

POWER NEWS

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On The Cover: A View Inside Peter Sutherland Sr. GS

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ISLANDING WELL UNDERWAY AT DARLINGTON NUCLEAR'S UNIT 2 REACTOR

With defuelling of Unit 2 at the Darlington Nuclear Generating Station successfully completed ahead of schedule, the islanding team is now well underway on the next phase of the Darlington Refurbishment.

The process to isolate Unit 2, the first of four nuclear reactors to be refurbished at Darlington Nuclear, began in January.

"It's an exciting time for the islanding team," says Bert Boston, Islanding Project Manager at OPG. "Defuelling set the bar high, but our group was ready. After almost five years of planning, we're now executing the plan."

Islanding is the process of isolating Unit 2 to create a safe work area separated from the three remaining operating units. This is done by putting in place physical barriers and controls, which include the installation of 16 panels, each weighing about 5,443 kilograms, to physically isolate the unit.

Before islanding of Unit 2 could get underway, however, two key activities had to be completed: vault crane maintenance and bulk draining

the heat transport system. A large portion of the work has now been handed over to OPG's engineering, procurement and construction vendor partner, the SNC-Lavalin/Aecon Joint Venture. The group is installing the modifications to isolate Unit 2.

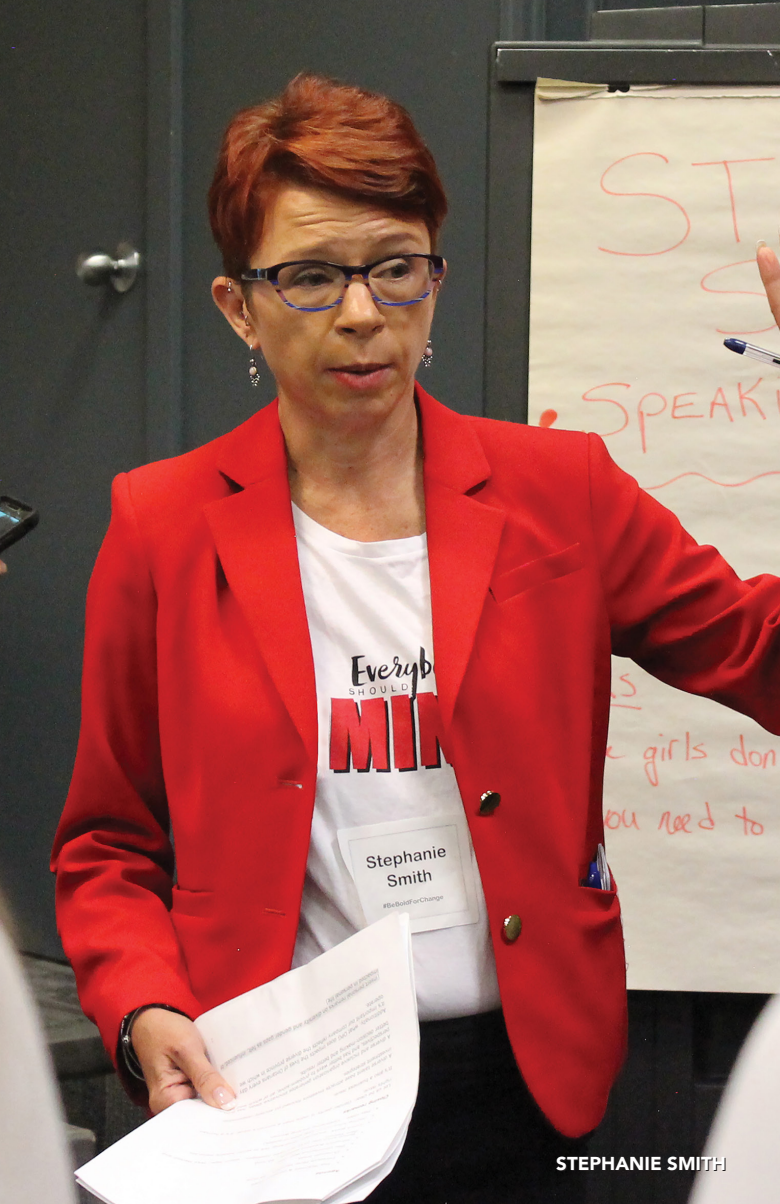
"We've been working closely with our vendor partners every step of the way," says Boston. "Success on Darlington Refurbishment will be determined by how well we all deal with the challenges that come up — and they will. Fortunately, everyone on the team is focused on working together and getting the job done well."

INSIDE DARLINGTON

In April, OPG will launch a multi-platform advertising campaign featuring the Darlington Nuclear Refurbishment. The campaign highlights the economic and environmental benefits of the project, while demystifying the subject of nuclear power.



UNIT 2 AT DARLINGTON NUCLEAR GS



STEPHANIE SMITH

EMPLOYEE SPOTLIGHT STEPHANIE SMITH

POSITION: Director of Operations and Maintenance

WORK LOCATION: Pickering Nuclear GS

YEARS OF SERVICE: 27

FAVOURITE SPOT TO VISIT IN ONTARIO?

Downtown Toronto. "I love going to concerts and my daughter lives there."

FAVOURITE MOVIES? *The Godfather* and *Goodfellas*

FAVOURITE WEEKEND ACTIVITY?

"I'm a runner and I also read a lot."

OUR PEOPLE: STEPHANIE SMITH

After nearly 20 years at the Pickering Nuclear Generating Station, Stephanie Smith says she's not going anywhere.

The nuclear station, which is scheduled to reach its end of service in 2024, continues to produce about 14 per cent of Ontario's power and is running better now than it ever has.

"Pickering is so unique because it's so large, so I'm never bored at this job," said the jovial Smith, who is Director of Operations and Maintenance at the plant. "I want to see this place through. It's going to be challenging but rewarding."

And that's fitting, because the executive has made a career out of taking on big challenges in her 27 years at OPG, establishing many firsts for a woman along the way.

Smith started at Darlington Nuclear in 1990 as a Graduate Engineer in Training and spent eight years working in engineering before moving to the chemistry lab at Pickering Nuclear.

In 2003, she enrolled in the shift supervisor training program while raising two young daughters. Three years later, she became the first female licensed shift manager at the plant, responsible for the safe operation of four nuclear reactors.

Then, in 2014, she became OPG's first female maintenance manager, responsible for 800 maintenance staff and 200 contractors. And in 2016, she continued to make history by becoming OPG's first female Director of Operations and Maintenance, overseeing all maintenance activity at the plant, from fuel handling to safety systems.

Being the first woman in these important roles "showed other people that it could be done," Smith said.

As a mother of daughters aged 21 and 19, Smith's success has had a lasting impact on her two children. While they haven't followed in their mother's footsteps, they have learned from her example as they head off into careers of their own.

"Both turned out very confident and both are very sure of themselves, because they've seen what I do and the way I handle myself," she said. "It's gone a long way."

A PRIMER ON FRESHET, THE ANNUAL SPRING THAW

As warmer temperatures set in, OPG's water management teams across the province are preparing for freshet — the annual spring runoff that occurs from melted snow and rain.

It's an important, but often misunderstood, process that can impact Ontario's hydroelectric operations and the people who use the affected river systems. OPG water management staff must balance many factors, including water management plans and agreements that help to determine allowable limits.

"On the Ottawa and Madawaska rivers, we really start to prepare for the spring melt as early as October with the start of the drawdown at Bark Lake," said Donald Ferko, who is responsible for water management activities at OPG's Eastern Operations along with Marc Bisson.

In the winter months, larger hydroelectric stations on those rivers will begin to release water from their reservoirs, lowering their levels in anticipation of the spring deluge. This includes Mountain Chute Generating Station (GS), Otto Holden GS and Des Joachims GS.

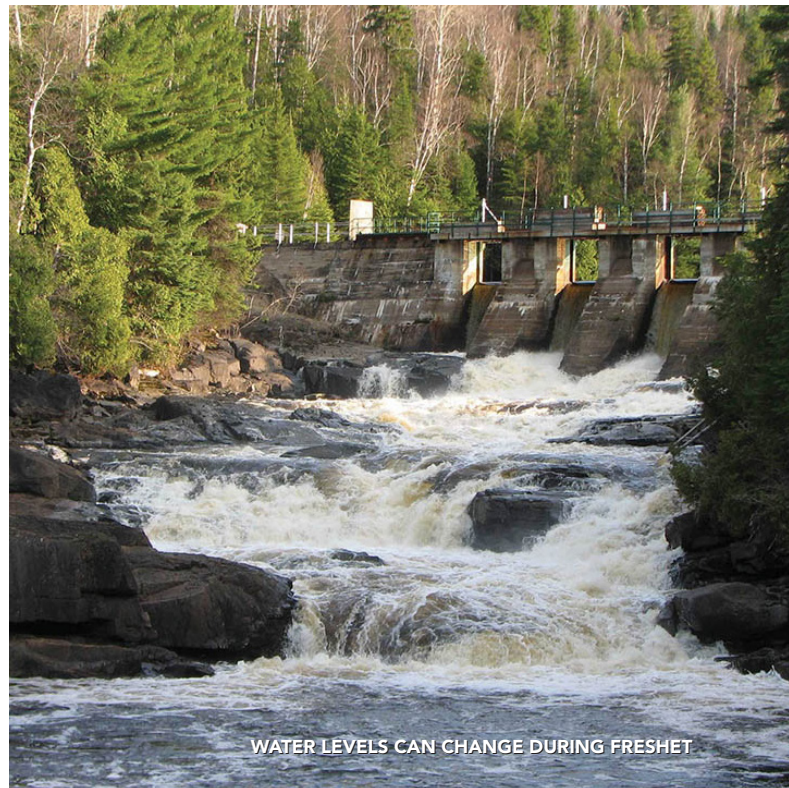
Ferko says the reservoirs for these "annual-cycle" stations should be entirely empty by the end of March in an average year. As flows pick up due to the thaw and spring rainfall, the reservoirs can be refilled while the stations continue to operate.

"We put water in them based on a number of different constraints, including addressing flooding issues if they occur, and other environmental conditions, like fish spawning activities," Ferko said.

The water levels in the reservoirs are generally kept in the top-range from summer to fall. Drawing down water levels begins between Thanksgiving and the winter months, and the cycle starts all over again.

But predicting water levels can be difficult, especially if there are many freeze-thaw cycles in a winter season.

"Just because you have a lot of snow on the ground doesn't mean you'll get a lot of runoff," Ferko said, noting that not all snow will make its way to the rivers. Depending on weather conditions, snow can sublimate (turn into a gas without melting first). Alternatively, if



WATER LEVELS CAN CHANGE DURING FRESHET

there's lots of rain and high humidity that will most definitely lead to higher flows. Spring freshet can take up to several weeks on large river systems.

"Every year is different," Ferko said. "There are some years we've had really high flows and localized flooding. We've also had trouble filling up some of the reservoirs until later in the summer or not all, despite normal snow conditions."

Lower water levels can lead to reduced power production at some stations. But Ferko said it's the individuals living or working near the river who feel the biggest impact from too much or too little water.

"If there's a rental property and you advertise it as a waterfront property, and the water isn't there, that's a problem," said Ferko, who fields calls from cottagers and municipalities each spring.

Regardless of what the water levels may look like, residents should remain vigilant around rivers and dams at all times. Even if it may look safe, water can rise at any minute around OPG's facilities.



PETER SUTHERLAND SR. GENERATING STATION SET TO POWER NORTHEAST ONTARIO

On the Abitibi River in northeastern Ontario, almost two years of construction and eight years of planning have culminated in a new hydroelectric station capable of powering 25,000 homes and businesses with clean and renewable power.

Crews are now commissioning the 28-megawatt (MW) Peter Sutherland Sr. Generating Station (GS), which is located about 80 kilometres north of the town of Smooth Rock Falls on the New Post Creek. The \$300-million project is tracking to be on budget and is expected to go into service sometime this spring, well ahead of its scheduled 2018 target.

That's a testament to the solid planning and execution between OPG and its partner in the development, Coral Rapids Power, a wholly-owned company of the Taykwa Tagamou Nation (TTN). The development, which is named after a respected TTN elder, has already had a positive impact on the community.

"We have had about 50 TTN members working on the project at one point, which was significant

for our First Nation partner," said Paul Burroughs, Project Director at OPG. "They are part of the project team working to make this a success."

As part of the project agreement, Coral Rapids Power has a one-third ownership in the facility, meaning they will receive a share of profits from the station and be a partner for life over the 90 or so years the plant is expected to operate. As the TTN's first foray into hydro development, the project took several decades to get off the ground before the First Nation partnered with OPG in 2007 as part of a past grievances settlement. Construction on the station began in 2015.

"The relationship we've built with OPG is based on a foundation of respect, trust and working toward a common goal," said Wayne Ross, President of Coral Rapids Power. "There have been many benefits from this project for our community, including good-paying jobs, transferable skills and a long-term revenue stream."



FREDA OUELLETTE AND WAYNE ROSS



In addition, approximately \$53.5 million in subcontracts were awarded to TTN joint-venture businesses during the construction phase of the station.

“The partnership is about creating a lifelong relationship with the First Nation, not just one which exists during construction,” said Burroughs.

At the peak of construction, there were about 220 individuals employed on the project. Currently, there are around 60 staff on the site as construction winds down and testing continues.

With the station set to go into service soon, crews successfully completed watering up the 170-hectare head pond and are now testing the penstock, a 250-metre-long steel pipe that sends water down to two 14 MW units that generate

electricity in the powerhouse. The station will utilize a portion of water flowing down New Post Creek, which will then be discharged into the Abitibi River.

While the project is set to finish ahead of schedule, that’s not to say there haven’t been any challenges along the way — the biggest one being the terrain in the area.

“There is very little bedrock on the site, and a fair amount of the station is built on swampy conditions,” Burroughs said.

The design-build contractor had to redesign elements of the site to make them more robust, particularly the earthfill dam that contains the reservoir. Engineers also had to devise a system to keep water out of the station’s excavated foundation while pouring concrete.

With Peter Sutherland Sr. GS nearing completion, the next step will be cleaning up the area and re-planting grass and trees to “return things to a more natural state,” Burroughs said.

The new station will be operated by OPG’s northeastern operations control room in Timmins and be maintained by technicians located at a nearby work centre in Abitibi Canyon.

AT A GLANCE

- New 28 MW station will power 25,000 homes, businesses
- 220 individuals employed at peak construction
- Set to go into service this spring, ahead of schedule

THE MAN WHO BUILT POWER ON THE ST. LAWRENCE

When Robert Hood Saunders looked over the great St. Lawrence River, he saw the last major undeveloped hydroelectricity resource in Ontario.

As chairman of the Hydro-Electric Power Commission of Ontario, he would make it his mission to unlock the river's power for Canadians and Americans alike. But, tragically, he wouldn't live to see the ambitious project finished.

"His accomplishments were many," then-Premier Leslie M. Frost said in 1958. "The most important and spectacular was his success in bringing together the governments and interests which made possible the St. Lawrence agreement."

A lawyer and politician, Saunders entered Toronto municipal politics in 1934 and served as the city's mayor from 1945 to 1948.

After resigning as mayor, the Toronto native was appointed chairman of the Hydro Commission in 1948, just in time to lead the company in its great post-war expansion program. Under his tenure, a total of 16 new generation projects were launched – including the Sir Adam Beck 2 hydroelectric generating station at Niagara Falls and the St. Lawrence Power Project, which was completed in 1958.

A gifted and tireless communicator, the gregarious Saunders used his political acumen and powers of persuasion to finally get shovels into the ground for hydro development on the St. Lawrence River, which he saw as an integral part of the larger St. Lawrence Seaway Project. The venture had been talked about for 40 years but nothing came of it until Saunders arrived on the scene.

Saunders travelled throughout Ontario and into the U.S. delivering countless speeches to promote the project. His hard work paid off when on June 7, 1954, the U.S. Supreme Court cleared the way for construction to begin, which was to be jointly undertaken by Ontario Hydro and the New York Power Authority.

One month later, it was announced the Canadian section of the St. Lawrence Power Project would be named the "Robert H. Saunders St. Lawrence



Generating Station." This station, along with the American-operated Franklin D. Roosevelt Power Project, would comprise the kilometre-long Moses-Saunders Power Dam, providing a combined output of 2,000 megawatts split between the New York and Ontario power systems.

Sadly, Saunders would not live to see his name on the station. On Jan. 14, 1955, the chairman and four others were returning to Toronto from Windsor when their ice-covered plane crashed near an airstrip in London. He died two days later of his injuries. He was only 51 years old and at the peak of his career.

The untimely death stunned Ontario, Canada and New York State. Thousands attended his funeral to pay tribute and in 1957 a memorial statue was unveiled in downtown Toronto in his honour.

Today, Saunders' legacy lives on in the St. Lawrence. Nearly 60 years after it first went into service, OPG's Robert H. Saunders plant is still providing clean, renewable electricity for Ontarians. The 1,045 MW station produces enough power to meet the annual needs of about 600,000 homes.

For more stories on OPG's hydro pioneers, visit OPG.com/ourstories.

BOOSTING BIODIVERSITY IN EASTERN ONTARIO

With wetlands across Ontario shrinking by the year, animals that rely on the province's soggy marshes to nest, rest and thrive have been feeling the pinch.

As part of their three-year Biodiversity Project, the South Nation Conservation (SNC) worked to stem this trend in eastern Ontario. The project, launched in partnership with OPG's Regional Biodiversity Program, wrapped up in late 2016.

"The project had the aim to increase biodiversity and habitats in our jurisdiction," said Karen Paquette, SNC Project Lead. "We were particularly focused on helping species at risk through tree planting, grassland restoration, and wetlands enhancement."

To help affected waterfowl, like the colourful Wood duck, SNC installed 30 nesting boxes in the Nash Creek wetland in South Dundas and Leitrim wetland near Ottawa. The ducks make their nests in dead trees with hollowed-out cavities found near swamps and rivers, but in the absence of these they rely on man-made enhancements, like the SNC's specialized boxes.

Elsewhere, other wetland creatures got a helping hand with the creation of wildlife ponds, turtle nesting platforms, and three vernal pools – a temporary pool of water that provides an important breeding habitat for frogs and salamanders. In addition, 300 pounds of northern and southern wild rice was sown with the support of local First Nations partners. The wild rice helps increase wildlife food sources.

SNC staff also sought to help improve the habitat of grassland bird species such as the Eastern meadowlark, Loggerhead shrike and Bobolink. To improve conditions for these birds, as well as pollinators, the conservation authority restored 150 acres of grassland habitat by planting native grasses and brush-cutting the area to eliminate invasive plants.

In the region's forested areas, the SNC successfully planted more than 100,000 native trees. Staff also assessed more than 2,700 acres

of woodland on private lots for the occurrence of plant species at risk, such as Butternut and American ginseng.

These efforts have not only helped improve eastern Ontario's overall biodiversity, it has also planted the seeds for even more effective habitat restoration programs in the future.

"It's all about creating stewardship on the ground," Paquette said. "We will continue monitoring areas enhanced through this project to measure success and identify future projects to continue enhancing biodiversity in eastern Ontario."





ALLEGHENY MOUNTAIN DUSKY SALAMANDER

RARE SALAMANDER'S HABITAT PROTECTED IN NIAGARA FALLS

A group of rare amphibians presented an unexpected hurdle during the refurbishment of the massive 750-acre reservoir at OPG's Sir Adam Beck Pump Generating Station in Niagara Falls.

The \$60-million project to drain, repair, and re-water the 60-year-old reservoir, which is Canada's largest, was recently completed ahead of schedule and under budget. But things took an unforeseen turn last April as grouting work threatened to impact the habitat of a dozen endangered Allegheny Mountain dusky salamanders living on the bank of the Niagara River.

"It was a big challenge," said Clara Greco, Project Manager with OPG.

As part of the refurbishment, impermeable plastic liners were installed in critical locations and grout was injected in 706 holes to seal the bedrock foundation of the reservoir dyke. During the initial grouting trials, however, some of the grouting mixture made its way through a network of cracks in the bedrock and surfaced in the salamanders' habitat some 700 metres away in an area called the Queenston Seep.

In Ontario, the slimy brown critter, which measures between seven and 10 centimetres, is found only in the wet groundwater seep areas within the Niagara Gorge.

"There was groundwater movement in the area and this ground water took the material and carried it a

fair distance. We didn't know the grout would travel that far," said Greco.

Immediately, grouting was halted and, with help from the Ministry of Natural Resources and Forestry and the Ministry of Environment, Greco and her team changed the grouting process to protect the affected habitat. Crews cleaned up the grout residue and conducted a survey to account for all salamanders in the area. Fortunately, no salamander was harmed as a result of the leakage.

Built in 1957, the PGS plays an important role in generating flexible emission-free power for Ontario. It uses electricity in off-peak periods to pump water into its reservoir, which can then be unleashed when electricity demand is high. The completed refurbishment adds 50 more years to the reservoir's life.

DID YOU KNOW?

- The Allegheny Mountain dusky salamander was discovered in Ontario in 2004
- It has the ability to self-amputate its tail when seized by a predator

OPG REPORTS SOLID OPERATING AND FINANCIAL RESULTS IN 2016

OPG reported solid financial and operating results for 2016 as the company makes advancements on major generation projects currently underway.

Net income attributable to the Shareholder was \$436 million for 2016, up from \$402 million in 2015. The increased earnings were mainly the result of higher generation from the company's nuclear fleet and higher earnings for stations in the Contracted Generation Portfolio segment. The higher nuclear production reflected more days when the Darlington Nuclear Generating Station (GS) units were producing electricity in 2016, compared to 2015.

Overall, OPG's electricity generation increased in 2016 to 78.2 terawatt hours (TWh) from 78.0 TWh in 2015. Nuclear production of 45.6 TWh in 2016 represented an increase of 1.1 TWh compared to 2015, primarily due to a lower number of planned outage days during 2016.

"The continued strong financial performance of OPG benefits the Province and electricity consumers," said OPG President and CEO Jeff Lyash. "OPG continues to produce about half the electricity used in Ontario with the power priced 40 per cent lower than other generators, which helps moderate customer bills."

The unit capability factor at Darlington Nuclear GS increased to 89.5 percent for 2016, compared to 76.9 percent for 2015, primarily due to fewer planned

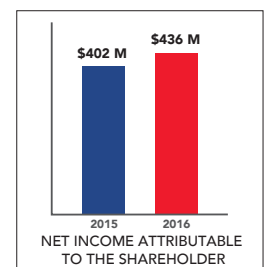
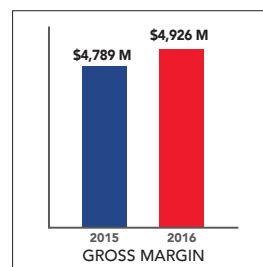
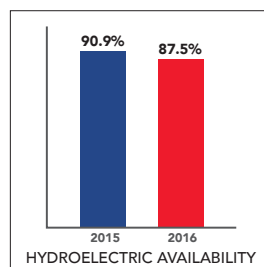
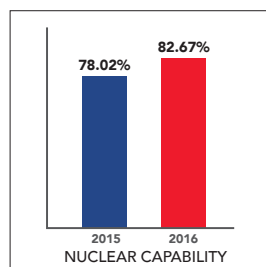
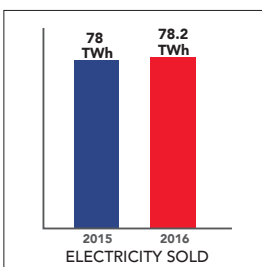
and unplanned outage days at the station during 2016, compared to 2015. The unit capability factor excludes Unit 2 while it is undergoing refurbishment. At Pickering Nuclear GS, the unit capability factor decreased to 75.2 per cent for 2016, compared to 79.4 per cent for 2015, primarily due to a higher number of additional outage days at the station in 2016.

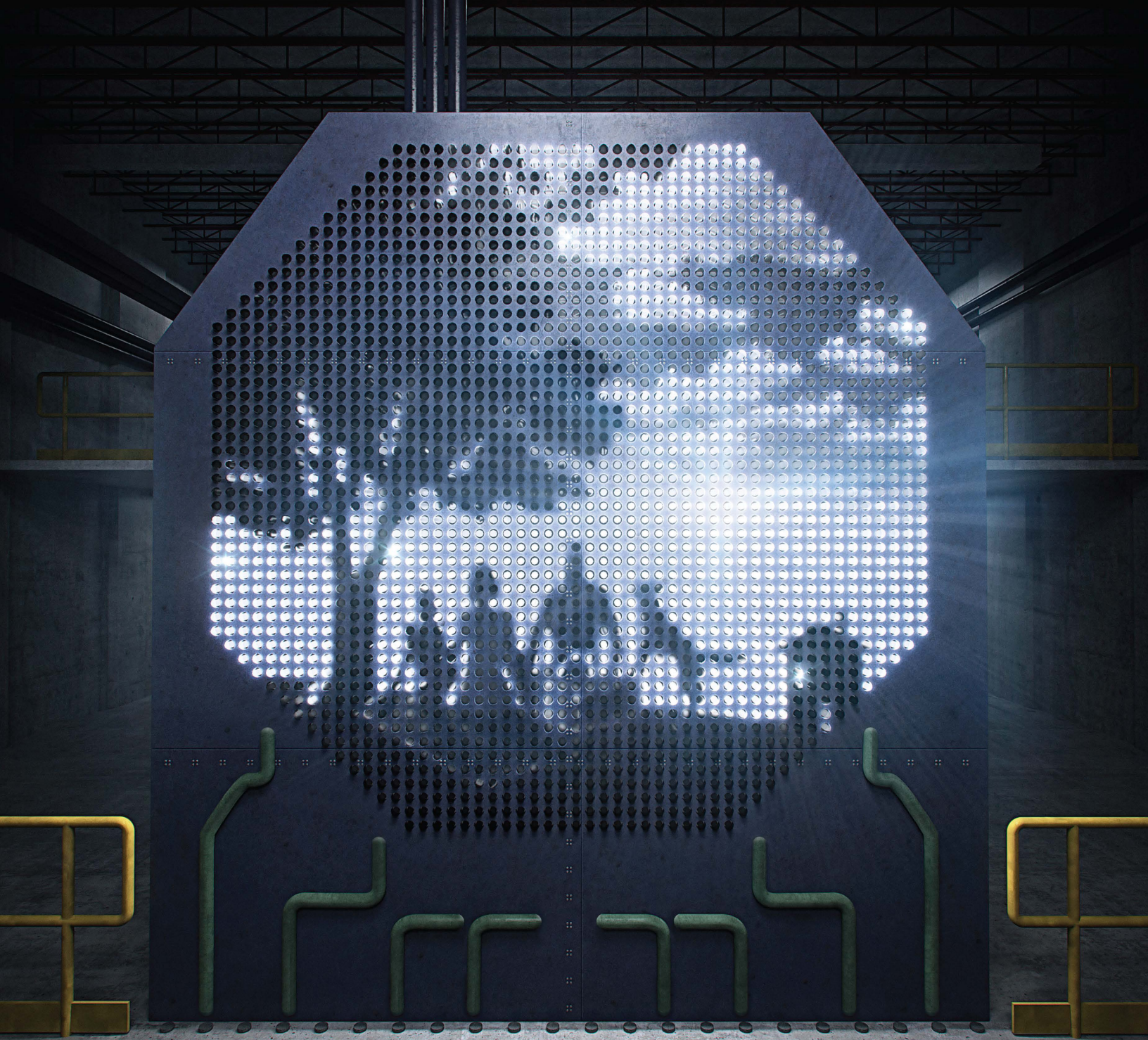
Across OPG's regulated hydroelectric generating stations, availability decreased to 89.0 per cent for 2016, from 91.2 per cent in 2015. The decrease was primarily due to the scheduled reservoir refurbishment project at the Sir Adam Beck Pump hydroelectric GS.

In 2016, OPG undertook a number of generation development and life extension projects in support of Ontario's electricity planning initiatives. Significant developments during the year included the start of the \$12.8-billion Darlington Refurbishment project in October, the Sir Adam Beck Pump GS reservoir refurbishment that began in April and was recently completed ahead of schedule, and construction of the new 28-megawatt Peter Sutherland Sr. GS in northeastern Ontario. The Peter Sutherland Sr. station is OPG's third partnership with an Indigenous community.

"We're pleased that construction is progressing ahead of schedule and within budget," Lyash said of the new station.

2016 FINANCIAL AND OPERATING RESULTS





What's the impact of refurbishing the Darlington Nuclear Station?

It's 30 more years of clean, reliable, low-cost power.

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