PRODUCTION FORECAST AND METHODOLOGY - NUCLEAR

1.0 PURPOSE

This evidence provides the production forecast for the OPG nuclear facilities and Darlington New Nuclear Program ("DNNP") facilities, and a description of the methodology used to derive the forecast. The nuclear generation forecast and methodology are substantively the same as in OPG's prior applications. Any changes are noted as applicable.

Altogether, the Application is seeking approval of a total nuclear production forecast of 128.6 terawatt-hours ("TWh") for the IR term. This includes:

- 126.2 TWh for OPG Nuclear Facilities (consisting of a plan of 18.7 TWh in 2027, 26.7 TWh for 2028, 25.1 TWh for 2029, 26.8 TWh for 2030, and 28.9 TWh for 2031), and
- 2.4 TWh for DNNP Facilities for 2030-2031 (consisting of a plan of 0.5 TWh in 2030 and 1.9 TWh in 2031).

2.0 NUCLEAR PRODUCTION METHODOLOGY AND PLANNING PROCESS

2.1 Methodology

Nuclear production planning and forecast methodology for this application remains substantively unchanged from EB-2020-0290 and broadly applies in the same manner for OPG nuclear facilities and DNNP facilities.

OPG nuclear facilities and DNNP facilities are designed as baseload generators. The annual nuclear production forecast for each is equal to the sum of the nuclear generating units' capacity multiplied by the number of hours in a year, less the number of hours for any planned outages, planned derates, forced production losses (i.e., unplanned outages and unplanned derates, as defined in Attachment 1 of this exhibit) and corrections for sources of generation losses (i.e., lake temperature, grid losses, and consumption (station service), as defined in Attachment 1).

The nuclear facilities and DNNP facilities production planning process is focused on establishing annual planned outage schedules and calculating variances to planned generation due to forced production losses. Outage durations are determined based on the scope of work defined for each outage while considering recent benchmarking efforts and industry best practices, with a commitment to continuously improve. The objective is to establish a realistic and accurate annual nuclear production forecast based on the generation and planned outage scope, and forced production losses with the following deliverables:

- A planned outage schedule for all stations that includes unit outage start dates, end dates, and durations based on the major elements and preventative maintenance comprising the scope of work that will be executed during each outage.
- Operational reliability targets such as Unit Capability Factor ("UCF"), Unit Capability Rate and the level of forced production losses based on forecast Forced Loss Rate ("FLR").
- Generation forecasts (in TWh) for individual nuclear units and an aggregated forecast for each station.

The generation and outage plan is an input to OPG's overall corporate business plan. As discussed in Ex. F2-4-1, outage resource requirements and cost estimates for the outage OM&A cost budget are also tied to the nuclear generation and outage plan.

2.2 Schedule

Planned outage schedules identify the number of days required for inspections and maintenance activities to ensure continued safe, reliable and long-term operation. The planned outage schedule is prepared, for OPG nuclear facilities, in accordance with OPG's aging and life cycle management programs and in for both OPG nuclear facilities and DNNP facilities, compliance with OPG's nuclear operating licenses issued by the CNSC, with consideration for Ontario's electricity grid system demand (i.e., IESO constraints). The planned outage schedule also incorporates "lessons learned" from past OPG outages and operating experience outside of OPG.

Planned outages are complex, involving many OPG divisions and groups working together. Outages require focus, expertise, high levels of coordination, training and includes a level of

detail that exceeds that of many major construction projects (due to nuclear regulatory complexity and constraints in work execution). They require careful preparation and the safe execution of a well-developed plan that accounts for nuclear, radiological, and industrial safety, as well as the efficient achievement of production goals and cost controls. OPG's nuclear facilities typically involve more than twenty thousand work activities (i.e., tasks), involving many different types of resource personnel and hours of labour, sequenced in an optimal order to ensure safe, and effective execution while ensuring the fuel core is cool, controlled and contained at all times. In comparison, DNNP facilities' outage activities and durations are largely based on refueling requirements.

Planned outages consist of a combination of "routine" inspection, maintenance and "non-routine" activities specific to a particular outage. Examples of routine inspections are fuel channel, feeder, steam generator legal requirements and fitness for service to operate to the next planned outage and preventative maintenance. Non-routine activities include corrective and deficient maintenance, and replacements or modifications of the equipment or plant configuration that can only be done when the unit is shut down.

Planned outages must be submitted to and be "time-stamped" by the IESO. In most cases, OPG submits its nuclear outage schedule early in order to secure an early time-stamp date; this date determines the outage's advanced approval priority in the IESO's outage queue. In addition to this advance approval process, all outages must receive final approval from the IESO before they can begin. The IESO can deny approval of a planned outage start at any time up to the beginning of the outage. OPG works with the IESO to proactively address concerns regarding grid demand and planned nuclear outages.

Consistent with prior applications and now utilized also for the DNNP facilities, planned outage durations include a station-level allowance under the control of the site for uncertainty related to discovery work that is based on industry OPEX. Planned outage durations also include nuclear fleet-level allowance days under the control of the Chief Nuclear Officer to address risks to the completion of planned outages due to complexity in fleet level constraints (e.g.,

availability of Advance Inspection and Maintenance resources that service multiple organizations and outages).

3.0 OPG NUCLEAR FACILITIES

The period between the 2027-2031 IR term encompasses significant changes to the OPG nuclear line of business. Refurbishment of all Darlington units is expected to be complete in 2026, with all four units in-service throughout the entire IR term (see Ex. D2-2-1). These generation gains are offset by Pickering, with Units 1 and 4 having ended their commercial operation in 2024, and Units 5-8 being planned to shutdown on September 30, 2026 prior to transitioning into refurbishments (see Ex. D2-3-1). This will temporarily reduce nuclear production as there will be no generation from Pickering until the first Pickering refurbished unit, Unit 5, is planned to return to service in May 2031.

In addition to the major projects, as described in Ex. D2-1-2, this IR term also includes several significant, emergent equipment replacements and rehabilitations required to address reliability risks to Darlington's post-refurbishment operations, and which with impacts to the generation forecast. This includes the Darlington Steam Generator ("SG") Primary Moisture Separators ("PMS") Replacement projects. OPG has taken the opportunity to complete this emergent work where possible in the 2022-2026 IR term. This includes replacing the PMS in two SGs in Unit 3 and the PMS in all four SGs in Unit 1 during refurbishment windows to minimize post-refurbishment outage impacts. Replacements of the PMS in all four SGs on Unit 4 have been installed while the unit is under refurbishment. The PMS replacements on the remaining two SGs in Unit 3 are planned to be undertaken in a 2026 Darlington outage. As a result of this optimization effort, only one outage is needed during the 2027-2031 IR term to replace the PMS for all four SGs in Unit 2. See Ex. D2-1-3, Section 3.1.3 for further discussion on this project.

Concurrently, during the same Unit 2 Darlington PMS replacement outage in 2027, OPG will execute the Darlington Unit 2 Turbine Control and Auxiliary Systems Upgrade project that was deferred from 2025 to support grid reliability and manage resource constraints during concurrent nuclear outages. OPG has reviewed the challenges with regard to parallel

execution of these significant work programs and built a strategy around key evolutions through existing work planning processes, allowing OPG to take one major outage instead of two. See Ex. D2-1-3, Section 3.1.3 for further discussion on this project.

OPG is also planning for Turbine Rotor Replacements for all four Darlington units starting in 2029, with three units' replacements being completed during the IR term in their respective planned outages. Once completed, this is forecasted to result in a planned uprate of 21 MW per unit, which is reflected in the nuclear production plan following each replacement. See Ex. D2-1-3, Section 3.1.3 for further discussion on this project.

Other major work planned includes Darlington Generator Stator Rewinds which were initially determined to be at low risk of requiring a rewind on Units 1 and 2 based on inspections performed prior to refurbishment. However, during a Unit 1 regular planned outage prior to refurbishment and in the refurbishment outage for Unit 2, scheduled inspections determined that there was increased degradation associated with generator stator winding conditions. As part of refurbishment, OPG conducted full/partial replacements of the stator winding wedges as a remedial action. While these less involved interventions were successful in enabling their return-to-service and mitigating near-term degradation, further assessments since have indicated signs of insulation degradation that cannot be managed by continued adjustments. As a result, OPG has determined that the Generator Stators in Unit 1 and Unit 2 will require an in-situ rewind in their respective planned outages in 2028 and 2030 respectively.

Another major non-routine work being planned at Darlington is Steam Generator ("SG") chemical clean on all four units. Based on build-up of boiler deposits in the SGs, a chemical clean is required continue to operate the SGs safely and reliably, maintaining the design and licensing bases. This commitment forms part of OPG's SG Life Cycle Management Plan as submitted to the regulator. Execution of SG chemical clean is planned in their respective planned outages for Unit 3 in 2026, Unit 2 in 2027, Unit 1 in 2028, and Unit 4 in 2029.

Major generation highlights of the 2027-2031 Plan (126.2 TWh):

- Reduction of 25.7 TWh compared to 2022-2026 OEB-approved Plan (151.9 TWh) primarily due to Pickering shutdown for Units 1 and 4 and Units 5-8 transition to refurbishment, offset by the return to service of all four Darlington units following their refurbishment.
- Darlington units post-refurbishment reflect improved performance:
  - Overall Darlington outage schedule efficiency efforts, including leveraging Canadian Nuclear Safety Commission ("CNSC") approved 36-months outage intervals and piloting planned outage duration improvements following refurbishment.
  - The 2027-2031 Plan reflects outage optimization efforts OPG undertook during the 2022-2026 IR term upon early return to service of Darlington Units, including extending a planned outage to support PMS replacements in 2026. These efforts have reduced the outages needed in the 2027-2031 Plan to execute the major equipment replacements and rehabilitations work described above.
  - Unit 4 post-refurbishment forecast FLR improvements at 6% and 4% for the first and second years respectively (versus 12% and 6% used in the EB-2020-0290 forecast). OPG has implemented initiatives to improve plant equipment reliability, fuel handling and lessons learned from prior unit refurbishments. An example is the Foreign Object Search and Retrieval program that has been included in Unit 4 refurbishment scope to minimize risk upon returning to service. This was a lesson learned from a Unit 3 outage, where foreign material in boilers resulted in a Boiler Tube Leak forced outage. These initiatives are addressed in Ex. F2-1-1.
  - Expectations of better outage execution performance as a result of outage improvement initiatives. Such initiatives are based on industry best practices to improve the outage planning process, outage tooling, scope of work assessments, and training. As an example, OPG is developing a Rapid Delivery Machine at Darlington, which will improve radiological safety for employees in all instances, as well as reduce durations of fuel channel inspection and vault maintenance campaigns by up to 10 days per outage whenever vault work is critical path. These improvements are incorporated into the generation forecast upon expected completion of the project.
  - Three out of four Darington units will have Turbine Rotor Replacements completed during the IR term, resulting in a net production increase of 0.6 TWh as a result of unit net electrical output rating increasing by 21 MW, which is built into production forecast.

- Reduced equipment-related outages from 30 days to 15 days due to retirement of certain risks following the completion of Darlington Refurbishment Program ("DRP").

- Darlington Vacuum Building Outage (regulatory requirement) is scheduled in 2027, strategically overlapping with the Unit 2 outage to replace PMS and execute the Turbine Control and Auxiliary Systems Upgrade, reducing the overall planned outage days.

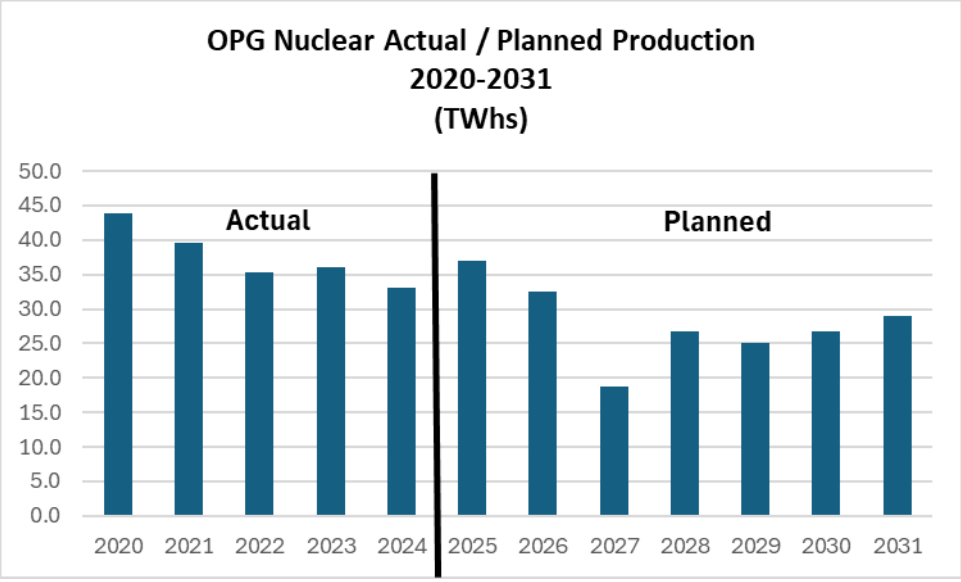
The actual nuclear production for 2020-2024 and the forecast for 2025-2031 are presented in Ex. E2-1-1, Table 1. The monthly nuclear production forecast for 2027-2031 is presented in Ex. E2-1-1, Table 2.

3.0 HISTORICAL RESULTS

In EB-2020-0290, OPG was planning to end commercial operations at Pickering during the 2022-2026 period. In September 2022, the Province of Ontario announced the extension of Pickering Units 5-8 operations from December 2025 to September 2026 ("extension period"). This will lead to approximately 11.4 TWh increase in generation for 2026. As discussed in Ex. H1-1-1, through the Pickering B Variance Account established under O. Reg. 53/05, OPG will record and return net revenues generated during the extension period that are earned from the output of the Pickering Units 5-8 to the ratepayers, subject to the OEB's review in a future application.

Overall, actual and planned nuclear production over the 2020-2031 period declines, with 2027 being the lowest, before rising towards the end of the IR term as shown in Chart 1.

Chart 1



The overall decline in nuclear production over the 2020-2029 period primarily reflects the impact of the DRP (up to 2026) and no Pickering generation starting October 1, 2026, with Units 1 and 4 having permanently shut down in 2024 and Units 5-8 planned to transition to refurbishment. Generation increase in 2030 is the result of one planned outage scheduled at Darlington (versus 2 planned outages in 2029) while 2031 is primarily attributable to Pickering Unit 5 returning to service post-refurbishment in May 2031.

The Planned Outage ("PO") days details over the years 2022-2024 are provided in Chart 2 below and are discussed under Ex. E2-1-2, Section 5.0.

Chart 2 – Planned Outage Durations[1,2]

	2022	2023	2024
Pickering Planned Outage Days (OEB-approved)	487.2	371.1	270.2
Pickering Planned Outage Days (Actuals)	393.8	355.6	283.0
Variance	**93.4**	**15.5**	**-12.8**
Darlington Planned Outage Days (OEB-approved)	73.0	112.2	55.0

Darlington Planned Outage Days (Actuals)	45.1	0.0 *	99.0
Variance	**27.9**	**112.2**	**-44.0**

[1] Includes Unbudgeted Planned Outages days. Excludes Planned Outage days for the Darlington Refurbishment Program.
[2] Does not reflect the EB-2020-0290 settlement adjustment for production forecast.
* Darlington PO deferred from 2023 to 2024

Darlington had fewer PO days compared to plan in 2022-2024 primarily due to not requiring a Unit 3 Post Refurbishment outage in 2023, combined with generation gains from lower number of unbudgeted planned outage days required. However, these generation gains were offset by a higher number of FLR days over those years (see Section 3.4, Chart 4), which are not factored into Chart 2. Pickering outage days show a declining trend as a result of Unit 1 and Unit 4 end of commercial operations. Pickering's 2022 PO days reflected a VBO and four POs. The variance is primarily attributable to one PO completed ahead of schedule and one PO that started later and was completed in early 2023 to mitigate execution overlap challenges of parallel execution of VBO.

Both stations have experienced equipment issues over the historical period, which led to the following unbudgeted planned outages (e.g., Equipment Aging Outage days):

Pickering Unbudgeted:

- Unit 7 unbudgeted PO was taken to address grayloc leak repairs (2022) – 5.9 days.
- Unit 5 unbudgeted PO to repair vault air conditioning units in order to prevent Forced Outage in summer months due to vault temperature limits (2023) – 13.5 days.
- Unit 8 unbudgeted PO to resolve oil ingress into the generator brush gear enclosure (2023) – 15.1 days.
- Unit 1 planned derate with an impact of 6.6 equivalent days lost to perform necessary inspection & maintenance on Fuel Handling equipment to ensure reliability (2023).
- Unit 5 unbudgeted PO to repair vault air conditioning units leaks (2024) – 21.9 days
- Unbudgeted POs (5 events) due to grid constraints or external factors with total impact of 20.6 days.

Darlington Unbudgeted:

- Unit 3 unbudgeted PO to address boiler tube leak (2024) – 7.1 days.
- Unit 2 had unbudgeted PO to address planned MW oscillation repairs during U2 Turbine Trip on Loss of Excitation window (2024) – 5.5 days.

3.1 Production Forecast Assumptions

The 2027-2031 production forecast considers recent historical results including the PO execution performance improvements realized since 2021 and incorporates the following key components:

- **Darlington units in operation post Darlington Refurbishment Program:** With the planned completion of DRP in 2026, the production forecast assumes that all Darlington units will be in operation through the entire IR term.
- **Pickering Shutdown of Units 1 and 4:** Pickering Units 1 and 4 ended commercial operation on October 1, 2024 and December 31, 2024 respectively. The production forecast therefore includes no generation from these units.
- **Pickering Units 5-8 Refurbishment:** The production forecast assumes that Pickering Units 5-8 will be taken offline at the end of September 2026 prior to transitioning into refurbishment in January 2027. The production forecast assumes that Unit 5 will return to service in May 2031 consistent with the Pickering Refurbishment Program's release quality estimate (see Ex. D2-3-1).
- **Pickering Post-Refurbishment Outages:** For Pickering Unit 5 returning to service in May 2031, one post-refurbishment outage has been scheduled to address equipment issues that are expected to emerge. As discussed in EB-2016-0152 and EB-2020-0290 with respect to the DRP, the need for these post-refurbishment outages is based on OPEX from other nuclear facilities that underwent major refurbishment. The need for these at outages at Pickering is underscored by the age of the units pre-refurbishment and the scope and execution complexity of the Pickering Refurbishment Program. The first post-refurbishment outage (55 days) is scheduled within six months following Unit 5 return to service, and is scheduled to be completed within 2031.
- **Pickering Planned Uprate:** The production forecast assumes that post-refurbishment, Unit 5 will return with a higher Maximum Continuous Rating ("MCR") capacity of 572 MW

compared with the current MCR of 540 MW as a result of improved turbine generator technology and thermal efficiency following refurbishment.

- **Planned Outage Cycles:** Maintaining a 36-month outage cycle for Darlington. Most of the PO durations during the IR term are longer than regular POs in order to complete major equipment replacements and rehabilitations to mitigate equipment reliability risks as discussed above. Other than the Unit 5 post-refurbishment outage, there will be no planned outages for Pickering during the rate term.
- **Equipment Risk Outages:** As discussed in Section 2.1 and Section 3.2.1, OPG has continued to observe equipment aging issues at both Pickering and Darlington that require equipment risk outages or unbudgeted planned outages to repair as it is not feasible or economical to proactively mitigate all possible modes of failure. In addition to this, OPG is also planning to undertake a significant amount of complex and significant modifications to replace and rehabilitate major equipment as discussed above, which may require equipment risk outages to address post-installation equipment issues. For these reasons, OPG has planned for equipment risk outages at Darlington to address equipment issues related to, (1) issues currently being tracked (Section 3.2.1 below), and (2) outages that may be required to address post-installation issues.
- **Darlington Vacuum Building Outage ("VBO") in 2027**: As per OPG's Power Reactor Operating Licence, the Darlington VBO has been scheduled for spring of 2027. This includes replacement of key Emergency Coolant Injection valves that can only be replaced during a VBO. OPG has leveraged lessons learned from the last Darlington VBO in 2015, the Pickering VBO in 2022 and industry best practices to refine outage scope and complexity.
- **Darlington FLR**: Darlington's unit post-refurbishment FLR targets are reduced to 6% and 4% for the first and second year respectively for Unit 1 and Unit 4, reflecting operating experience and lessons learned from Units 2 and 3. FLR was previously 12% and 6% in the first two years post-refurbishment. All Darlington units are expected to transition to post-refurbishment normal operations by 2028. The resultant station FLR varies between 2.9% to 2.0% per year (2.2% average) over the IR term, as discussed further in Section 3.3.
- **Pickering Post-Refurbishment**: Consistent with industry OPEX, higher FLR is expected immediately after Units return from refurbishment. The FLR target for Unit 5 is 12% in the

first year; which applies to the approximately 7.5 months following the Unit's return to service in May 2031. The FLR target for this first Pickering unit to undergo refurbishment has been set higher than the FLR target for Darlington Unit 4, which is the 4th unit returning to service.

3.2 Planned Outages

3.2.1 Schedule

The four Darlington Units are on a three year (36-month) planned outage cycle, which means that either one or two regular single unit planned outages occur each year for routine inspection and maintenance over the IR term. With Unit 4 expected to return to service in 2026, Darlington units are effectively reinstated to three-year (36-month) PO cycle interval over the entire IR term.

As noted above in Section 3.2 relating to equipment risk outages, while each station has an extensive preventive maintenance program that is realized through online or planned outage repairs, it is not feasible or economical to proactively mitigate all possible modes of failure. Unless there are safety concerns or regulatory limits requiring immediate action, OPG will take an equipment risk outage at an appropriate time to repair components that fail. As discussed in Section 2.1, OPG has undertaken unbudgeted planned outages and experienced forced outages due to the equipment issues at the Darlington and Pickering facilities. Such instances highlight the various equipment-related risks that OPG monitors under its Risk Management Program. In addition, as a result of the major equipment replacements and rehabilitation work during the IR term, there are risks associated with the performance of new equipment installations. Accordingly, OPG's outage plan for the IR term includes a 15-day equipment risk outage each year to address potential issues at Darlington. These outages are expected to be taken in response to specific active risks that OPG is currently tracking under the Risk Management Program or to address any issues associated with major equipment being placed in-service, namely:

- Darlington boiler tube leak
- Darlington low pressure service water system degradation
- Darlington fuel handling reliability issues

- Darlington MW oscillation repairs (experienced in 2024, as discussed above)
- Emergent post-installation equipment issues for major, complex and non-routine work, including SG PMS replacements, SG rewinds, Turbine Rotor Replacements, Turbine Control and Auxiliary Upgrade and non-routine steam generator cleanings.

The completion of the DRP has retired some aging-related risks. This has enabled a reduction in the expected equipment-risk related planned outages from 30-days duration during the 2022-2026 rate term to 15 days in this IR term as OPG continues to monitor active equipment issues at Darlington that were not addressed during refurbishment.

3.2.2 Vacuum Building Outage

The VBO is planned at a twelve-year frequency as approved by CNSC in Darlington's Power Reactor Operating Licence. The last VBO at Darlington was in 2015. As a result, OPG is required to conduct a VBO in 2027 which will result in all four-units being taken offline for nuclear safety purposes. OPG has scheduled the VBO during the extended Unit 2 outage in 2027, resulting in only incrementally taking three units offline.

In planning for the VBO, OPG has reviewed lessons learned and benchmarked other utilities. In addition, OPG is utilizing innovative technology and drones to perform some of the vacuum building inspection work and planning to initiate projects that would provide opportunities in future VBO's.[1] OPG's generation forecast reflects a planned duration of 45.9 days to execute the VBO. Any further scoping opportunities would require CNSC approval.[2] OPG will update its application should there be any material change related to the VBO duration.

There is no VBO scheduled for Pickering during the IR term.

[1] See Project #84552 Darlington VBO Power Operated Valves Replacement Project in Ex. D2-1-3, Section 3.1.1.
[2] Subsequent to the establishment of the generation plan underpinning the 2025-2031 business plan, OPG has received CNSC approval for a one-day reduction to the VBO outage duration per unit (3 days total).

3.3 Forced Loss Rate

Forced production losses (i.e., unplanned outages and derates) are a source of variance to planned generation. OPG forecasts FLR targets that reflect the risk of forced production losses at Darlington and Pickering. The FLR targets are based on the plants' historical performance, any known improvements or component condition issues, initiatives to improve equipment reliability, and with consideration of post-refurbishment risks.

Pickering's FLR performance is set out in Chart 3 below:

Chart 3 – Pickering Forced Loss Rate

	2020	2021	2022	2023	2024	Avg.	10-Year Avg.
FLR- Actual (%)	2.7	6.2	1.8	2.8	2.6	**3.2**	**4.17**
OEB-Approved (%) [1]	5.0	5.0	3.5	3.5	3.5	**4.1**	**4.89**

[1] EB-2020-0290, Ex. E2-1-2, Table 1

Pickering's FLR performance has averaged 3.2% over the 2020-2024 period compared to an OEB-approved target of 4.1%. The Pickering FLR target remains at 3.5% until September 30, 2026, considering some equipment challenges that may emerge in the final years of operation prior to Units being taken offline for refurbishment. Considering operating experience from other nuclear fleets and industry, Pickering's Unit 5 FLR is set at 12% for the first-year post-refurbishment.

Darlington's FLR performance is set out in Chart 4 below:

Chart 4 – Darlington Forced Loss Rate

	2020	2021	2022	2023	2024	Avg.	10-Year Avg.
FLR-Actual (%)	1.5	3.5	7.5	1.4	12.1	**5.2**	**3.85**
OEB-Approved (%)[1]	4.2	3.0	2.1	1.2	6.0	**3.3**	**2.07**

[1] EB-2020-0290, Ex. E2-1-2, Table 1

Darlington's FLR performance has averaged 5.2% over the 2020-2024 period compared to an OEB-approved target of 3.3%. The high FLR in 2022 and 2024 was primarily attributable to a forced outages on Unit 2 (Turbine Stop Valve) and Unit 3 (Boiler Tube Leak) respectively.

With operating experience from Units 2 and 3 and leveraging lessons learned that have since been applied to subsequent units, Units 1 and 4 FLR targets were reduced to 6% and 4% for first and second year respectively post-refurbishment.

Notwithstanding the recent FLR performance at Darlington, and the need to execute major replacement and rehabilitation projects in support of post-refurbishment operations during the IR term, Darlington continues to target an improved FLR performance, set at 2.0% FLR over the 2028-2031 period once Units 1 and 4 enter their third year of post-refurbishment operations.

3.4 DNNP FACILITIES

The first of four DNNP facilities' units is planned to be commercially available and generating starting in October 2030. The 2027-2031 DNNP facilities' production forecast incorporates the following key components and assumptions:

- **DNNP Facilities Unit 1:** The production forecast includes 2.4 TWh generation from the first unit, which is planned to enter commercial operation in October 2030. Unit 1 is the only DNNP facilities unit operating during the IR term, generating for close to 15 months during the IR term. A mechanism has been established under O. Reg. 53/05 to account for any production variances as a result of differences between the actual in-service date and the OEB-approved forecast in-service date. See Ex. H1-1-1 for more information.
- **DNNP Facilities – Unit Rating:** Based on current design information, OPG is planning its generation forecast to include a MCR and net electrical rating of 327 MW and 315 MW respectively (includes 12 MW consumption).
- **DNNP Facilities – FLR:** Based on industry experience and considering the first of a kind nature of the project, the generation plan for the first SMR reflects lower availability with FLR of 12% for first year of operation, before reducing to 6% in the second year.

- **DNNP Facilities – PO Days:** With only one unit planned to be in operation during this IR period, the production forecast includes one 15-day outage to address equipment issues that are expected to emerge within the first six months of operation. In addition, there is a 50-day planned outage after its first year of commercial operations in the fall of 2031. The first outage currently includes initial re-fueling, prescribed inspection and maintenance, as well as potential additional regulatory inspections over first of a kind operations and first time start-up related activities. This outage is based on the available OPEX from industry peers (Tennessee Valley Authority and Boiling Water Reactor Owner's Group data) including OPG's nuclear fleet and extensive input from the original equipment manufacturer. After the initial PO, the SMR units are expected to be on a two year (24-month) PO cycle.

LIST OF ATTACHMENTS

Attachment 1: Glossary of Outage and Generation Performance Terms

ATTACHMENT 1

GLOSSARY OF OUTAGE AND GENERATION PERFORMANCE TERMS

The following evidence is substantially unchanged from that filed in EB-2013-0321.

Consumption Losses: The electrical service energy consumed by a station and used to supply the electrical load for ancillary equipment and related on-site processes.

Derate: A derate is where a unit is delivering a portion but not all of its full electrical power. Derates include:

- **Planned Derate:** A planned reduction in available power generation, scheduled with the IESO at least 28 days in advance.
- **Forced Derate:** An unplanned reduction in available power generation, which can include deratings due to equipment, safety, or environmental reasons.

Forced Extensions to Planned Outages: An extension to a planned outage which is not scheduled with the IESO at least 28 days in advance, and is unavoidable because the unit is not capable of safe operation at the scheduled outage completion time (e.g., an unexpected condition discovered during the scheduled outage which drives critical path).

Forced Loss Rate: Forced Loss Rate is a World Association of Nuclear Operators ("WANO") indicator of performance reliability. Forced Loss Rate is a measure of the percentage of energy generation that a plant is not supplying to the electrical grid during non-planned outage periods, because of forced production losses, i.e., forced outages or unplanned derates. This indicator excludes forced production losses due to high lake water temperatures and forced extensions to planned outages.

Forced Outage: An unplanned electricity system component failure (e.g., immediate, delayed, postponed, startup failure) or other condition that requires the unit be removed completely from service immediately and, per WANO industry performance reporting guidelines, for which OPG did not provide at least 28 days advance notice to the IESO for the start of the outage.

Forced Production Losses: Lost production due to forced outages and forced derates.

Generation Losses: The total generation losses that are outside the control of plant management, equal to the sum of “Consumption Losses” + “Grid Losses” + “Lake Temperature Losses”.

Grid Losses: Generation losses due to a reduction in electrical power generation because the grid is unable to accept the available power (due to a problem outside of the station boundary) or because of demand limitations.

Lake Temperature Losses: High lake water temperature losses due to reduced condenser efficiency resulting in lower generation output.

Life Cycle Management: Life cycle management is the integration of safety management, ageing management and business management decisions, together with economic considerations over the life of a nuclear power plant in order to:

- Maintain an acceptable level of performance including safety.
- Optimize the operation, maintenance and service life of structures, systems, and components.
- Maximize returns on investment over the operational life of the nuclear power plant.
- Take account of strategies for life cycle funding (including decommissioning), fuel management, and waste management.

Maximum Continuous Rating: The design, or demonstrated higher, maximum power of a unit operating continuously (in MWs).

Planned Outage: An outage which has been scheduled with the IESO at least 28 days in advance of the start date. It is subject to final approval by the IESO, the starting time of which could be postponed up to the scheduled hour of shutdown. The schedule must include the planned completion date. The planned outage duration cannot be revised (increased or decreased) after the planned outage has commenced.

Unbudgeted Planned Outage: An emergent outage that was not included in the approved integrated nuclear outage and generation plan that underpins the business plan, but for which OPG had sufficient time to notify the IESO at least 28 days prior to the start date. Although not included in the approved plan, the notice provided allows the outage to be categorized as "planned" for performance reporting purposes as per WANO industry guidelines.

Unit Capability Factor: A standard WANO indicator of performance reliability. Unit capability factor is the percentage of maximum energy generation that a unit is capable of supplying to the electrical grid, limited only by factors within the control of plant management. Unit capability factor is derived as the ratio of generation available from a unit over a specified time period divided by the maximum generation that the unit is able to produce under ambient conditions and at maximum reactor power during the same period. The available generation is reduced by planned and unplanned production losses deemed under station management's control. However, the derivation of available generation is not affected by losses due to events not under station management's control including environmental conditions (e.g., loss of transmission, lake water temperature derates, labour disputes, and potential low demand periods). While these events do impact production, they do not penalize unit capability factor as the units are considered available to produce at these times.

Unit Capability Rate: A standard indicator of performance reliability. Ratio of the available energy generation over a given time period to the reference energy generation over the same time period but not counting planned energy losses in the denominator. Unit Capability Rate, like UCF, is expressed as a percentage.

Numbers may not add due to rounding.

Table 1
Production Trend - Combined Nuclear (TWh)

Line No.	Prescribed Facility	2020 Actual	2021 Actual	2022 Actual	2023 Actual	2024 Actual	2025 Budget	2026 Budget	2027 Plan	2028 Plan	2029 Plan	2030 Plan	2031 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	OPG Nuclear Facilities												
1	**Darlington NGS**	23.4	18.5	13.9	14.6	11.7	21.1	21.1	18.7	26.7	25.1	26.8	27.1
2	**Pickering NGS**	20.5	21.1	21.4	21.5	21.3	15.8	11.4	0.0	0.0	0.0	0.0	1.9
3	**Total OPG Nuclear Facilities**	43.9	39.6	35.3	36.1	33.0	36.9	32.5	18.7	26.7	25.1	26.8	28.9
4	**DNNP Facilities**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9
5	**Total**	43.9	39.6	35.3	36.1	33.0	36.9	32.5	18.7	26.7	25.1	27.3	30.9

Numbers may not add due to rounding.

Table 2
Monthly Production - Combined Nuclear (TWh)
IR Term

Line No.	Prescribed Facility	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
	2027 Plan:													
	OPG Nuclear Facilities													
1	**Darlington NGS**	2.0	1.7	1.9	0.6	0.2	1.7	1.8	1.8	1.7	1.9	1.8	1.6	18.7
2	**Pickering NGS**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	**OPG Nuclear Facilities Subtotal**	2.0	1.7	1.9	0.6	0.2	1.7	1.8	1.8	1.7	1.9	1.8	1.6	18.7
4	**DNNP Facilities**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	**Total**	2.0	1.7	1.9	0.6	0.2	1.7	1.8	1.8	1.7	1.9	1.8	1.6	18.7
	2028 Plan:													
	OPG Nuclear Facilities													
6	**Darlington NGS**	2.0	1.8	1.9	1.8	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.2	26.7
7	**Pickering NGS**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	**OPG Nuclear Facilities Subtotal**	2.0	1.8	1.9	1.8	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.2	26.7
9	**DNNP Facilities**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	**Total**	2.0	1.8	1.9	1.8	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.2	26.7
	2029 Plan:													
	OPG Nuclear Facilities													
11	**Darlington NGS**	2.2	1.7	1.9	2.5	2.5	2.4	2.4	2.3	1.8	1.9	1.8	1.6	25.1
12	**Pickering NGS**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	**OPG Nuclear Facilities Subtotal**	2.2	1.7	1.9	2.5	2.5	2.4	2.4	2.3	1.8	1.9	1.8	1.6	25.1
14	**DNNP Facilities**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	**Total**	2.2	1.7	1.9	2.5	2.5	2.4	2.4	2.3	1.8	1.9	1.8	1.6	25.1
	2030 Plan:													
	OPG Nuclear Facilities													
16	**Darlington NGS**	2.6	2.3	2.6	2.5	2.6	2.4	2.5	2.3	1.8	1.9	1.8	1.7	26.8
17	**Pickering NGS**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	**OPG Nuclear Facilities Subtotal**	2.6	2.3	2.6	2.5	2.6	2.4	2.5	2.3	1.8	1.9	1.8	1.7	26.8
19	**DNNP Facilities**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.5
20	**Total**	2.6	2.3	2.6	2.5	2.6	2.4	2.5	2.3	1.8	2.0	2.0	1.9	27.3
	2031 Plan:													
	OPG Nuclear Facilities													
21	**Darlington NGS**	2.6	2.2	1.9	1.9	1.9	1.8	2.5	2.5	2.4	2.6	2.5	2.3	27.1
22	**Pickering NGS**	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.3	0.3	0.3	(0.0)	0.1	1.9
23	**OPG Nuclear Facilities Subtotal**	2.6	2.2	1.9	1.9	2.1	2.2	2.8	2.8	2.7	2.9	2.5	2.3	28.9
24	**DNNP Facilities**	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.1	(0.0)	0.2	1.9
25	**Total**	2.8	2.4	2.1	2.0	2.3	2.4	3.0	3.0	2.9	3.0	2.5	2.5	30.9