

POWER NEWS

WINTER 2016

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TIME TO BREAK THE ICE

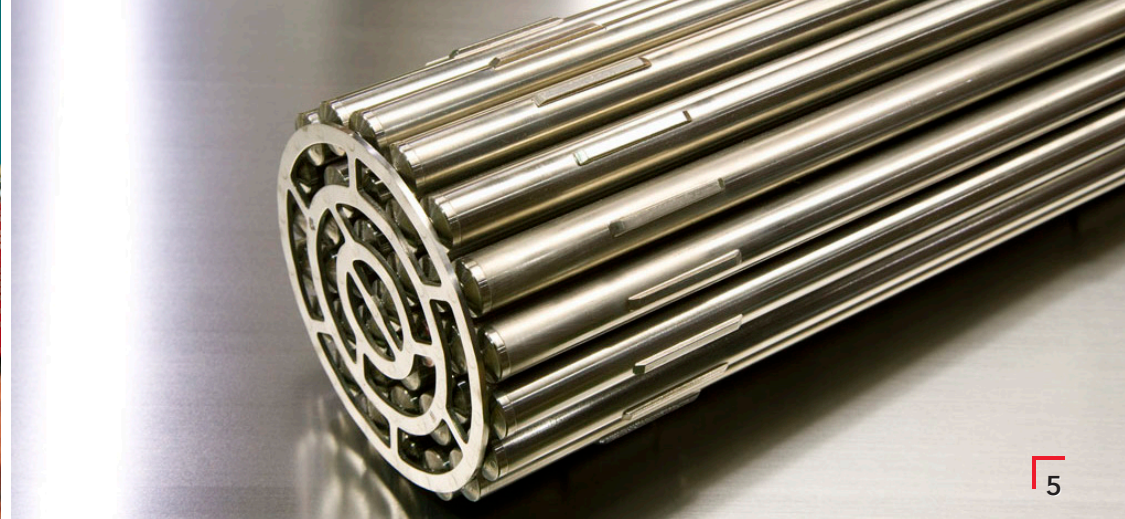
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NIAGARA QUEEN II ICE BREAKER READY FOR ANOTHER FRIGID WINTER

The Niagara Queen II is all tuned up and ready for another winter of kicking ice on the Niagara River.

First commissioned in 1992, the dependable ice breaker, owned and operated by OPG, just completed a regulatory maintenance check by Transport Canada that's conducted every five years.

The 85-tonne vessel, which is powered by two 1,720 horsepower diesel engines, received the green light and is now ready to help keep the water flowing to OPG's Adam Beck hydroelectric stations, which generate almost 2,000 megawatts of power for the province.

And this small ice smasher has got many more years of service left in it.

"Presently, there are no plans to replace it," said Peter Kowalski, Operating Manager at OPG's Niagara River Control Centre (NRCC). "These vessels can go for 30-plus years. With regular maintenance, they can go even longer than that."

Kowalski is in charge of the 24/7 operation of regulating the water flow in the Niagara River and over Niagara Falls. In the winter, this also involves monitoring for ice buildup in the river, in an area called the Chippawa-Grass Island Pool, upstream from the control centre. If ice threatens to clog the hydroelectric intakes that deliver water to the stations downstream, the NRCC team will call on the Niagara Queen II and its three-person crew – a captain, an engineer, and a deck hand – to deal with the problem.

"Ice on the surface that's two inches thick can grow to six feet thick or more in a hurry if it's allowed to stack and build up on the intake wall," Kowalski said. "Adding to that, while working on the Niagara River, the water flows are very dynamic, and you're typically breaking very thick ice in moving water. It can be quite challenging."

Depending on the weather, a typical winter sees the ice breaker running for 300 to 400 hours in a season, and it can be out clearing ice as early as Dec. 20 and as late as May.

OPG's predecessor Ontario Hydro first began deploying an ice breaker in the early 1960s with the



NIAGARA QUEEN II ICE BREAKER

Niagara Queen, a modified tugboat ice breaker. Today, depending on the location and severity of the ice problem, Kowalski can call upon the Queen II or the larger William H. Latham ice breaker that is owned and operated by the New York Power Authority.

The Latham, which has a spoon-shaped bow, can break up a large field of ice by riding on top of it, whereas the Queen II has a knife-edged bow better suited for slicing through ice, especially near the intakes.

In cases of extreme weather, like the cold wave that blanketed North America in 2014, both ice breakers are called to help maintain the flow of water. But there are times when the ice packs can become overwhelming even for these specialized beasts.

"These ice floes, if they're eight to 10 feet thick, the boat won't be able to cut through it," Kowalski said. "We're very careful about not putting the boat out at the wrong time, since employee safety is paramount. And we make sure to send it out with a companion vessel where the conditions would warrant that."



JEFF LYASH, OPG PRESIDENT AND CEO

OPG RECOGNIZES DARLINGTON REFURBISHMENT MILESTONE

This past fall, OPG reached a major milestone in the refurbishment of its Darlington Nuclear Generating Station.

On October 15, Unit 2 at Darlington Nuclear was taken offline marking the official start of the \$12.8-billion Darlington Refurbishment, Canada's largest clean energy project.

Leading up to the historic milestone, Ontario Minister of Energy Glenn Thibeault, members of the OPG team and vendor partners gathered at the Darlington Energy Complex (DEC) on Friday, Oct. 14, for an official event to kick things off.

"I've been involved in a lot of major projects over the years and I can confidently say I've never seen one that has had this amount of rigorous preparation and is this poised for success," said

OPG President and CEO Jeff Lyash. "Your planning, your preparation and your daily commitment to operational excellence has demonstrated to our shareholder, our community and the people of Ontario, that OPG can and will get the job done."

The next day, more than 1,800 members of the public were welcomed to a Refurbishment Open House at the DEC to celebrate the important milestone.

Visitors got a chance to meet representatives from many of the project's construction partners and trade unions. Guests also toured the impressive full-scale reactor mock-up and took in a series of training and science demonstrations.

The refurbishment of Unit 2 is now in progress, with workers tackling the first phase of the three-year project with the defuelling of the reactor core.

DEFUELLING DARLINGTON

The first step of the Darlington Nuclear Refurbishment is now well underway with defuelling of Unit 2.

This crucial step involves removing fuel from the 480 channels inside the reactor vessel, also known as the calandria. Each channel contains a pressure tube housed inside a calandria tube, as well as feeder pipes that transport heavy water coolant to and from steam generators. Each pressure tube holds 13 uranium CANDU fuel bundles that generate the heat required to power the turbines that create electricity.

To accomplish this complex task, the Fuel Handling team at Darlington Nuclear Generating Station uses a specialized trolley equipped with a pair of remote-controlled fuelling machines to carefully remove the fuel bundles. For this first of three phases, each machine works on a different channel in the reactor face, meaning two channels can be defuelled simultaneously. During this process, the Fuel Handling team also performs preventive maintenance on the fuelling machines while maintaining Darlington's three operating units at full power.

"So far, there haven't been any major challenges," said Subo Sinnathamby, Fuel Handling Senior Manager at Darlington Nuclear. As of early December, 350 of the 480 channels have been defuelled, which is ahead of schedule.

Each fuel bundle measures half a metre long and weighs about 20 kilograms. The bundles contain uranium dioxide pellets wrapped in zirconium alloy tubing. In total, there are 6,240 of these fuel bundles inside each of the four reactors at Darlington Nuclear.

After all the fuel bundles have been removed, the calandria will be drained of all heavy water, which is used to sustain the nuclear fission chain reaction to produce heat.

The Unit 2 Defuel Campaign is scheduled to be completed early January.



CANDU REACTOR FUEL BUNDLE

OUR PEOPLE: MARK CIPHERY

Mark Ciphery knows what it takes to keep a hydroelectric station running.

With 35 years experience under his belt from OPG and its predecessor Ontario Hydro, the Electrical and Control Technician is comfortable tackling any challenge.

“Being familiar with the equipment is the key,” said Ciphery, who works at OPG’s Stewartville Generating Station (GS) on the Madawaska River. “If we get calls from the control room, we’ll troubleshoot the problem, repair and maintain it and keep it going.”

Ciphery’s day is spent dealing with many pieces of auxiliary equipment, inspecting, maintaining and repairing things like generators, transformers and high-voltage circuit breakers to ensure the station is running optimally.

But he also spends a lot of time mentoring the next generation of electrical workers and passing on the years of knowledge he acquired from others.

“I’ve always liked to share my knowledge and experiences. Hopefully, people are getting something out of it at the end of the day,” he said.

Ciphery started his career in 1981 after post-secondary education. Just seven years later, he started teaching other apprentices entering the industry.

Today, he continues to share his know-how as he trains operator agents in the Lower Madawaska area who serve as the eyes and ears of control room managers at hydro stations.

Ciphery says training people is important work, especially now with stations like Stewartville GS and Arnprior GS going through extensive upgrades to aging equipment.

“Until the day I leave, we’ll have to maintain the new equipment. Someone has to do that,” Ciphery said.

Even after 35 years, Ciphery is happy to continue to be one of the people who does just that. While retirement may be looming, it isn’t quite on his mind yet.

“I’m not staying because I have to stay; I’m staying because I like my job.”



MARK CIPHERY HOLDS A PHOTO TAKEN EARLY IN HIS CAREER

EMPLOYEE SPOTLIGHT MARK CIPHERY

POSITION: Electrical and Control Technician

WORK LOCATION: Eastern Operations – Stewartville Generating Station

YEARS OF SERVICE: 35

FAVOURITE SPOT TO VISIT IN ONTARIO: Ottawa Valley. “It’s nice for a day drive.”

FAVOURITE MOVIES: *A Few Good Men*, *Passchendaele*

FAVOURITE WEEKEND ACTIVITY: Spending time with family and his first grandchild, who will turn one on December 7

ENSURING A STEADY SUPPLY OF LIFE-SAVING COBALT-60

For decades, OPG's nuclear generating stations have been the source of a product that keeps millions of Ontarians healthy and safe.

Aside from producing the clean, reliable energy we benefit from every day, Pickering Nuclear Generating Station has been a vital source of life-saving Cobalt-60, a radioactive isotope. Together, OPG and Bruce Power work with Ottawa-based health science company Nordion to supply 70 per cent of the world's Cobalt-60, which is used to safely sterilize medical equipment and food products.

"OPG has been supplying Cobalt-60 to Nordion on an exclusive basis since 1971 starting with Pickering A, which was the first Ontario generating station to produce Cobalt-60, later joined by the Bruce B and Pickering B stations in the early 1980s," said Alfred Mo, Director, Commercial Services, at OPG. Today, Cobalt-60 is harvested from three units at Pickering B and at Bruce B station, which has been leased to and operated by Bruce Power since 2001.

In November, Bruce Power and OPG signed a Memorandum of Understanding that will see the companies work together to ensure a steady long-term supply of Cobalt-60 as operations at Pickering wind down in eight years. This includes setting up a joint working group to look at expanding Cobalt-60 production to OPG's Darlington Nuclear Generating Station and Bruce Power's Bruce A facilities.

DID YOU KNOW?

- Cobalt-60 is produced in nuclear reactors
- First discovered in 1938
- Is used as a radiation source in cancer treatment



COBALT-60 STERILIZES MEDICAL EQUIPMENT

A product of the nuclear fission that takes place inside a CANDU reactor, Cobalt-60 is produced by irradiating Cobalt-59 adjuster rods from one scheduled maintenance outage to the next. During this process, a good portion of the Cobalt-59 inserts absorbs a neutron and change at the atomic level to become radioactive Cobalt-60. At each planned maintenance outage, the Cobalt-60 adjuster rods are removed, processed and safely loaded for shipment to Nordion.

As Cobalt-60 emits gamma radiation, it is an ideal isotope for medical and industrial applications. In the medical field, Cobalt-60 is used to sterilize surgical pre-packaged medical instruments, implantable devices, syringes, and medical gowns. The isotope is also used to safely irradiate food products after they've been packaged, ridding them of insects and harmful bacteria, like E.coli.



FATHER AND SON TEAM UP TO HELP PROTECT LAKE STURGEON

For seven-year-old James Shaughnessy, this was a very good day in his young life.

The fishing enthusiast and his father, David, lent a hand during OPG's lake sturgeon tagging day in October. For young James, helping track the threatened freshwater species from the shores of the Ottawa River was an experience he won't soon forget.

"Tracking the sturgeon with the receiver was awesome," James said. "It was just like on Shark Week!"

As part of OPG's mitigation plan for lake sturgeon in the Ottawa River, the company works to help facilitate breeding of the at-risk species and track populations of the fish.

In the fall, members of OPG's environmental support team conducted a netting program downstream of Chenaux Generating Station (GS). Data collected from each sturgeon included length, weight, and a fin ray sample to determine fish age. Each sturgeon received a PIT (Passive Integrated Transponder) tag which carries a unique identification number and allows for comparison of length, weight and location in the future.

Ten of the sturgeon collected also received a surgically implanted radio transmitter, which allows researchers to track sturgeon movements.

Living on the Ottawa River, David Shaughnessy, an Electrical and Control Technician at Des Joachims GS, spends a lot of time fishing with his son, James. This past spring, while looking for catfish from the dock of their home, James pulled in a fair number of lake sturgeon.

Intrigued, David got in touch with OPG's environmental support team to relay details of the fish they were finding. After getting the invite to participate in the tagging program, David and James observed the procedures and assisted where they could.

At the end of the day, the seven-year-old student got to try out the radio tracking device, listening for the "beep" from the tagged sturgeon.

"He's always outside doing something," David said of his son. "I've been trying to instill in him that if it's something he enjoys, it's something he should do."

DID YOU KNOW?

- Lake sturgeon are the largest of any of Canada's freshwater fish species
- Can reach up to 2.5 metres in length, weigh more than 150 kilograms, and live more than 100 years

LONG LAKE #58 RESIDENTS ENJOY NEW SHORELINE

After more than a decade of collaboration between OPG and the Long Lake #58 First Nation, the three-year project to remediate the community's shoreline in northwestern Ontario has been completed.

The restoration has been a long time coming for Long Lake #58 residents who, since 1905, have lived on the same 2.5-square kilometre tract of land located west of Longlac, Ont. In 1938, construction of the Long Lake Diversion led to flooding that affected the community's shoreline on the northeast side of Long Lake. Later, in the 1970s, OPG's predecessor Ontario Hydro attempted to protect the shoreline from further erosion, but the project led to more problems than it fixed.

"Ontario Hydro agreed to put rock there to protect the shore, but it wasn't well designed," said Karl Piirik, Senior Plant Engineer at OPG's Northwestern Operations. "The understanding of shoreline erosion wasn't as well known back then."

When the rock barrier started to fail, questions were raised about the materials used in the repair. And that's when it was discovered the rocks – waste rock from a nearby mine – had higher levels of naturally occurring minerals that posed a potential health concern to the First Nation residents using the shore.

"We needed to make sure the residents were free to safely use and enjoy the shore," said Cathy Levis, Environmental Site Advisor at OPG's Northwestern Operations. She helped lead an environmental site assessment that determined the nature of the contamination in the water.

In 2006, a past grievance settlement was reached between OPG and the Long Lake #58 First Nation, with OPG taking full responsibility for its predecessor's actions. The company worked with the First Nation to develop a plan to bring the shoreline back to usable condition for the community. Under the agreement, Long Lake #58 was granted sole ownership of the three-year project.

"That was a huge leap forward in terms of building trust and working with the First Nation," said Piirik,



who advised workers at the site about water level conditions so they could conduct the job safely. "The community decided what they wanted and how it was to be done. That ownership was probably the biggest thing that contributed to this being a success."

In late September, during an emotional ceremony to mark the completion of the project, members of the First Nation lauded OPG's role in the successful remediation process. The shoreline is now protected by clean rock and also includes a new pathway that allows easy access for residents.

"OPG stepped up and said, 'We would do the right thing. We would fix it.' You could tell how much it meant for the community," Piirik said.

A WINTER WONDERLAND OF LIGHTS AT NIAGARA FALLS

Planning on popping the big question to your loved one this holiday season? Looking for a fun family getaway? The Ontario Power Generation (OPG) Winter Festival of Lights could be the perfect spot for both occasions.

With more than two million sparkling lights illuminating an eight-kilometre route along Niagara Falls, the 34th edition of the annual holiday celebration offers up a truly romantic and festive backdrop for couples and families alike.

"We get a lot of families. But we also get a lot of proposals in the park," said Tina Myers, Executive Director of the OPG Winter Festival of Lights.

This year's festival, the largest of its kind in Canada, runs from Nov. 19 to Jan. 31. Admission to the festival is free.

OPG, a proud partner in the Niagara Falls community, is a long-time supporter of the Winter Festival of Lights. The company supports local initiatives like the festival to enhance the well-being of communities that host its operations. In Niagara Falls, OPG operates the Sir Adam Beck hydroelectric stations, which have generated clean, renewable power for decades.

"The Winter Festival of Lights is about creating new memories," said Steve Repergel, Corporate Relations Officer at OPG. "It generates the holiday spirit for the

whole family. And every year it gets bigger and better." This year is no exception. Organizers stepped it up with the addition of 60,000 LED lights across Dufferin Islands, bumping the total there to an impressive 400,000 lights. And in a prehistoric twist, a new 10-foot-tall woolly mammoth display towers over the route at Dufferin Islands as part of the Canadian wildlife displays.

Elsewhere along the route, spectators can take in nutcrackers and candy cane ornaments lit up in bright holiday colours. Or, if you're in the mood for something truly mesmerizing, the new Fallsview Sound & Light Show provides a spectacle of colour, pictures and music using projection lighting technology.

Last year, the festival attracted more than 1.2 million visitors and it had a direct economic impact of \$54 million in the Niagara region. Tina Myers is hoping this year's event attracts even more people. The Festival is in the third year of a five-year plan to create a bigger, brighter, and more interactive experience.

"Thanks to the support of Ontario Power Generation, we continue to expand the festival," Myers said. "The hope is that the festival will become an international event of distinction."

For more information on the festival, visit www.wfol.com.



OPG REPORTS POSITIVE THIRD QUARTER EARNINGS

OPG reported a solid third quarter for 2016 with income of \$194 million, an increase of \$114 million from the same quarter in 2015.

The positive performance comes as refurbishment of the Darlington Nuclear Generating Station, Canada's largest clean energy project, gets underway. In October, the company celebrated breaker open for Unit 2. The defueling phase is now in progress and proceeding to plan.

"The Darlington Nuclear Refurbishment Project is an investment in Ontario's future," said Jeff Lyash, OPG's President and CEO. "It benefits communities across the province, provides clean, safe and reliable power, and will help moderate customer prices."

Net income attributable to the Shareholder for the third quarter of 2016 was \$194 million compared to \$80 million for the same quarter in 2015. The electricity generation business reported slightly higher earnings before interest and taxes during the third quarter. Additionally, there were higher earnings on the nuclear fixed asset removal and nuclear waste management segregated funds of \$85 million, driven by higher market returns on fund assets.

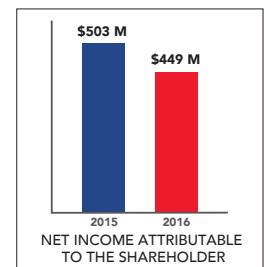
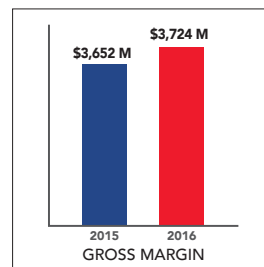
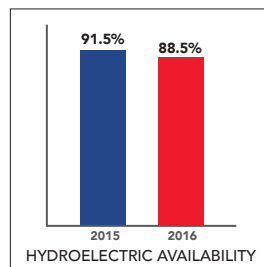
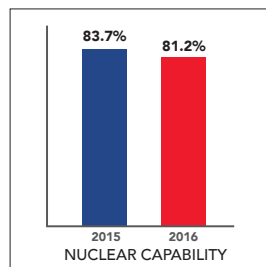
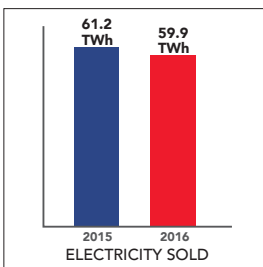
Earnings from the company's electricity generation business segments for this quarter totalled \$238 million compared to earnings of \$232 million in the third quarter of 2015.

Overall, the electricity generated this quarter was 19.5 terawatt hours (TWh) compared to 19.1 TWh for the same quarter in 2015. Electricity generation increased by 0.4 TWh primarily due to a higher number of planned outage days during the third quarter of 2015 reflecting the four-unit Darlington Vacuum Building Outage, which was completed at the end of October 2015.

OPG's nuclear capability factor at both the Darlington and Pickering Nuclear sites remained steady year to date. The unit capability factor at Darlington Nuclear for the nine months ended Sept. 30, 2016, was 87.6 per cent compared to 88.3 per cent for the same period in 2015. At Pickering Nuclear, the unit capability factor was 73.8 per cent compared to 78.4 per cent for the same period last year. The lower capability factors at Pickering Nuclear were primarily due to an increase in unplanned outages.

This quarter, OPG continued construction on Peter Sutherland Sr. Generating Station, a 28-megawatt hydroelectric station on the New Post Creek in northeastern Ontario. The project is tracking on budget and is estimated to be completed ahead of schedule. The company also completed the last tranche of the project financing for the Lower Mattagami River Project during the quarter. "This is a project management success story that was completed ahead of schedule and on budget," said Lyash. "In partnership with the Moose Cree First Nation, we have expanded the Lower Mattagami River Complex, which adds to our renewable generation fleet."

YEAR-TO-DATE SEPT. 30 RESULTS



THE IMPACT OF THE DARLINGTON REFURBISHMENT.

We all know that when it comes to the environment the best impact is zero impact. The refurbishment of the Darlington nuclear generating station is underway. Already rated one of the world's best nuclear stations, the refurbishment will ensure another 30 years of safe, reliable energy that's over 99% free of smog and greenhouse gas emissions. See more at opg.com

 @opg

ONTARIO **POWER**
GENERATION

