POWER NEWS

SUMMER 2017

Connecting the people who power Ontario

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OPG LOOKS TO THE STARS

OPG's Darlington Nuclear Generating Station (GS) could soon help fuel NASA space probes exploring the final frontier.

Working with its venture arm, Canadian Nuclear Partners, the company is seeking approvals to produce and harvest Plutonium-238 (Pu-238), an isotope of Plutonium, at Darlington Nuclear's reactors beginning as early as 2020. The radioactive isotope, which can only be produced in a nuclear reactor, is used to power spacecraft involved in deep space exploration.

A similar process at Pickering Nuclear GS creates Cobalt-60, a life-saving radioactive isotope that is used in the sterilization of surgical and medical supplies as well as packaged food.

"This is a very exciting project," said Jeff Lyash, OPG President and CEO. "No pursuit pushes the boundaries of our scientific and technical limits like space travel. We are proud to have Ontario play a part, however small, in this most noble of human endeavours."

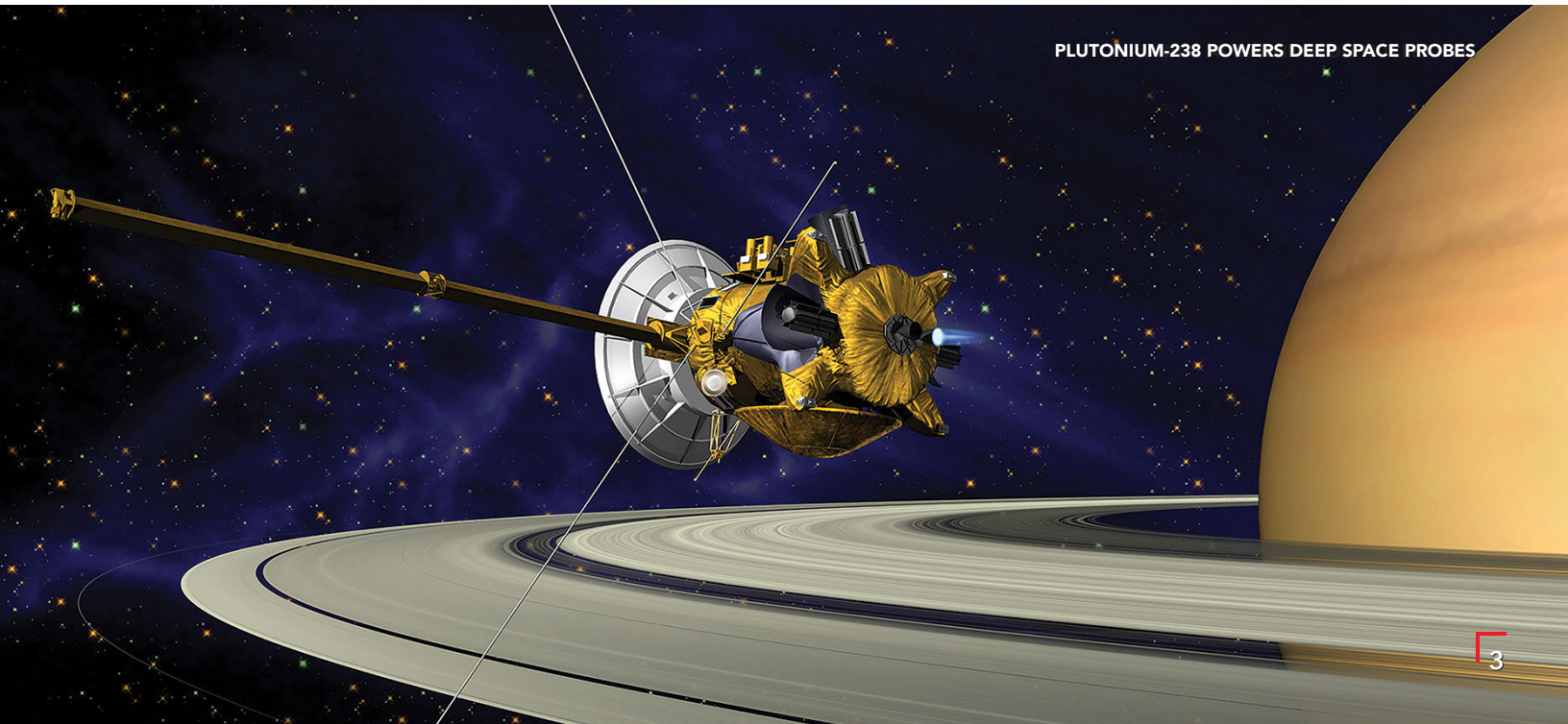
All deep space exploration projects are powered by the isotope, including NASA's Voyager 1 and 2, which were launched in 1977. Voyager 1 is now roaming somewhere in interstellar space, having travelled farther than anyone or anything in history. The isotope has also powered the Curiosity Rover currently on Mars and supplies of Pu-238 will be used to fuel the Mars 2020 Rover, set to launch in three years.

Acting as a nuclear battery, Pu-238 emits steady heat due to its natural radioactive decay. The isotope can't sustain a nuclear reaction and therefore can't be used as fuel in a nuclear reactor or in a nuclear weapon. But the heat generated by the isotope decreases slowly in a highly predictable manner, making it suitable to be harnessed into electric energy onboard a space ship. In addition, the heat keeps scientific instruments warm enough to function in space.

The energy provided by Pu-238 is also more practical for deep space exploration, as these craft usually travel far distances from the sun, making solar power less feasible.

If the project is approved, OPG's efforts could help bolster the global supply of Pu-238, which has been dwindling in recent years. As of March 2015, a total of 35 kilograms of Pu-238 was available for use in NASA spacecraft, but only one kg was in good enough condition to meet NASA specifications for power delivery. It takes about 4.5 kg to power one deep space probe.

"This project is just another example of the broad economic and societal benefits of nuclear power," Lyash said. "It provides clean, low-cost power, it helps in the medical world and if successful can be a part of the next generation of space travel."



PLUTONIUM-238 POWERS DEEP SPACE PROBES

CALM WATERS NEAR DAMS CAN TURN TURBULENT IN AN INSTANT

STAY CLEAR, STAY SAFE THIS SUMMER

On a blistering summer day, nothing is more tempting than a dip in calm and refreshing waters. But if that watering hole happens to be near a hydroelectric dam, you'd be tempting more than just fate.

Calm waters near a dam can turn turbulent in a matter of seconds as electricity demands change and dam gates are opened, sending a torrent of water into the rivers or lakes near OPG's hydroelectric stations.

It's a warning that Tony Bennett, OPG's Director of Dam and Public Safety, has been driving home since 2002, when he took up the position. In the last 15 years, he has noticed a marked improvement in the public's awareness of the life-threatening dangers.

"We've made real inroads to improving public perception of the hazards associated with hydropower and dams and their operation," Bennett said.

OPG's work has included conducting a study with the Centre for Addiction and Mental Health on public perception of the dangers of swimming and boating near dams, as well as taking a deeper look at the risk takers who actively ignore the warning signs and trespass willfully.

"What we found is that if you put up an effective sign, 97 per cent of people will respect it and keep out," Bennett said. "But if you have an ineffective sign, it doesn't matter what words are on it, people are going to walk by it. That's why we have spent so much time researching to make sure our signs worked."

Today, OPG has large, clear and bold signs around its 240 dams warning against trespassing. Fences around dams and safety booms in the water also help keep swimmers and boaters at bay. In addition, the company runs a "Stay Clear, Stay Safe" province-wide public awareness campaign.

Bennett and his group have also been instrumental in creating industry standards for safer dam operating procedures as well as guidelines for educating the public.

This thorough approach to public safety has informed all of OPG's new hydroelectric builds, like the Peter Sutherland Sr. Generating Station in northeast Ontario that went into service this year. OPG worked with the nearby Little Abitibi Provincial Park to ensure canoeists going downstream on New Post Creek were informed of the new hydroelectric station, which uses a portion of the falls for its operation.

DARLINGTON REACTOR DISASSEMBLY TO BEGIN

The disassembly of Darlington Nuclear Generating Station's Unit 2 reactor, the first of four nuclear reactors to undergo refurbishment, is set to commence this July.

The work will involve a series of pre-requisite activities to prepare for a safe and efficient disassembly, including the set-up of specialized tooling platforms on either side of the calandria face (also known as the reactor core) that will be operated remotely.

After the project team has completed these steps, the project enters the disassembly phase where specially designed tools and technology come into play.

"We have to synchronize the work on both sides of the calandria face to push and pull out each of the 480 pressure tubes," said Roy Brown, Senior Director of Projects, Re-tube Feeder and Replacement and Fuel Handling at OPG.

The team will first remove the calandria tube inserts in the reactor vessel using induction heating. The calandria tube inserts securely hold the calandria tubes, which house the pressure tubes that contain the bundles of uranium fuel that generate power.

"Induction heating gets things hot through magnetism," says Brown. "The process heats up the inserts within half a second and cools them just as fast. The quick temperature change shrinks the inserts, allowing us to remove them."

Following insert removal, the same push and pull exercise is performed to remove the calandria tubes. The pressure tubes and calandria tubes are then moved to the Re-tube Waste Processing Building where they are safely stored in shielded containers.

After all this removal work is complete, the only action left is a series of quality inspections on the calandria vessel itself.

THE REACTOR MOCK-UP AT DARLINGTON NUCLEAR

AT A GLANCE

- More than 1,600 people are engaged in the disassembly of the Unit 2 reactor
- The Re-tube Tooling Platform comprises two large elevating platforms on either side of the calandria face
- The feeder pipes, which carry the coolant required to cool nuclear fuel, will be cut off the calandria face using reciprocating saws and hydraulic tools

PHOTO COURTESY LAURA MCROBB

OUR PEOPLE: TIM BURGESS

In Tim Burgess's professional tool belt, a book detailing a firefighting tragedy has proven to be indispensable in his training of OPG's emergency responders.

The book, *In Honor of the Charleston 9* by Dr. David Griffin, tells the true story of a deadly inferno at a sofa store in Charleston, South Carolina, that claimed the lives of nine firefighters in June 2007.

"I use excerpts from it in my training all the time," said Burgess, a Training Tech for Emergency Response with OPG. "It's been a very influential book for fire services, because it talks about changes we can make so the same thing doesn't happen to us."

Burgess and seven other trainers, along with management and administrative staff, work out of OPG's Wesleyville site in eastern Ontario. It's a true fire school that houses a rope rescue area, a hazardous materials area, and classrooms for medical training.

Emergency Response Team (ERT) members from both the Darlington and Pickering nuclear generating stations come to Wesleyville to receive important schooling in firefighting and emergency medical response.

"What we do here does make a difference," said Burgess, a 27-year veteran with OPG. "It's very fulfilling to teach people and watch them make things happen."

As an example of the difference proper training makes, Burgess cites the lives saved by emergency workers at Pickering and Darlington through the timely use of defibrillators. Earlier this year, a contractor's life was saved at Darlington after he suffered a heart attack thanks to the quick response of staff.

"That's where training really hits home. You practice on a mannequin, but now it's a real person you bring back to life," Burgess said.

A long-serving volunteer firefighter, and instructor with the Ontario Fire College, Burgess conducts workshops while off-duty on responding to electrical emergencies. He says the team at Wesleyville enjoys the same close camaraderie of a fire crew, even though they aren't a fire department in the traditional sense. "I work with a great bunch of folks who are all caring, knowledgeable and experienced," he said.

EMPLOYEE SPOTLIGHT
TIM BURGESS

POSITION: Training Tech – Emergency Response

WORK LOCATION: Wesleyville GS site

YEARS OF SERVICE: 27

FAVOURITE SPOT TO VISIT IN ONTARIO?
North of Wawa on Lake Superior

FAVOURITE BOOK?
In Honor of the Charleston 9 by Dr. David Griffin

FAVOURITE WEEKEND ACTIVITY?
Spending time with his wife and three children

LAKE STURGEON GET A SECOND CHANCE TO FLOURISH

A fish that has cultural significance for many Indigenous peoples is getting a second chance to thrive in the upper Winnipeg River in northwestern Ontario.

Over the past 100 years, the population of lake sturgeon in the river has been decimated due to overharvesting and pollution. But conditions have improved for Canada's largest freshwater fish, a threatened species in Ontario, to stage a potential comeback.

The Ochiichagwe'babigo'ining Ojibway Nation near Kenora, also known as the Dalles First Nation, has launched a lake sturgeon recovery program in partnership with OPG and the Ontario Ministry of Natural Resources and Forestry. OPG, which is providing financial support, hopes to help bring this sacred fish back to glory.

"The number of juvenile and adult lake sturgeon in the upper Winnipeg River is still very minimal," said Adrienne Igo, acting site environmental advisor at OPG's Northwestern Operations. "A rebound in sturgeon population is not something you see overnight."

To kick off the recovery project, students, elders and members of the Dalles First Nation took part in a ceremonial event to release 12 juvenile sturgeon into the Winnipeg River. Elders and volunteers carefully pulled the metre-long fish out of holding tanks and carried them to the river bank to reintroduce them to the First Nation's traditional waters.

Members of the First Nation hope these young sub-adults, each around 10 to 14 years old, can spawn a self-sustaining population in the upper portion of the river, which spans from Kenora to OPG's Whitedog Falls Generating Station. Full grown sturgeon can reach up to 2.5 metres in length, weigh up to 180 kilograms, and live more than 100 years.

"This project will enable Ochiichagwe'babigo'ining Ojibway Nation to continue to act as stewards of the land and play an active role in the conservation and restoration of lake sturgeon in our homeland," said Chief Lorraine Cobiness.

Also present at the release were members of the Rainy River First Nation, which has also partnered with Dalles in the recovery program.

About 20 years ago, the Rainy River First Nation successfully rehabilitated the lake sturgeon population in its own ancestral waters of Rainy River near Emo. The 12 sturgeon were selected from the river and donated to Dalles First Nation in a gesture of goodwill.

Before they were deployed, each sturgeon had a transmitter surgically implanted. Sixteen acoustic receivers placed throughout the river will help biologists track the sturgeons' movements and allow the First Nation to learn more about their sacred fish.

With luck and time, this species will be flourishing once again. Depending on how well these 12 juveniles fare, a few thousand sturgeon fingerlings could be reintroduced to the river next year.

THE HAROLD TOWN MURAL AT R.H. SAUNDERS GS

A PIECE OF CANADIAN ART HISTORY LIVES ON AT R.H. SAUNDERS GS

In the old observation deck of OPG's Robert H. Saunders Generating Station stands a piece of Canadian art history – a large mural painted by internationally renowned abstract artist Harold Town.

Commissioned for the big station's opening on the St. Lawrence River in 1958, the Toronto-born artist's work of abstract expressionism symbolized the spirit of the R.H. Saunders GS facility.

For Town, the St. Lawrence Power Project mural was almost as complex and vast as harnessing the great river itself. Measuring three metres by 11.3 metres, the mural was one of the largest of its kind in Canada at the time and also one of the most unusual. The painting depicts the taming of nature, the reshaping of the landscape and the dynamics of hydroelectric power.

Working in a gallery at the Canadian National Exhibition grounds, Town began painting the mural in May 1958 on a single piece of canvas stretched across a wooden frame. When it was finished three months later it was carefully rolled around a drum and transported to the station. A special adhesive was used to affix the painting firmly to its wall in the station's administration lobby in time for the official opening ceremonies.

Town was only 34 years old when he completed his first mural but he was already internationally recognized. By this time he was leading the Painters Eleven group of abstract artists and had won numerous awards at exhibitions such as the Bienal de São Paulo. After completing the mural, he said, "I've never painted anything that has made me so happy."

Of the expressionistic style, Town said he "felt the intricacies, as well as the overall grandeur of the project, could best be symbolized and complemented in this way."

"I also wanted to do a mural in the spirit and style of this day," he continued, "so that, in the years ahead, it will age with the dam in a manner that will give a true picture of the creative character of our time."

Today, the mural is still mounted on the penthouse level of the Saunders station. A smaller replica of the painting can be viewed by the public in the auditorium at OPG's St. Lawrence Power Development Visitor Centre in Cornwall.

Town went on to enjoy an eclectic career until his death in 1990 at the age of 66.

RANNEY FALLS EXPANSION ADDS MORE CLEAN POWER

After nearly 90 years of dedicated service, the second powerhouse at OPG's Ranney Falls Generating Station (GS) in the Town of Campbellford is being replaced.

Known as the "Pup", or G3, the small powerhouse contains a 0.8 megawatt (MW) unit that went into service in 1926 and reached its end of life in 2014. Along with the existing station's main powerhouse, which houses the two original 4.8 MW units, Ranney Falls GS produces 10.4 MW of clean, renewable power in southeastern Ontario.

Now that the "Pup" has been decommissioned, construction is underway to expand Ranney Falls GS and replace the "Pup" with a more powerful and efficient 10 MW generating unit and powerhouse. The combined 20 MW Ranney Falls GS will be capable of serving an additional 10,000 homes.

"This project supports OPG's mandate to expand the hydroelectric capacity of its existing sites," said Project Manager Iskander Boulos. "It also supports Ontario's climate change action plan."

The clean, renewable power from Ranney Falls GS will help displace the equivalent of 28,000 tonnes of carbon dioxide emissions. Replacing the existing generating unit will also result in more efficient use of water at the station as it will better utilize the available flow in the Trent River.

Currently, work is progressing to expand the existing forebay and tailrace channels to accommodate the new G3 powerhouse.

The new powerhouse is expected to be up and running by the end of 2019 and will produce clean and renewable hydroelectric power for 90 years or more.

AT A GLANCE

- Ranney Falls GS supplies clean, renewable power from the Trent River
- The new secondary powerhouse will help serve an additional 10,000 homes
- Original 0.8 MW unit went into service in 1926 and reached end of life in 2014

RANNEY FALLS GENERATING STATION


NANTICOKE GENERATING STATION

NANTICOKE SPARE PARTS FIND A SECOND LIFE

At the Nanticoke Generating Station (GS), there's been a veritable fire sale going on for the former coal-burning plant's varied spare parts and equipment.

From instrumentation and control equipment, to machine shop gear, scissor lifts, valves, and shelves, more than 4,500 parts have found a second life at OPG's active stations.

It's all part of Nanticoke's decommissioning process. Formerly Ontario's largest coal-fired power plant, Nanticoke GS burned its last piece of coal in 2013 and is set to be the home of a new solar development. With the station no longer operating, and the announcement of site decommissioning and demolition, a large amount of equipment and tooling has been relocated.

The process, which began in 2015, has resulted in more than $3 million worth of parts and tools being repurposed elsewhere in the company, said Jeffrey Hansen, Vice-President of Strategic Operations at OPG. That represents a "huge savings," he said.

The equipment has found a new home at thermal stations like Lennox GS and Atikokan GS, hydroelectric plants like the Sir Adam Beck stations in Niagara Falls, OPG's Pickering and Darlington nuclear stations, and even learning and development facilities like OPG's Kipling Training Centre.

Brad Snelgrove, site manager for Nanticoke and Lambton GS, has tracked every bit of inventory that has been removed from Nanticoke using a computer database. Stations interested in equipment or tools visit the site, identify the part, reserve it, and arrange their own shipping method to get it delivered.

"I was at Lakeview (Generating Station) when we went through a similar process there," said Snelgrove, referring to the now-demolished coal-burning station in Mississauga.

One of the pieces of equipment relocated was a machine shop lathe once used to make parts when Nanticoke was operating. About $50,000 worth of machine shop equipment has since been relocated to Pickering Nuclear GS. Spare turbine rotor parts also went to Pickering in 2015, allowing for a repair that saved the company more than $500,000.

Elsewhere, Darlington Nuclear GS received Nanticoke's cabinets and shelves – $400,000 worth of them – for use with the Darlington Refurbishment.

"This is all working equipment that just needs a new home," Snelgrove said.

OPG COMPLETES THREE MAJOR PROJECTS, REPORTS FIRST QUARTER EARNINGS

In a busy first quarter, OPG successfully completed three major projects: the Peter Sutherland Sr. Generating Station (GS), refurbishment of the Sir Adam Beck Pump GS reservoir, and the first segment of the Darlington Refurbishment. All three were completed on time and at or below budget.

"Our commitment to project management excellence is evident in these recent results," said Jeff Lyash, OPG President and CEO. "Projects that are well planned and managed often end the way they start and this shows the benefit of all the pre-planning we have done."

In the first quarter of 2017, OPG's net income attributable to the Shareholder was $64 million, down from $123 million for the same period in 2016. The decline was attributed to lower nuclear generation due to the ongoing refurbishment of Unit 2 at the Darlington Nuclear GS and the continuation of existing base regulated prices.

Electricity generation during the three months ended March 31, 2017, decreased to 18.6 terawatt hours (TWh) from 21.0 TWh for the same quarter in 2016. The decline in generation was primarily due to removing Darlington's Unit 2 from service, which began in October 2016 and is expected to continue until early 2020. Partially offsetting Darlington Nuclear's reduction in generation was an increase of 0.3 TWh from Pickering Nuclear GS.

Lower generation from hydroelectric's Contracted Generation also contributed to the decrease in electricity generation, due to lower water flows on the northeastern Ontario river systems. Subsequent to the first quarter, higher water flows have been experienced on the eastern and northeastern Ontario river systems.

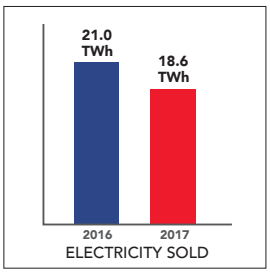
At OPG's Pickering Nuclear GS, the unit capability factor increased to 78.5 per cent, compared to 72.8 per cent for the same period in 2016. The result is indicative of the tremendous effort going into making sure this important asset runs safely and reliably. The unit capability factor at Darlington Nuclear GS stood at 85.3 per cent in the first quarter, compared to 97.2 per cent in the same period last year. The decrease there was primarily due to the higher number of unplanned outage days at the station.

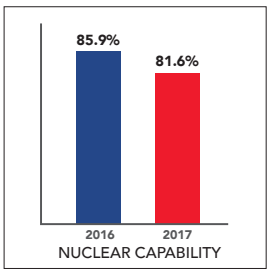
In April 2017, OPG completed the public hearing for its Ontario Energy Board (OEB) rate application that will set prices for the company's nuclear and most of its hydroelectric generation for the next five years, with a proposed effective date of Jan. 1, 2017.

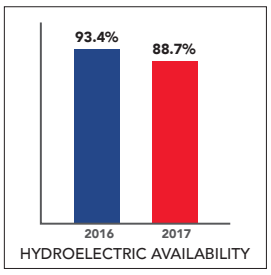
"OPG provides electricity at a price that is 40 per cent less than other generators and is the only electricity generator in Ontario that has its prices set through a public hearing process by the OEB," said Lyash.

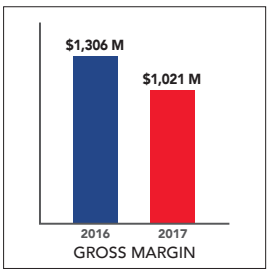
A decision by the OEB is expected in the second half of this year. When those prices get reset, the impact of having a Darlington Nuclear unit out for refurbishment will be reflected in the nuclear rate and the company's income is expected to improve in subsequent quarters of 2017.

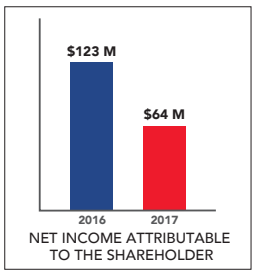
YEAR-TO-DATE MARCH 31 RESULTS











Happy Birthday Canada!

OPG is proud to join its employees and communities
across Ontario in celebrating the best country in the world.

Have a safe and happy Canada Day weekend.

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ONTARIO POWER GENERATION