Darlington New Nuclear Public Information Sessions Questions & Answers

Topics

Cost and Timeline

With a lifespan of 60 years, what would the decommissioning of Small Modular Reactors (SMRs) look like? Also are those costs included in the levelized cost of energy?

A: When we're building the cost of the project, we include the overall life cycle cost, which includes decommissioning plans. We are still working on the specifics of the decommissioning plan and we expect it will be completed over the next few years.

As our design evolves in the current planning phase, the Release Quality Estimate will break down further. Our plan is to be in a position to publish our release quality estimate by end of 2024.

What is the average time to build a boiling water reactor (BWR) of this size?

A: Our planning goal is 48 months for the first unit.

Can you elaborate on the timeline for the additional units?

A: The current plan is to start construction on the second unit after completion of construction of the first unit, in late 2028.

Experience from past projects, such as the success of the Darlington Refurbishment Project, shows that there will be lessons learned from the first unit which would be applicable to improving execution of the second unit.

For subsequent units, it is anticipated there will be overlapping construction activities. The overall planning timeline is to complete all four units by 2036.

Energy Supply and Generation Growth

Are there any other SMRs being built or planned in North America?

A: Within the North American space, there have been a few very exciting announcements and we are working with different utilities, both in Canada and the United States, looking at additional deployments of the BWRX-300.

For example, SaskPower has announced their intent to deploy some BWRX-300 units - the same design we're building at Darlington - and in the US, the Tennessee Valley Authority is working with us on the standard plant design.

On the east coast of Canada, New Brunswick Power is investigating two different types of reactors - ARC Clean Technologies and Moltex reactors, which are different type of salt reactors.

What does the competition look like in this space, ie. are there any other companies in the world who are further ahead or on the heels of Ontario Power Generation (OPG) in the pursuit towards executing an SMR project?

A: There are other nuclear projects going on in North America; the US federal government provided the Advanced Reactor Demonstration Program, under which two reactors were selected with the goal of being online by the end of the decade. Those reactor technologies are the X-energy design, which is a high temperature gas reactor, and the other is a Natrium design which is a molten salt reactor. These two reactor designs are following closely behind OPG, but the BWRX-300 project here at Darlington is going to be the first one inside Canada.

What we can say about this industry is that we all work together to make sure that these projects are successful. One of the key tenants of our industry is making sure that we push each other forward to make sure that we're safe, reliable, on-time and on-budget.

What other nuclear generation projects does OPG have in the planning stage?

A: In response to the system operator's Pathways to Decarbonization assessment, the province of Ontario responded with the Powering Ontario's Growth Report. Issued this past summer, the report asked the system operator, OPG and Bruce Power, to look at what it will take to deliver on roughly 18 gigawatts of nuclear.

The response to the province will be delivered at the end of next year and will include our assessment of what is possible at existing sites and what electricity the province will need and when and where.

We do not have an active deployment today of another project such as the Darlington New Nuclear Project (DNNP), but we are investigating, as part of the feasibility report and looking at the suitability of additional sites for additional nuclear generation in the province that's on a large scale.

We do have other feasibility studies as well. Reactors that are used beyond just the grid are called industrial reactors and can produce high temperature steam for industrial applications to help the broader industry that is currently dependent on natural gas to decarbonize.

Lots of things are moving in the nuclear space all at the same time, while our focus is on delivering clean, reliable power for the province of Ontario.

What percentage of Ontario's electric generation capacity do you expect will be nuclear by 2040?

A: We do not have the exact percentage, however, the Independent Electricity System Operator's (IESO) Pathways to Decarbonization report, which talks about 18 gigawatts of new nuclear, is relevant. By 2040, we expect to have completed the DNNP, which is about 1,200 megawatts of new nuclear.

Nuclear will play a part of the solution for clean sources of energy, including small modular reactors. They all have different and unique features and requirements based on the jurisdictions they are selected for deployment in.

We have chosen the BWRX-300 because it will be needed in many jurisdictions in Canada as different areas begin to decommission their coal power plants. Both large and small nuclear will play a vital role in the decarbonization of our economies. Both will also have a piece to play in nuclear development.

Will nuclear reactors eventually phase out other forms of clean energy such as wind or hydro? Or are there special benefits to having wind and hydro?

A: The truest and most reliable and sustainable grid that we can have to provide our power is one that involves many forms of generation.

The IESO's Pathways to Decarbonization report demonstrated significant growth in both wind and hydro generation. A mix of sizes is important in reactors and generators and hydro needs to be a part of the solution. We are fortunate to have abundant hydroelectric resources in our province and we've been asked by the provincial government to explore further expansion, so it will certainly not be phased out.

As part of the mix, it's important to have an increase in nuclear, which provides the carbon-free and reliable base load of power 24 hours a day, seven days a week. Nuclear will take on and grow its share of the portfolio. When the sun isn't shining, when the wind isn't blowing, nuclear will be there.

Safety and Emergency Preparedness

What is the radius of the emergency planning zones (EPZ) for the BWRX-300?

A: In Canada, the provinces and territories have the primary responsibility for off-site nuclear emergency planning and response to protect public health, property and environment. As part of the licensing process, OPG is required to provide the necessary information for the provincial authorities to effectively establish their nuclear emergency planning policies and EPZ.

As the size of the EPZ for this project is established, we fully expect it will fit within the bounds of the existing Darlington Nuclear Generating Station's EPZ, with large safety margins. This will be confirmed with our license to operate application.

Will the reactor side of the plant be seismically qualified?

A: Yes, it will meet all current safety standards, regulatory requirements and seismic requirements as specified.

What are some distinguishable safety features between the SMR and a larger reactor design?

A: The Canadian nuclear industry has been reliably operating nuclear power plants to the highest levels of safety for decades and OPG specifically is recognized as a world leader in nuclear operations.

Building on those decades of safe operations, the BWRX-300 is the *tenth* generation of the BWR and offers an improved safety case due to the inherent design characteristics and passive safety features that do not rely on external power sources or cooling water to reach a safe state.

For example, the Isolation Condenser System is a passive safety system that provides cooling for the reactor for several days with minimal operator action and without the need of off-site power. This is one of the significant enhancements to the design of the BWRX-300.

Licensing Activities

Why are the licences to prepare the site, construct and operate issued years apart from each other?

A: The Canadian Nuclear Safety Commission's (CNSC) licensing process outlines the steps in each of the major phases of the licence, including what information is required for each license application.

The way in which those requirements are laid out allows for flexibility for the licenses, to in some cases, be combined, depending on what the licensee's intent is for the licensing activities that they are requesting.

For example, when the Environmental Assessment (EA) or Impact Assessment is taking place at the beginning of a project, it typically accompanies a site preparation license, which is the first license application that would be submitted to the CNSC, but a licensee may choose to combine it with a construction license instead.

So, the timing is more dependent on the project and at what point a licensee is determined to plan and carry out certain licensing activities. In some cases, they can be combined and in some cases, they might be years apart.

Why is the License to Construct (LTC) for only one unit? Isn't it more expensive to do it this way? Will the next LTC be for three units?

A: Our original submission was primarily based on the mandate from the government at that time, for one unit. Moving ahead with licencing one unit first will allow us to demonstrate we can meet all the requirements.

The submission for the subsequent units will likely be an amendment to the LTC.

What actually happens at one of these hearings?

A: In advance of a CNSC hearing, there are a few key pieces of information that need to be prepared and submitted. A Commission Member Document needs to be prepared, both by the licensee and by CNSC staff. For the January 2024 hearing, OPG submitted a CMD to the Commission outlining our findings and conclusions as they pertain to the hearing subject matter (e.g. applicability of the Environmental Impact Statement (EIS) and Plant Parameter Envelope to the BWRX-300 technology) and the CNSC staff did the same, outlining their position and recommendation.

The next step is a period for intervenors to submit their interventions on the hearing subject matter, as set by the Commission Registrar.

The hearing itself begins with a presentation by both OPG and the CNSC staff. This is followed by a second portion of the hearing where CNSC commission members ask questions related to the submitted information and commission member documents.

The next stage involves registered intervenors presenting oral interventions. Commission members may then ask questions based on the presented information. These questions can be posed to either CNSC staff or OPG staff for response.

Written interventions are also discussed as part of the agenda. Any resulting questions from the commission members must be responded to. A final round of questions takes place as well to make sure all topics are covered.

What happens after this hearing? What does it let you do?

A: Right now, we are authorized to undertake site grading activities and bring construction power services to the SMR site. This non-nuclear work falls under the site preparation licence.

Pending the outcome of the January 2024 CNSC hearing, we are planning for the Part 2 hearing on the LTC in late 2024, for an anticipated Commission decision in 2025. At that point, we would be authorized to start construction on the nuclear side of the plant.

Project Staffing and Careers

What are your plans to ensure adequate staffing?

A: We are working closely and continue to build relationships with universities and colleges like Ontario Tech, McMaster and Durham College to ensure we have a talent pipeline of future leaders.

We are developing a response to the Powering Ontario's Growth report, which will be submitted next year and explicitly outlines what staff we will need over the next 25 years and when, with an actionable plan to ensure we have the right numbers and skills at the appropriate times.

How many staff will it take to operate the station, specifically shift workers, maintenance etc.? Does four SMRs mean four times the jobs?

A: It takes approximately 200 people to operate one unit, so probably 600 people (or three times) to operate four because the units are spaced together, allowing for some synergy for the onsite workforce.

Related to job creation, what % does OPG expect to hire in-house vs. contract out?

A: We expect the majority of jobs to operate and maintain the plant in the future to be in-house hires. During the construction phase, a number of jobs will be in-house hires, but the larger percentage would be contracted out, simply because of the way the labour jurisdiction is split in construction, from building trades to the operating plant.

Could you please provide any tips for external hiring and specifically for new grads?

A: There are several ways students can get involved with OPG. Depending on what you are taking in post-secondary education, you may have seen OPG active in colleges and universities doing information sessions. We know that these exciting projects we are undertaking are going to require a lot of staff and young workers in order to be successful, so we are actively recruiting within the college/university space.

OPG's career website www.opg.com/careers will continue to post project jobs for external hires, as well as programs for interns, co-op students and new graduates. We've recently hired a number of individuals for the project and will continue to need various resources for the foreseeable future.

Those interested can also get involved with the project though our partners' career websites: General Electric Hitachi, Atkins Realis and Aecon; all of whom have a number of subcontract companies that will need people in support of the project.

Reactor Technology and Design

Is there a plan to tie the SMR in with any of the Darlington Nuclear common services?

A: The existing Darlington Nuclear Generating Station and the planned DNNP are separate and distinct stations. Therefore, there will be very minimal ties between the two stations (potential for Public Address System, only).

What will refueling outages look like on the SMRs (frequency/length)?

A: Refueling outages can be on a 12, 18, or 24-month frequency. Initially, our plan is that the BWRX-300 will be refuelled at a 12-month frequency with assessment of the benefits of extending the frequency for future cycles.

A refueling outage is anticipated to be approximately two weeks in duration. Approximately every 10 years, there would be a longer maintenance outage.

Is there a plan to build a simulator for the SMR?

A: As a world leader in nuclear operations, few are better positioned to train our skilled workforce in the operation of a new nuclear technology.

OPG has an existing extensive training program and is consulting and benchmarking to improve upon that system to develop a world class training program that utilizes the most current training techniques and technologies.

An essential part of our existing training program is the use of nuclear simulators to develop and maintain critical skills and knowledge; we will have one DNNP simulator built onsite and another offsite to ensure our staff are trained, prepared and proficient in their roles and on the new equipment, well in advance of actual operation.

Where are the SMR modules built?

A: They will be fabricated at offsite factories within Ontario. Steal composite bricks are then delivered to the site for assembly and concrete fill.

Does OPG plan to leverage existing systems, applications and processes from existing nuclear plants, or will you approach DNNP with a fresh perspective for SMRs?

A: OPG has leveraged our existing people and processes to get to this point in the project. Our expertise from operating our existing power plants and from refurbishing the Darlington station on budget and on time, has gotten us to where we are today. From this point on, we are looking into processes for the BWRX-300 specifically and tailoring those for the selected design.

Why was a BWR chosen instead of, say, a Canada Deuterium Uranium (CANDU) reactor? Is it simply that GE Hitachi does not make one or are there other technical reasons?

A: Several considerations were taken into account when selecting the DNNP reactor technology. Characteristics such as safety case, reactor size, readiness/timeliness for deployment, experience of the reactor developer and extent of Ontario/Canada supply chain content, to name a few.

Following completion of a rigorous technology comparison against key criteria, the OPG executive decided on the GE-Hitachi BWRX-300. This is a 10th generation design of BWRs which operate safely throughout the world today.

Environment and Biodiversity

Will OPG reinstall the 1.4 km section of the Great Lakes Waterfront Trail that has been detoured to Energy Drive upon completion of the build as an integrated section that will enhance user experience and showcase OPG's commitment to the public?

A: As a safety precaution for users of the trail, we have rerouted a small section of the eastern portion of the Waterfront Trail while soil moving activities are ongoing. We have an EA commitment to reestablish the trail once this work is complete and it is safe to do so.

OPG will continue to work closely with the Municipality, community members and trail users as the project progresses and will seek input from Indigenous nation and community representatives, the local community, users of the trail, Darlington Community Advisory Committee and Municipality of Clarington staff to consider opportunities to enhance and improve on the future route of the trail, as part of the post-construction site layout.

What will the cumulative lake temperature impacts of additional reactors using once through lake water cooling be?

A: The DNNP design uses a once-through cooling system.

The effects on lake water temperature are expected to be consistent with those assessed in the approved EA and may have reduced effects due to a lower flow rate. OPG has committed that the design of the discharge diffuser will mitigate potential environmental effects, including those associated with a thermal plume.

The design of the discharge diffuser is progressing and thermal plume modeling is underway.

Does the EIS take into consideration impacts from all reactors on site or is specific to BWRX-300?

A: The EIS looks at both the DNNP and cumulative effects between DNNP and the Darlington Nuclear Generating Station and other operating facilities and activities at the site. It also looks at the cumulative effects of other projects that were in progress or planned to be occurring in the local and regional study areas. These include Ministry of Transportation projects, water treatment plant expansions and various other projects that were planned across the region. The assessment looked at whether or not there were similar effects that would be occurring as a result of those projects being carried out at the same time as the DNNP.

The assessment was then reviewed during our recent EIS review that was specifically considering the BWRX-300. We looked at whether there has been any change to our cumulative effects assessments and concluded there were no new projects that were not considered originally in the EIS cumulative effects assessment.

The impacts of the BWRX-300 deployment would actually have less cumulative effects than were originally assessed and therefore remain within the bounds of the EIS.

What are some biodiversity initiatives being taken by OPG?

A: At the Darlington site, we installed a meadow and pollinator habitat in 2018 to improve the habitat for local pollinators.

In 2020, we deployed a MOTUS Tower on Bobolink Hill, next to our on-site Coots Pond. This is a tower that is used to study migratory birds, bats and insects that have been electronically tagged.

This tower is a partnership between OPG and Birds Canada and the data collected supports federal migration research. It also provides valuable insights for us on what species fly on or near our site. Since deployment, nine bird species have been noted at this tower.

We also have a tree swallow nest box which is in its 25th year. Since 1998, 900 chicks have successfully fledged their nests. These nest boxes are also installed by Coots Pond.

As well, in 2022, a turtle basking platform was built and installed at Coots Pond, in partnership with Courtice Secondary School. This raft provides a safe basking habitat for painted turtles and reduces the chances of land predation. We have observed spotted painted turtles using this platform.

Fuel Supply and Management

Is there a plan to be self-sufficient for supply of enriched fuel or will we import from the US?

A: In late 2023, OPG announced we're partnering with companies from Canada, the U.S. and France to ensure a fuel supply for the first unit of the four-unit DNNP.

The partnership includes:

- Canadian company, Cameco, which has uranium mines in Saskatchewan and a Uranium Hexafluoride conversion facility in Port Hope, will supply natural UF6.
- US-based, Urenco USA will provide uranium enrichment services from their operations in Eunice, New Mexico.
- France's Orano will provide additional Enriched Uranium Product from their operations in France.
- And US-based, Global Nuclear Fuel-Americas LLC, a GE-led joint venture, will provide fuel fabrication and related technical services and fuel assemblies.

While the fuel for the DNNP will be fabricated outside the country, much of the raw materials will be sourced from within Canada. There is also potential that Canada may at some point in the future look at developing a domestic supply of BWRX-300 fuel.

Is there any difference with processing and storage of enriched fuel (compared to natural fuel)?

A: OPG has existing programs and resources which will be leveraged to safely manage the used fuel from the DNNP, just as we have done for decades for our existing nuclear fleet.

The fuel selected for use in the BWRX-300 is slightly enriched uranium (between 3-5%) and utilizes the Global Nuclear Fuel 2 fuel assembly which has been safely used for more than 15 years of operations around the world. The management of this fuel is fundamentally the same as the management of the fuel that is used in our existing operating fleet. As a learning organization, OPG has partnered with nuclear utilities in the U.S. to share their lessons learned with respect to best practices in the safe management of used nuclear fuel from BWRs.

Once the fuel has reached its end of life, the fuel from the reactor will be removed and transferred into a spent fuel pool, where it will remain for a period of approximately 8 years. After this time, the used fuel will be moved to dry storage in an approved storage cask, where it will be stored in a licensed facility for interim storage.

Miscellaneous

Does OPG also do research or development on fusion reactors?

A: Fusion is the next generation of nuclear technology that has been around for many years and has been seeing some interesting breakthroughs as of recent times. Over the last couple years, significant investment has been made in this area externally from the private markets.

OPG is a company that innovates and stays on pace with technology. As such, we have a team of people educated in fusion technologies that monitor its progress for potential future potential deployments in Canada.

Canada itself does not currently have a national fusion policy, so that's something that is being looked at across the industry and being informed by staff here at OPG.

Acronym List

- BWR - Boiling Water Reactors
- CNSC - Canadian Nuclear Safety Commission
- DNNP - Darlington New Nuclear Project
- EA - Environmental Assessment
- EIS - Environmental Impact Statement
- EPZ - Emergency Planning Zones
- IESO - Independent Electricity System Operator
- LTC – Licence to Construct
- OPG – Ontario Power Generation
- SMR - Small Modular Reactor