred Dermarkar, COG and Neil Wilmschurst, EPRI at the Technology Transfer Awards ceremony in February. Gandhi led one of two OPG projects recognized by EPRI this year.

to CANDU operators allowing cost-sharing and efficiency of analysis where it is relevant to the CANDU fleet.

"COG is proud to play a part in helping our members engage with EPRI," says Kerry Clemen, COG Program Manager, Information Exchange and Chair of the Nuclear

Managers EPRI Technology Transfer Technical Committee. "EPRI has recognized our members' research for a number of years because it consistently strengthens plant safety and efficiency and helps ensure the reliability of the electrical supply we all rely on."



Celebrating a "great legacy"

Ontario Power Generation's (OPG) Tom Nushaj passed away on May 6. Nushaj spent 18 years with the organization including more than a decade serving as section manager in civil design and analysis for its nuclear engineering division. Most recently, he worked in OPG's engineering mechanics and design group.

Nushaj was a graduate of Albania's University of Tirana with a bachelor of civil engineering. After a successful career outside Canada, he joined OPG Nuclear's Pickering refurbishment engineering team in 2002. In 2005, he was promoted to senior technical engineer and, in 2009, was promoted once again to section manager.

Nushaj was known for his breadth and depth of knowledge, experience and strong belief in professional mentorship and collaboration. He was the industry lead on the COG Concrete Working Group, participated on the CSA's N287 (Concrete) and N289 (Seismic) Technical Committees and he chaired the EPRI-Nuclear Power Council's Advisory Committee on Concrete. Tom was also a member of IAEA's Integrated Generic Aging Lessons Learned (IGALL) team.

"Tom was a respected member of various industry committees," says Glenn Pringle, COG Chemistry, Materials and Components Program Manager. "At COG and in the working group, Tom was known for his competence, professionalism, integrity, friendly demeanour and willingness to listen."

Nushaj most recently reported to Jey Alalasantharam, OPG Engineering Mechanics and Design Manager, who considered Tom a dear friend. Jey often sought counsel from Tom on a variety of topics.

"Tom was fond of travel and full of charm," says Alalasantharam. "He was one of those rare personalities with strong business acumen, leadership and technical competence. His immense contribution and great legacy in the nuclear industry will always be legendary."



Jacquie Hoornweg

Managing partner at Querencia Partners

Candu suppliers leading the way

Through the CANDU Owners Group (COG) supplier participant programme (SPP), suppliers have collaborated to develop an internationally-recognised approach to achieve stronger safety and quality culture, **Jacquie Hoornweg** reports

SIX TIMES A YEAR, A few dozen industry leaders, representing almost 30 Candu suppliers, gather for a one-day meeting at one of the participant's facilities. These meetings are not about industry advocacy or business development. There is no golf.

Instead, the host sets the table for meaningful, outcome-oriented discussion on several topics core to the role of the supply chain in today's nuclear environment where, increasingly, suppliers are taking on leadership roles in projects and operations working alongside their clients.

The purpose of the COG programme is to provide the supply community with a technical forum to manage knowledge. Its goal is continuous business improvement and innovation, like that COG utilities have achieved through the organisation for several decades.

"Over the past several years, through the COG programme, the supplier community has done a few important things that have really opened the doors for communication both amongst the suppliers and between the supply community and the utilities," says Ian Trotman. He is the programme chair, and representative for Hatch, a global engineering and consulting company with several Canadian offices, including one in Port Elgin, near the Bruce Power nuclear plant.

Meeting topics include shared operating experience, strategies for strengthening safety and security of the supply chain, nuclear safety culture, quality control and leadership and human performance. There are also discussions on common challenges in the supplier-operator relationship and how to resolve them with a common voice. Since the meetings generally have participation by a few

senior utility leaders, for at least part of the day, there is also an opportunity for dialogue that can help all parties tackle the challenges head on, together.

"There has been a significant increase in the openness to sharing operating experience, both good and bad," says Trotman. "This is not the norm as we think of it amongst competitors in an industry. Through the programme over the past several years, we have built trust and an understanding that when we work collaboratively on things like setting safety and quality culture, it strengthens the industry, and the opportunities, for all of us."

COG is a member organisation founded in 1984 to pool resources, collaborative research and information exchange amongst Candu operators in seven countries. In 2004, a Supplier Participant programme was created. But it was in 2015 that the programme, then with eight participating organisations, really lifted off.

Given the increasingly integrated role suppliers were playing at Candu plants, including projects like Ontario's \$26-billion refurbishment and major component replacements, there was recognition that utility success depended heavily on suppliers striving for the same high standards of human performance, product quality and nuclear safety culture as plant employees. "Achieving that requires the same level of leadership in every organisation involved from part manufacturing to assembly at site. The responsibility is not just on the one holding the operating licence," says Fred Dermarkar, COG's president and CEO.

Dermarkar notes there are requirements to be a member of the COG programme. Companies must meet a minimum business requirement to join. "It keeps the dialogue at an

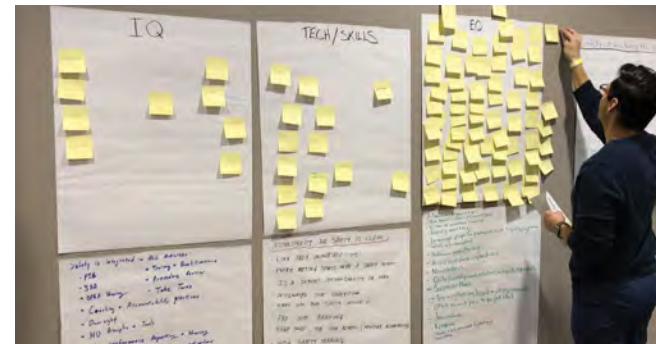
Below: **Timeline showing growth of the COG Supplier Participant Programme and related industry events**



Above left: **COG supplier participants**



Above right: **COG Supplier Participant Programme chair and representative for Hatch, Ian Trotman, with Glen Crawford of Rolls-Royce**



Above: **CANDU Owners Group recently introduced a first-line supervisor leadership training programme tailored to suppliers**



industry leadership level where the people meeting are the ones with sufficient influence to take the actions back and have their companies, and their own suppliers, implement them," he says.

The expectation is that what is hatched and put into action in the programme meeting rooms is shared throughout the supply chain and that the collective senior supplier leadership is working on this with a common objective in mind.

Dissemination has also been helped by industry organisation collaboration, notes Dermarkar. Ron Oberth, president of the Organization of Canadian Nuclear Industries, attends the meetings and shares information through his approximately 250-member organisation.

In 2015, Trotman was an independent consultant working with COG. He was tasked with taking the sleeper programme and revitalizing it. Macit Cobanoglu took over the role in 2017, when Trotman moved over to Hatch. In his current role as chair Trotman sees the work evolving.

"It is encouraging to see that even as original SPP representatives move on to other roles, the companies are replacing them with knowledgeable and engaged individuals," he says, adding, "This is crucial to maintaining the value of the interactions."

The initial thinking for the revitalised supplier programme began with the project-focussed need and that drove the requirement for suppliers to adopt strong conventional and nuclear safety cultures. In the years that followed, the relationship between operators and suppliers evolved. New vendor-designed digital technologies, artificial intelligence and other operational innovations developed in

the supply chain have been integrated into operating plants. These make it more important that suppliers have a strong quality culture in their processes.

Operators need to have confidence that the supply chain can manage issues like managing counterfeit, fraudulent and suspect parts, that they have sophisticated quality assurance processes and that they are adopting the right cultures to instil safety and security requirements.

Cobanoglu has experience as a reactor designer and major service provider, as well as a nuclear construction services supplier. He spent several years as the director of joint projects and services at COG. He is excited by the progress he has seen since taking over the programme two years ago. The value of the collaboration model has been recognised. Early context-setting conversations have matured to include programme work and action plans, including developing supplier performance metrics and formalisation of opex sharing processes.

In 2019, COG introduced a first-line supervisor training programme tailored to suppliers, with elements similar to its long-running nuclear professional development seminar programme for emerging nuclear utility leaders.

Dermarkar says the model can provide a blueprint for utilities and supply chains worldwide. "We are happy to share our experience and to help others take the lessons for their own efforts," says Dermarkar. "A strong nuclear industry where everyone has all the tools and skills for strong nuclear and conventional safety and quality work will further strengthen our collective performance. This in turn strengthens public confidence in our industry. That can only help everyone." ■



An international perspective

SNN Romania returns to its leadership role within COG

Societatea Nationala Nuclearelectrica (SNN Romania) rejoined the Chemistry, Materials and Components (CM&C) and Fuel Channel research programs at the end of 2019 and in doing so, returns to its long-standing leadership role as part of the COG Board of Directors.



SNN Romania's Sorin Ghelbereu brings an international perspective to COG's Board of Directors.

With SNN re-joining the research programs, after a temporary departure in 2016, R&D gains both additional financial contributions and the knowledge of the SNN participants.

In addition, COG is pleased to welcome back Sorin Ghelbereu,

Engineering Director as the company's representative on the COG Board of Directors. Ghelbereu's first COG board meeting is scheduled for July.

"SNN has played an important role in COG over many years. The international perspective they bring to the Board and to the committees on which they participate helps strengthen our understanding of the needs of the C6 fleet and provides important insight to our programs," says COG President and CEO Fred Dermakar.

"This is an exciting time for SNN at Cernavoda as they work toward refurbishment and the possible completion of more CANDU units at the Cernavoda site. The COG collaboration model can provide an important resource as SNN moves forward with those projects," adds Dermakar.

In addition to his roles with SNN and the COG board, Ghelbereu also serves as CANDU 6 Fleet Steering Committee Chair. During Ghelbereu's tenure as chair, the committee has worked to strengthen the value of C6 collaborative initiatives.

SNN secondee leaves her mark on COG

A budding relationship between an SNN secondee to COG and her colleagues in Canada was cut short due to COVID-19, this spring, but Corina Mocanu left her mark on COG in the short time she worked at COG's Toronto office.

The SNN Romania secondee joined COG in November 2019. In early March, Mocanu returned home to Romania, on vacation, with the intention of coming back to Toronto. However, due to international COVID-19 travel restrictions, she was not able to return to Canada. She resumed her regular duties at the Cernavoda Nuclear Plant in late March.

Mocanu had been serving as a member of the Information Exchange team while at COG, but contributed to many COG areas and represented SNN and Romania with pride and a high level of commitment to collaboration.

"Corina's contributions to workshops, weekly screening and peer team meetings were beneficial," says IE Director John Sowagi. "She was helpful in reaching back into SNN to get status updates on potential and existing projects. Her attendance at project meetings was also welcomed, especially with her broad components and equipment background."

Mocanu also contributed significantly to COG's R&D

Work-in-Kind initiative, by connecting Cernavoda site staff with technical experts at ICN Pitesti, and helped to produce an effective statement of requirements that was supported by the Health Safety and Environment Technical Committee.

Post-pandemic, COG looks forward to welcoming Mocanu back to Canada.



SNN secondee Corina Mocanu with her COG colleagues at COG's holiday celebration in December 2019.



NB Power passes baton to a new leader

Keith Cronkhite appointed new president and CEO, taking over for Gaëtan Thomas

From one New Brunswicker to another.

On March 30, New Brunswick Power (NB Power) announced the appointment of Keith Cronkhite as its new president and CEO, replacing the retiring Gaëtan Thomas, who held the leadership role for the last decade at the CANDU utility. Cronkhite and Thomas are both New Brunswick natives and lifelong residents of the province.

Cronkhite is an energy expert with more than 30 years of industry experience. He has held positions of increasing responsibility within NB Power operations and corporate, including his most recent role of SVP, Business Development and Strategic Planning.

Cronkhite has a bachelor of business administration from the University of New Brunswick and completed the reactor technology course for utility executives at the Massachusetts Institute of Technology. He holds an ICD.D with the Institute of Corporate Directors and is a board member on the Energy Council of Canada as well as the Atlantica Centre for Energy. He is also a member of the Canadian Standards Association Technical Committee.

Cronkhite's appointment came following Thomas' decision to retire after a 38-year career at NB Power in which he advanced nuclear energy in many ways through his different roles. Before his tenure as NB Power's president and CEO, he held the role of Chief Nuclear Officer and VP, Nuclear. In 2018, he was also appointed as the Chairman of the World Association of Nuclear Operators (WANO)-Atlanta Centre Regional Governing Board.

In recent years, Thomas, a long-time COG collaborator, was instrumental in positioning NB Power as a leader in the development and deployment of small modular reactors (SMRs). He

also worked with the New Brunswick Government to encourage investment in SMR technology.

In June, Thomas was recognized with the Ian McRae Award, presented by the Canadian Nuclear Society (CNS) and Canadian Nuclear Association (CNA), to recognize leadership excellence in the advancement of nuclear energy in Canada.

Cronkhite takes the reigns of NB Power in a milestone year. NB Power is celebrating its 100th anniversary, having been formed by an act of the New Brunswick provincial legislature in 1920.

Read more about Cronkhite's appointment [here](#).

Read more about Thomas' nuclear career achievements [here](#).



From left: Gaëtan Thomas, recently-retired former NB Power President and CEO and Keith Cronkhite, who took over for Thomas on April 1. The lifelong New Brunswickers, combined, possess nearly 70 years of electricity-sector experience with NB Power.

A campus style community hub.
Encouraging active industry and research.
Fostering creative and economic ideas.



Nuclear Innovation Institute (NII) founding President, Frank Saunders (above right), helped establish NII as an Ontario centre of excellence. In May 2019, Saunders, along with Professor Graham Wren (above left) of the University of Strathclyde and Mitch Twolan, Bruce County Warden signed NII's first international partnership agreement.



Remembering Frank Saunders

A respected leader in the Canadian nuclear industry, Frank Saunders passed away, unexpectedly, on July 4

Over more than 35 years in the nuclear industry, Bruce Power executive and founding Nuclear Innovation Institute (NII) President Frank Saunders earned a strong reputation for professionalism and integrity. Known as someone who advocated for nuclear technologies and safety, Frank was also committed to the industry's continuous improvement. At the time of his passing, Frank had been serving as Chair of the Canadian Nuclear Association's Board of Directors.

Frank had a strong working relationship with CANDU Owners Group (COG).

"Frank played a leading role in our industry," says COG President and CEO Fred Dermarkar. "Through his insights and influence, he helped to shape the strong framework of regulatory requirements and CSA nuclear standards that we have in place today. We will miss him not only for his contributions to the nuclear industry, but also for his wry wit and his warm smile."

Frank worked mainly with COG's Nuclear Safety & Environmental Affairs (NSEA) line of business and contributed to the Regulatory Affairs Vice Presidents Forum, Chief Nuclear Officer Forum and sponsored the Nuclear Environmental Affairs and Emergency Preparedness & Response Peer Groups. Frank, most recently, had been part of the core team leading the SMR effort.

"Frank's understanding of the technical aspects of reactor design and also what needed to be changed from a policy perspective made him an asset for the work COG coordinated in NSEA and SMRs," says Deputy CEO and NSEA Director Rachna Clavero, who worked closely with Frank on the regulatory files. "He was never afraid to challenge our industry norms to help us move ahead."

Since 2001, Frank had been serving as Bruce Power's Vice President Nuclear Oversight and Regulatory Affairs. In 2018, he was named the first NII president, where he worked to establish it as an international centre of excellence for applied research and training.

Last year, Frank was recognized by the CSA Group with their highest honour, the John Jenkins Award for outstanding lifetime achievement. The award recognized Frank's work advocating for the development and use of CSA nuclear standards and improving overall value of CSA's nuclear standards program.

A link to Frank's obituary can be found [here](#).

Read the statements from [Bruce Power](#), [CNA](#) and [NII President Bruce Wallace](#) on Frank's passing.

PROTECTING YOUR DIGITAL HEALTH

Canadian nuclear utilities, Canadian Nuclear Laboratories and the Canadian Nuclear Safety Commission are viewed as world leaders in the area of cybersecurity. Cyber security measures in nuclear plants include processes, procedures and technical measures. Combined, these steps can be effective in combatting cyber threats. COG supports these efforts through information sharing, events and a peer group focussed on cybersecurity best practices.

With the Canadian Centre for Cyber Security and others within the Canadian IT and cybersecurity communities reporting an increase in cyber-attacks on remote workers since the COVID-19 pandemic forced many to transition to their home offices, these protections are being put to the test. The attacks are designed to take over computers and mobile devices, defraud victims of funds and steal data.

Like our members, COG is continually upgrading and evolving with technology to ensure a safe and secure online workspace, working in collaboration with industry experts to strengthen cybersecurity and protect the repository of CANDU IP and information.

To help you and the work of your organizations stay safe and secure, COG's IT team has gathered cybersecurity tips and helpful hints for maintaining privacy and records as you work from home.

Use a WIFI Protected Setup (WPS) with strong encryption through your router

- Ensure you secure your home WIFI network;
 - Protect your network with a strong password;
 - Update your router's firmware settings; and
 - Don't use a public WIFI network for work activity
- Protect your personal devices;
 - Keep your computer and smartphone operating systems up-to-date;
 - Use a firewall as well as antivirus and anti-malware software;
 - Ensure these devices are password-protected; and
 - Limit users of these devices.

Be cybersecurity aware

- Email-based scams, often claiming to be urgent, from disguised email accounts, targeting remote workers;
 - Malware including ransomware can disrupt or damage devices, personal or organizational networks. Ransomware is a malicious program that blocks access to a device or account until a ransom fee is paid.
 - Malware can come from suspicious email attachments, website or hyperlink redirects, links from social media sites, false advertisements (also known as "malvertisements"), unknown USB keys, suspicious software downloads and other sources; and
- Endpoint attacks: Attacks which target home networks, devices and cloud services where company information may be more easily accessible.

Take preventive action

- Do not open unknown or suspicious emails and hyperlinks;
 - Always double-check the source email address to ensure it is not disguised;
- Avoid sharing or entering login credentials on unfamiliar systems or pages;
- Verify cybersecurity issues that claim to have a "sense of urgency";
- Activate your web browser's pop-up blocker;
- Use strong password protection on all devices;
 - Don't use the same username & password for different services; and
- Back up your files.

Alert your organization's IT services team if you encounter suspicious emails or software.

Chances are, others in your organization could be experiencing a similar issue. The safety and security of your devices and your organization's work may depend on it.

Celebrating nuclear community success

CNS-CNA annual list of award winners includes familiar faces at the CANDU Owners Group



Clockwise from top left: Award winners: Former COG board member, New Brunswick Power's Paul Thompson shares a laugh with COG President Fred Dermarkar at the Darlington Energy Centre; New Brunswick Power's Kathleen Duguay (centre) at a community event and Ontario Government's Wilson Lam hosts a session at the CNS Conference in 2019.

From leadership to education, technical excellence and incredible teamwork, the annual CNS-CNA awards once again highlighted the powerhouse talent that drives Canada's nuclear industry.

The Canadian Nuclear Society and Canadian Nuclear Association jointly recognized the outstanding work of those within nuclear industry and academia, many, if not all of whom, have been CANDU Owners Group (COG) collaborators at some point. The list of winners includes COG staff, members, participants, partners and stakeholders; all part of Canada's vibrant and diverse nuclear community.

Among the winners was Gaëtan Thomas, New Brunswick (NB) Power's recently-retired CEO and a driving force in the Canadian nuclear industry. Thomas's leadership was felt throughout the refurbishment of the Point Lepreau CANDU-6 reactor. A known innovator, Thomas was a champion of small modular reactor development and is also well-known for his commitment to the communities served by the New Brunswick utility.



Sonia Qureshi (third from right) is the WiN Canada Golden Horseshoe West Chapter Lead, serving on the WiN Canada Board with Laurie Fraser (second on left), a member at large. WiN Canada was a recipient of the CNS-CNA 2020 Achievement Award for Communication and Education.

With Qureshi and Fraser, **from left to right** during the 2019 WiN Canada conference are OPG's Carla Carmichael who serves on the COG board of directors along with COG staff members Nicole Kost, Fenia Ignat, Natalie Alderson, Nancy Boraso and Esther Sun-Lee.

NB Power is a COG voting member, with a seat on the COG Board of Directors. The director's role was filled by NB Power's Paul Thompson for several years. Thompson was recognized with the Harold A. Smith Outstanding Contribution Award for his significant contributions to the nuclear field, including his role in nuclear power plant safety, plant life extension and the development and deployment of small modular reactors (SMRs), work done in part through COG collaborative initiatives.

Women in Nuclear Canada (WiN Canada) received an award in the education and communication category for its mentorship, training and leadership initiatives for female industry professionals including its 2019 "Presenting with Confidence" webinar series. COG Director of Joint Projects and Services Sonia Qureshi is a member of the WiN leadership team and serves as chapter lead of WiN Golden Horseshoe West. As well, COG Information Exchange Project Manager Laurie Fraser serves as a member at large on the WiN Canada board.

Several people and teams were recognized for the Communications and Education award, this year, reflecting the strong emphasis and commitment to all forms of communication and engagement by the industry.

For the full list of award winners, [click here](#).



Top left: The team who produced the documentary *Of Great Service: The Story of National Research Universal* was recognized as one of five communications and education award recipients. **Directly above:** Recently-retired New Brunswick Power CEO and long-time COG collaborator Gaëtan Thomas received the Ian McRae award for leadership excellence.

To see all the CNS-SNC 2020 winners, click on the link in the story above.

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