

NUCLEAR FUEL COSTS

1.0 PURPOSE

This evidence presents: (i) the nuclear fuel costs for OPG's facilities, which are included in OPG's proposed nuclear revenue requirements and (ii) the nuclear fuel costs for the Darlington New Nuclear Program ("DNNP") facilities, which form part of the nuclear fuel service fee expected to be charged by OPG as the owner of such fuel to DNNP LP and which is included in the DNNP LP's proposed nuclear revenue requirements; including the key cost drivers and assumptions for both of these costs over the IR term.

OPG's nuclear fuel costs for its facilities are discussed in Sections 2.0 to 4.0, and the DNNP facilities' fuel costs and nuclear fuel service fees are discussed in Sections 5.0 and 6.0.

2.0 OVERVIEW – OPG NUCLEAR FACILITIES

The Application is requesting approval of OPG nuclear facilities' fuel costs of \$150.9M in 2027, \$221.7M in 2028, \$223.6M in 2029, \$261.2M in 2030, and \$306.1M in 2031. Nuclear fuel costs for 2027-2031 are provided in Ex. F2-5-1, Table 1a. The evidence also presents OPG nuclear facilities' fuel costs for 2020-2024 (actual) and 2025-2026 (budget).

As in prior applications, OPG's nuclear facilities' fuel costs consist of the following:

1. The weighted average cost of manufactured uranium fuel bundles loaded into a Canadian Deuterium Uranium ("CANDU") reactor (also referred to as nuclear fuel bundle consumption cost),
2. Used fuel variable storage and disposal costs, which are discussed in Ex. C2-1-1, and
3. Fuel oil used to run standby generators at OPG's nuclear facilities.

With respect to the uranium fuel bundle component, the CANDU nuclear fuel bundle costs are forecast at \$121.2M in 2027, \$181.6M in 2028, \$183.9M in 2029, \$209.3M in 2030, and \$250.2M in 2031. The remainder of this exhibit focuses on the CANDU nuclear fuel bundle costs. The nuclear fuel bundle costs have increased since EB-2020-0290, impacted by a

1 change in trends since that proceeding including the global demand for nuclear power and
 2 nuclear fuel, geopolitical landscape, and supply-demand uncertainty in the uranium market.

3
 4 The aggregate nuclear fuel bundle consumption cost for OPG's CANDU nuclear facilities is
 5 forecasted to increase by \$127.5M for the period of 2027-2031 compared to the previous five-
 6 year period comprised of 2022-2024 (actual) and 2025-2026 (budget). This increase primarily
 7 reflects changes in the individual component costs that make up the cost of a fuel bundle
 8 (including uranium concentrate, uranium conversion, and fuel bundle manufacturing) reflecting
 9 experienced and forecast price increases, partially offset by the impact of lower expected
 10 energy production from OPG's nuclear facilities on fuel usage. The attribution of the above
 11 variance is summarized in Chart 1 below:

12
 13 **Chart 1 – Attribution of Aggregate CANDU Nuclear Fuel Bundle**
 14 **Consumption Cost Variance: 2027-2031 to 2022-2026¹**

Comparison Periods	Amount in CAD (\$M)
IR Term (2027-2031) Cost	946.1
2022-2024 Actual and 2025-2026 Budget Cost	818.5
Net Variance	127.7
Attribution Factor² of Net Variance:	
Uranium Concentrate, Conversion Services, and Nuclear Fuel Bundle Manufacturing Costs	390.4
Energy Production (together with Fuel Utilization Efficiency ³)	(262.7)
Net Variance	127.

¹ Numbers may not add due to rounding.

² Attribution values are statements of equivalent impacts on fuel expense if only one attribution factor is altered, for example holding uranium, conversion and manufacturing costs (i.e., unit value of fuel bundle inventory) and station fuel efficiency/mix constant while comparing only the difference in energy production between periods of comparison.

³ Fuel utilization efficiency is measured as the electricity energy generation (MWhe) / fuel consumption (KgU).

1 **Uranium Concentrate, Conversion Services, and Nuclear Fuel Bundle Manufacturing**

2 **Costs:** OPG's average price of manufactured nuclear fuel bundles loaded into a CANDU
3 reactor has increased since EB-2020-0290 and this trend is expected to continue over the IR
4 term. A key driver of this increase has been and continues to be the market price of uranium
5 concentrate. OPG's forecast of the continuing nuclear fuel bundle cost increases is based in
6 part on the proprietary forward uranium price curves purchased from UxC, LLC, and the
7 forecasted cost of uranium conversion services and fuel bundle manufacturing. Chart 4 (in
8 Section 4.2.2 below) shows the historical spot market price of uranium concentrate for the
9 years 2021-2025, where the price has increased by approximately 150% since 2021. Taking
10 into account this trend, the Application expects the following increases in the acquisition costs
11 for the supply chain components of OPG's nuclear fuel bundles between 2025-2031: a 48%
12 increase for uranium concentrate, a 12% increase for uranium conversion, and a 33% increase
13 for fuel bundle manufacturing.

14
15 Taking into account the experienced and forecasted increases in the acquisition costs for the
16 nuclear fuel supply chain components, Ex. B1-1-1, Chart 2 shows the actual and forecasted
17 average unit costs of the components comprising nuclear fuel inventory.⁴ That chart shows the
18 average cost of the nuclear fuel bundle increasing from \$235/KgU in 2020 to over \$360/KgU
19 in 2026, and then to over \$500/KgU by the end of the IR term, more than doubling over a
20 decade-plus period. Reflecting a similar trend, the nuclear fuel bundle consumption cost per
21 megawatt-hour ("MWh") is projected to increase from over \$4/MWh in 2020 to close to \$6/MWh
22 in 2026 and then to over \$8.60MWh by the end of the IR term (Ex. F2-5-1, Table 1a, line 4).
23 There is no deferral or variance account in place for changes in the costs of nuclear fuel, with
24 OPG carrying the associated risk once payment amounts are set for an IR term.⁵

25 Overall, the escalation in pricing has an attribution effect of increasing the cost of nuclear fuel
26 bundle consumption in the IR term by an equivalent of \$390.4 million for the Pickering and
27 Darlington stations combined, compared to the 2022-2026 period (actual and budget).

⁴ The average cost of an inventory differs from the acquisition cost in that the latter represents the cost of purchasing an incremental quantity of stock while the former averages the cost of previously purchased stock with the cost of the incremental purchase.

⁵ In EB-2010-0008, the OEB terminated OPG's nuclear fuel cost variance account that had been established in EB-2007-0905.

1 **Energy Production and Fuel Utilization Efficiency:** Nuclear fuel cost is impacted by
2 variations in generation which drive fuel usage. A key driver over the IR term is significantly
3 reduced generation due to Pickering Units 5-8 being offline for refurbishment for most of the
4 period. Overall, the IR term forecast has 47.5 TWh less planned production compared to the
5 previous five-year period comprised of 2022-2024 (actual) and 2025-2026 (budget). The
6 change in production (together with fuel utilization efficiency) has an attribution effect of
7 lowering the cost of nuclear fuel bundle consumption by an equivalent \$262.7M for the
8 Pickering and Darlington stations combined. The details of the generation forecast for OPG's
9 nuclear facilities can be found in Ex. E2-1-1.

10
11 **New Fuel:** The nuclear fuel procurement plan and the forecasted nuclear fuel bundle
12 consumption cost reflect the effects of a one-time quantity of fuel that will be required for the
13 preloading of a unit reactor core for each of Pickering Units 5-8 in preparation for their return
14 to service. These procurements will be held as inventory until physically loaded into the
15 reactors near the end of the respective unit's refurbishment. As in prior applications, the
16 inventory cost loaded into the reactor core is capitalized at a rate of 50%, with the remaining
17 50% expensed over the first three months of operation following a unit being returned to
18 commercial service. This is consistent with the concept that half of the fuel in the fuel channels
19 will be unused at the end of the station life. Capitalized fuel cost is depreciated over the
20 station's remaining service life. Based on the Pickering Refurbishment Program ("PRP")
21 working schedule, Unit 5 and Unit 6 new fuel is forecast to be loaded in 2030 and 2031,
22 respectively. Unit 5 and Unit 6 require initial fuel reloads estimated at \$47.4M and \$49.8M,
23 respectively, of which approximately \$23.7M (2030) and \$24.9M (2031) will be capitalized and
24 depreciated per above (Ex. D2-1-2, Table 2, line 20). This treatment is consistent with that of
25 the new fuel similarly preloaded into Darlington reactors as they have been returning to service
26 from refurbishment, as discussed in EB-2020-0290.⁶

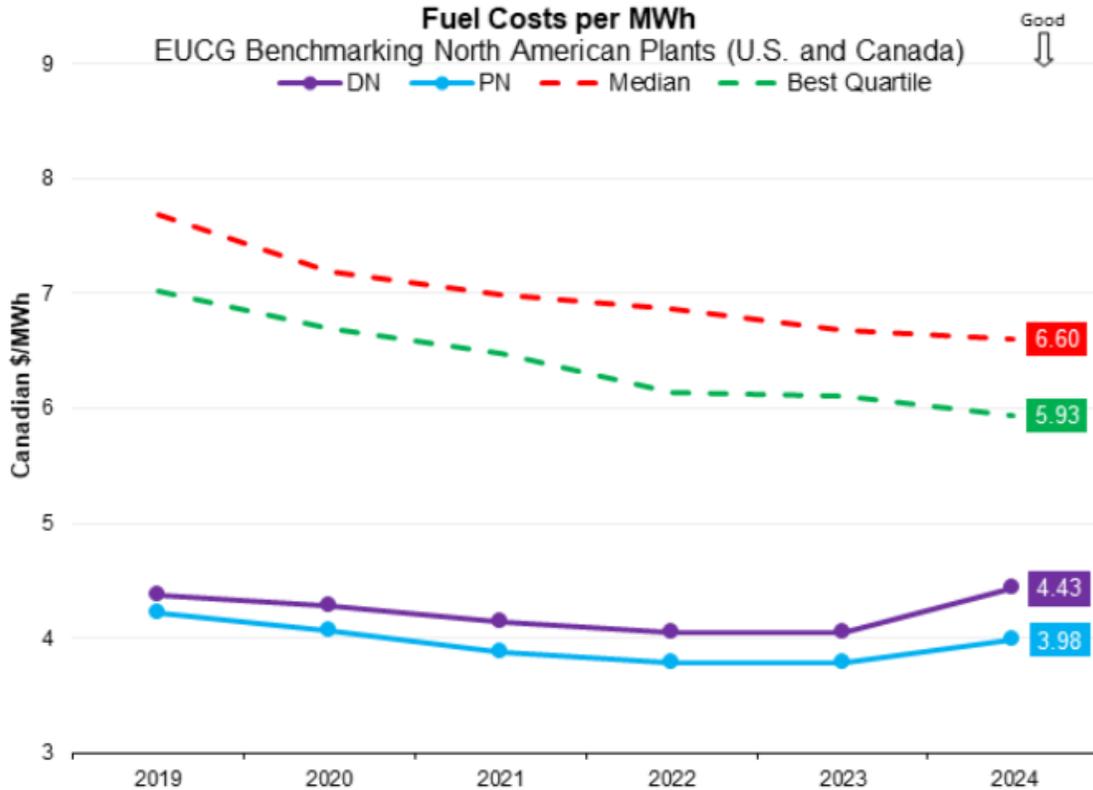
27
28 OPG nuclear facilities' nuclear fuel cost variances over the period 2020-2031 are provided in
29 Ex. F2-5-2.

⁶ The capitalized portion of Darlington New Fuel cost incurred over the 2020-2026 period is shown at Ex. D2-1-2, Table 2, line 19.

1 **3.0 BENCHMARKING OF CANDU NUCLEAR FUEL COSTS**

2 Darlington and Pickering continue to rank among the top North American Electric Utility Cost
 3 Group (“EUCG”) plants in terms of fuel costs mainly due to the use of natural uranium by
 4 CANDU reactors. The trends in OPG’s fuel bundle costs are also consistent with other North
 5 American nuclear operators, based on EUCG data (which includes CANDU, Pressurize Water
 6 Reactors and Boiling Water Reactors), as discussed in the 2024 Benchmarking Report (Ex.
 7 F2-1-1, Attachment 2, p. 40) and reproduced in Chart 2 below.

8 **Chart 2 – Fuel Costs per MWh (2024 Benchmark Report)**



9
 10

11 **4.0 CANDU NUCLEAR FUEL SUPPLY**

12 This section discusses OPG’s nuclear fuel procurement methodology, which is substantially
 13 similar to the evidence filed in EB-2020-0290 with respect to CANDU nuclear fuel, subject to
 14 certain changes described below.

1 **4.1 Overview**

2 OPG's nuclear fuel supply strategies and procurement plans are reviewed and approved by
3 OPG's senior management, including consideration of nuclear fuel quality, because the supply
4 and quality of nuclear fuel are extremely important factors in maintaining nuclear safety and
5 ensuring reliable energy production.

6
7 To ensure high quality nuclear fuel supplies, OPG requires its CANDU fuel bundle
8 manufacturer to maintain a quality program which conforms to a rigorous Canadian quality
9 standard (CSA N299.1-2016). This ensures that all phases, including design, procurement,
10 manufacturing and inspection, are appropriately controlled. OPG performs surveillance of all
11 manufacturing processes to monitor conformance to design requirements and verify
12 conformance to OPG's quality standard requirements. Any potential vulnerabilities in the
13 supply chain need to be carefully managed as only two contractors have been qualified by
14 OPG and licensed by the Canadian Nuclear Safety Commission to manufacture the fuel bundle
15 designs required by OPG's CANDU units.

16
17 The OPG nuclear fuel supply objectives are to:

- 18 • Ensure security of supply: OPG must minimize the risk of its reactors being shut down due
19 to lack of fuel bundles, including the risk that any step in the supply chain is substantially
20 delayed due to a lack of materials from an earlier step.
- 21 • Minimize cost: OPG seeks to obtain its fuel supply at the lowest cost, consistent with its
22 fuel quality requirements.

23
24 OPG's CANDU nuclear fuel procurement supply chain is made up of the following three stages:

- 25 • The purchase of uranium concentrates;
- 26 • The purchase of services for the conversion of uranium concentrate to natural uranium
27 dioxide pellets; and
- 28 • The purchase of services for the manufacture of nuclear fuel bundles containing natural
29 uranium dioxide pellets.

1 OPG's fuel procurement planning begins with a 15-year⁷ forecast of the required number of
2 manufactured fuel bundles to be loaded into its CANDU reactors. This forecast includes the
3 approved nuclear generation plan (Ex. E2-1-1) and determines the forecast of fuel bundles
4 required for fueling, adjusted by forecasts of fuel burn-up and reactor thermal efficiency rates.
5 From this forecast and considering existing inventories, OPG determines its need for
6 purchasing additional manufactured fuel bundles. This in turn determines the need for uranium
7 dioxide conversion services and the need to procure and deliver new supplies of uranium
8 concentrates.

9
10 For CANDU fuel, OPG purchases each of the uranium concentrates ("U₃O₈"), and natural
11 uranium dioxide ("UO₂") and fuel bundle fabrication components separately and maintains
12 ownership of the uranium at each stage of the nuclear fuel supply chain. OPG therefore
13 arranges each stage to protect itself from possible supply disruptions.

14
15 OPG plans to maintain a target level of 12-month operational supply of CANDU fuel bundles
16 to allow continued fueling in the event of a disruption in the supply of fuel bundles or uranium
17 conversion due to production issues, labour unrest, or other factors. As seen in Ex. B1-1-1,
18 Chart 2, the year-end inventory of fuel bundles is forecast to temporarily decline in 2025 and
19 2026, reflecting the transition of Pickering Units 5-8 to refurbishment. The increase in year-end
20 fuel bundle inventory between 2026- 2030 is explained by two factors: (1) increased planned
21 production from Darlington beginning in 2028 following the return to service of Darlington Unit
22 4 in 2026, an extended outage on Darlington Unit 3 in 2026, and an extended outage on
23 Darlington Unit 2 in 2027, with all four Darlington units in regular operation in 2028, and (2)
24 procurement of core reload quantities for Pickering Units 5 and 6 carried as inventory prior to
25 reactor core loading.

26
27 For CANDU fuel, a three-month supply of work-in-process uranium dioxide is targeted to feed
28 the fuel bundle manufacturing process. Additionally, the uranium conversion supplier currently

⁷ Since EB-2020-0290, OPG has increased the fuel procurement planning timeframe from five years to 15 years, due in part to market drivers such as increasing nuclear power demand, and supply and demand dynamics expected in the global uranium market. Refer to Section 4.2 regarding changes to physical and financial risk limits in 2024 for further discussion of this change.

1 guarantees six months of “safety stock”. By the end of 2032, OPG is targeting to instead hold
2 a similar level of its own “safety stock” inventory of uranium dioxide to protect against supply
3 disruption at the uranium converter and ensure continuous flow of uranium dioxide to the fuel
4 fabricator.

5
6 In recent years, OPG has utilized a minimum uranium concentrate inventory target of 288,000
7 KgU, representing between a four to six-month supply to feed the production of uranium
8 dioxide. Due to the permanent shutdown of Pickering Units 1 and 4 in 2024 and Pickering Units
9 5-8 coming offline for refurbishment beginning in late 2026, this minimum target has been
10 adjusted downwards to 227,000 KgU beginning in 2027 and will be gradually adjusted upwards
11 as Darlington production reaches more steady levels in 2028 and Pickering Units 5-8 prepare
12 for return to service. In 2031, the minimum target inventory level is 258,000 KgU, which
13 considers the need to maintain sufficient quantities of all components of the fuel inventory to
14 accommodate the new fuel needed for each reactor prior to the restart of Pickering Units 5-8.

15
16 CANDU nuclear fuel inventories are set out in Ex. B1-1-1, Section 3.2.3.

17 18 **4.2 Uranium Concentrate Procurement**

19 **4.2.1 Objectives**

20 The primary objectives of OPG’s CANDU uranium concentrate procurement program are to
21 ensure an adequate and secure supply of uranium is available to meet the operational
22 requirements of OPG’s nuclear units, while minimizing the price, market, and credit risks
23 associated with this supply. In addition, OPG also must ensure quality standards are met.

24
25 As in EB-2020-0290, the procurement program has the following requirements:

- 26 • **Purchase within pre-established physical coverage limits.** OPG’s contracted
27 coverage aligns with the physical coverage limits. These limits are derived by analyzing
28 OPG’s forecasted uranium requirements, reviewing global supply and demand trends,
29 and benchmarking against industry practices observed among major nuclear utilities in
30 Europe and the United States. The derivation process includes assessing factors such
31 as market outlook, supply security, inventory strategy, and contract lead times.

1 Physical coverage limits define the maximum and minimum percentages of future
2 uranium requirements that can be under contract or held in inventory, and the maximum
3 forward contractual delivery period, referred to as coverage years. The minimum limit
4 is set to ensure a reliable supply by requiring that a certain proportion of forecasted
5 consumption requirements be secured in advance; the maximum limit is intended to
6 prevent over-contracting and excess inventory, helping to control storage costs and
7 maintain operational flexibility while allowing OPG to adapt to changing requirements
8 and market conditions. The limits are structured as a declining scale such that higher
9 coverage is required for near-term needs, tapering for later years. The forward
10 coverage years are set at 15 years.

- 11 • **Purchase within pre-established financial coverage limits.** OPG's financial
12 coverage limits specify the maximum and minimum portion of supply to be under fixed-
13 price or base-escalated arrangements,⁸ expressed as a percentage of OPG's
14 aggregate amount under contract. OPG's financial coverage limits are unchanged from
15 EB-2020-0290, with a minimum to maximum range of 45% to 65%.

16
17 OPG's financial coverage limits are determined using a quantitative risk management
18 model that applies efficient frontier analysis to optimize the balance between cost risk
19 and opportunity risk associated with uranium pricing. Cost risk is defined as the risk
20 that fuel expenses increase if market prices rise, while opportunity risk captures the
21 potential cost of locking in fixed prices should market prices subsequently fall. The
22 results of the quantitative analysis, combined with a qualitative review of current
23 inventory, market outlook, and procurement processes, forms the basis for setting the
24 financial coverage limits.

25
26 Financial coverage limits are expressed as a percentage range to provide operational
27 flexibility and allow for participation in both fixed and spot markets. This approach
28 mitigates near-term cost uncertainty, supports a diversity of contract pricing

⁸ Base-escalated arrangements are contracts where the initial price is set and then adjusted over time based on an agreed-upon escalation formula, such as inflation-related indices.

1 mechanisms, and ensures that OPG's procurement strategy remains robust under
2 varying market conditions.

3 • **Maintain, as market conditions dictate, a strategic target inventory of uranium.**

4 This further mitigates the impact of supply disruptions and ensures continuous reactor
5 operations.

- 6 • **Employ competitive and fair procurement practices.** The use of these practices
7 provides value for money. OPG's standard procurement practice is to employ
8 competitive processes where available, using pre-determined evaluation criteria that
9 include quality, security of supply, and costs.

10
11 **4.2.2 Uranium Concentrate Pricing Provisions and Fuel Contracts**

12 OPG periodically purchases uranium concentrate under long-term contracts, short-term spot
13 contracts, or a combination of both. OPG's existing term contracts for the supply of uranium
14 concentrates contain a mix of pricing provisions, as shown in Chart 3 below. Under contracts
15 with market-related pricing terms, quantities are priced at a market price established at or near
16 the time of delivery. Contracts with fixed or indexed pricing include base prices set at the time
17 of contract signing. Base prices in contracts with indexed pricing escalate to the time of delivery
18 by a formula or by published inflation-related indexes (i.e., base-escalated arrangements).
19 Combination, or hybrid contracts, provide for a combination of market-related pricing and
20 fixed/indexed pricing. For spot market purchases, OPG generally enters into contracts priced
21 for delivery within three months of contracting.

1

Chart 3 – Summary of Existing Uranium Contracts⁹

Contract	Contract Award	Date of First Delivery	Delivery Period	Total Quantity (000 kgU)
A	2019 2nd Q	2020	8 years	1,019
B	2020 3rd Q	2021	6 years	846
C	2024 1st Q	2027	6 years	671
D	2023 1st Q	2023	7 years	490
E	2024 1st Q	2024	3 years	298
F	2023 1st Q	2024	6 years	202
G	2024 2nd Q	2028	1 year	73
H	2024 2nd Q	2029	4 years	138
I	2024 1st Q	2026	2 years	119
J	2024 2nd Q	2026	4 years	257
K	2025 1st Q	2026	2 years	136
L	2025 4th Q	2030	11 years	2,923

2

3 Typically, OPG enters the uranium market annually by making purchases under medium-to-
 4 long-term contracts with what have been typical durations of up to eight years. As part of the
 5 adjustment to the physical risk limits in 2024, which extended the coverage period to 15 years,
 6 OPG has added some additional contracted coverage such that the total duration between the
 7 time of contract and the final delivery now aligns with the 15-year coverage period.

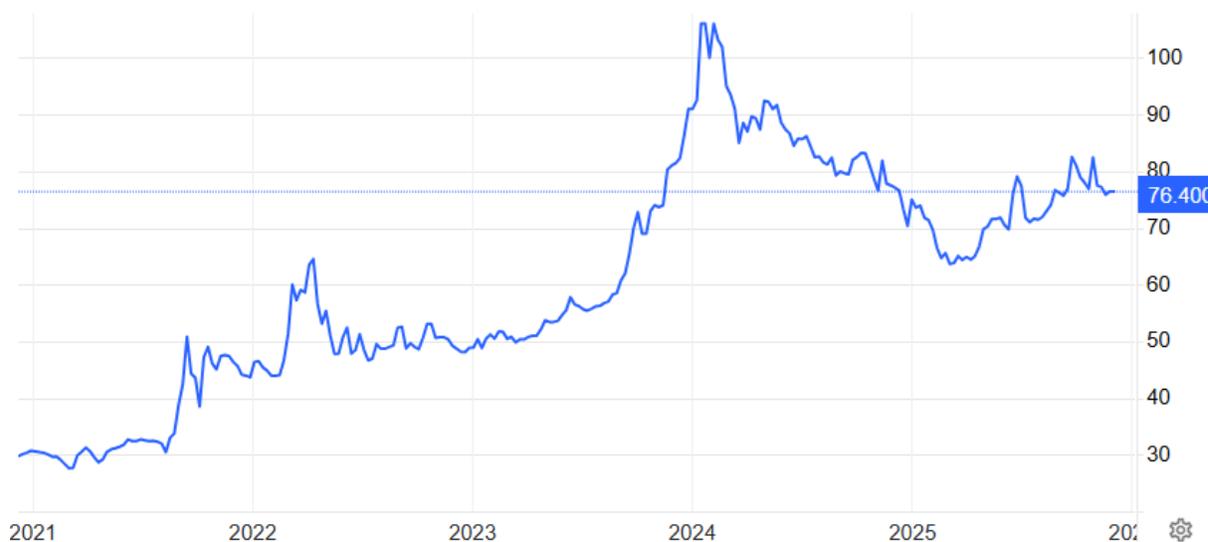
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9 Since 2021, uranium prices have seen notable increases and exhibited relatively high volatility.
 10 Beginning in 2021, the uranium spot price began to increase more rapidly than in the 2017-
 11 2020 period. Following a period of reprieve in 2022, the spot price increased rapidly in 2023,
 12 then peaked and partially retracted in 2024. They have remained at historically elevated levels
 13 during 2025, representing an approximately 150% increase compared to the beginning of
 14 2021.

⁹ Chart 3 lists all existing contracts as of December 3, 2025 that have deliveries within the IR term. Contract L was entered subsequent to the finalization of OPG's 2025-2031 Business Plan and is not reflected in the cost forecasts underpinning this Application.

1 With increased electricity demand from nuclear power globally, demand for uranium is
2 expected to continue to grow during the IR term. There is an elevated likelihood for further and
3 increased uranium price volatility due to a number of factors such as exchange rates, startup
4 of new uranium production, suspension of existing uranium production, the rate of new reactors
5 coming online, plant closures/restarts in countries with reactors (United States, France, Japan,
6 Korea), as well as the role of trade policies and other geopolitical factors. These elements
7 impacting demand, combined with supply risk related to existing mines coming offline and new
8 mines under development being brought to market, create an elevated risk of worldwide supply
9 and demand imbalance that further increases uranium price volatility.

10
11 **Chart 4 – Five-Year Historical Uranium Spot Price (USD¹⁰)**



12
13
14 In forecasting CANDU nuclear fuel bundle costs and inventory balances for the IR term, OPG
15 models its existing contracts using forecasts of cost escalators, foreign exchange rates, and
16 market price indicators. For its uncontracted uranium requirements, OPG relies on a forecast
17 based on information from industry market participants, specifically the annual average of
18 UxC's spot forecast. Given the observed increase in uranium price volatility and the elevated

¹⁰ Trading Economics, Uranium Price Summary, <<https://tradingeconomics.com/commodity/uranium>>

1 risk of continued cost increases during this IR term, OPG has relied on UxC's High-Price
2 Midpoint curve instead of the Mid-Price Midpoint curve used in EB-2020-0290.

3 4 **4.3 Uranium Conversion Services Procurement**

5 To meet fuel quality requirements, OPG's uranium conversion suppliers must conform to CSA
6 Standard N299.2-2016, Quality Assurance Program. This standard ensures that all phases of
7 production, including procurement, manufacturing and inspection, are appropriately controlled.
8 OPG performs audit and surveillance of the conversion supplier and verifies conformance to
9 the quality standard.

10
11 In 2022, OPG negotiated an agreement for uranium conversion services for the period 2022-
12 2032, inclusive. The price charged under this agreement is subject to future adjustments for
13 inflation and is subject to adjustment for cost (or benefit) sharing if actual cost changes go
14 beyond a threshold. Cameco Corporation continues to be the only domestic CANDU provider
15 of uranium conversion services, and it currently supplies both OPG, Bruce Power, and New
16 Brunswick Power.

17 18 **4.4 Manufactured Fuel Bundle Procurement**

19 OPG currently has a supply contract with BWXT Nuclear Energy Canada (one of the two
20 domestic CANDU fuel bundle manufacturers) to supply OPG's requirements to 2031, inclusive
21 of an extension agreement for these services for the 2027-2031 period, executed in late 2025.
22 The base price under this contract is subject to future adjustments for inflation and changes in
23 zirconium costs, a key component in fuel bundles. Recent market trends indicate that zirconium
24 prices have become increasingly volatile, largely driven by evolving global supply and demand
25 dynamics. While cost escalation factors have been incorporated into cost projections, there
26 remains a risk that actual market movements may outpace these assumptions. Although price
27 volatility persists, OPG continues to mitigate supply availability risks through ongoing supplier
28 diversification efforts with BWXT Nuclear Energy Canada Inc.

1 **5.0 OVERVIEW – DNNP FACILITIES NUCLEAR FUEL**

2 The Application is requesting approval of DNNP facilities nuclear fuel service fees of \$9.1M in
3 2027, \$13.8M in 2028, \$12.7M in 2029, \$18.1M in 2030, and \$49.8M in 2031. Nuclear fuel
4 service fees for 2027-2031 are provided in Ex. F2-1-1, Table 1b line 10 and calculated in Ex.
5 F3-3-1, Table 1.

6
7 Under the DNNP LP partnership arrangements, OPG is expected to procure, manage, and
8 maintain ownership of the nuclear fuel for the DNNP facilities, charging DNNP LP a service
9 fee for the costs of the nuclear fuel inventory and its consumption (Ex. A1-4-4). This nuclear
10 fuel service fee is expected to have the following two components:

- 11 • A nuclear fuel consumption cost (and a minimal amount of fuel oil) calculated in a manner
12 consistent with how these costs would be expensed by DNNP LP (i.e., had DNNP LP
13 owned the fuel it consumes), and
- 14 • A tax-adjusted cost of capital charge on the nuclear fuel inventory (and a minimal amount
15 of fuel oil inventory) carried by OPG for use by the DNNP facilities in a manner consistent
16 with how such inventory would be treated if it were included in DNNP LP's rate base (i.e.,
17 had DNNP LP owned the fuel inventory).¹¹

18
19 The nuclear fuel consumption cost (also referred to as nuclear fuel expense) component of the
20 forecast service fee is \$0 in 2027, \$0 in 2028, \$0 in 2029, \$7.2M in 2030, and \$27.8M in 2031,
21 as presented in Ex. F2-5-1, Table 1b. The nuclear fuel inventory balance underpinning the
22 forecast service fees is presented in Ex. B1-1-1, Chart 2. There are no used fuel storage and
23 disposal variable costs included in the Application for the DNNP facilities, for the reasons
24 discussed in Ex. C2-1-1, Section 8.0. All components of the forecast nuclear fuel service fees
25 are for DNNP Unit 1.

26
27 Annual nuclear fuel expense for the DNNP facilities represents the proration of the energy
28 portion of the cost of the fuel assemblies within the reactor, as replaced during each fueling
29 outage. The energy portion is determined based on preliminary multicycle fuel design

¹¹ Nuclear fuel inventory for the DNNP facilities is not included in either OPG or DNNP LP's rate base.

1 estimates provided by OPG's fuel fabricator and may vary with each fueling cycle. The
2 remaining portion of the fuel assembly cost will be capitalized and depreciated over time.

3
4 Based on available DNNP station design data at time of filing, fuel design estimates suggest
5 that 69% of the fuel assembly acquisition cost of the initial core load, forecasted in 2030, and
6 26% of the fuel assembly acquisition cost of the first core reload, forecasted in 2031, will not
7 directly contribute to energy production. The resulting DNNP capitalized fuel amounts are
8 \$78.1M in 2030 and \$25.0M in 2031 (Ex. D2-1-2, Table 2, line 23), which OPG's 2025-2031
9 Business Plan assumes will be depreciated over the useful life of the Small Modular Reactor
10 ("SMR") facility, in line with the established accounting methodology for the CANDU facilities
11 (Section 2.0). Final fuel design data, including the initial core load replacement methodology,
12 may result in changes in the forecast fuel expenses in 2030 and 2031.

13
14 DNNP facilities' nuclear fuel consumption cost variances over the period 2026-2031 are
15 provided in Ex. F2-5-2.

16 17 **6.0 DNNP FACILITIES NUCLEAR FUEL SUPPLY**

18 This section discusses OPG's nuclear fuel supply methodology for the DNNP facilities. OPG
19 has awarded contracts for certain initial fuel cycles and carry-inventories for the DNNP
20 facilities, including contracts for fuel fabrication and technical services, enrichment services,
21 natural uranium hexafluoride supply, uranium hexafluoride conversion services, and uranium
22 concentrates supply. Additional contracts for the supply of nuclear fuel for subsequent refueling
23 cycles will be required.

24 25 **6.1 General**

26 Unlike OPG's CANDU nuclear stations that use natural uranium nuclear fuel, DNNP LP's SMR
27 is a BWRX-300 Boiling Water Reactor design and requires Low-Enriched Uranium¹² nuclear
28 fuel. Accordingly, certain processing steps and suppliers involved in the DNNP facilities
29 nuclear fuel supply chain are different than those of the CANDU nuclear fuel supply chain,
30 requiring the establishment of a different set of supply contracts.

¹² Low-Enriched Uranium is enriched in the isotope U-235 to no greater than 5% by weight.

- 1 The DNNP facilities' nuclear fuel procurement supply chain is made up of the following stages:
- 2 • The purchase of uranium concentrates;
 - 3 • The purchase of services for the conversion of uranium concentrates to natural uranium
 - 4 hexafluoride ("UF₆");
 - 5 • The purchase of services for the enrichment of natural uranium hexafluoride to enriched
 - 6 uranium hexafluoride (or enriched uranium product, "EUP");
 - 7 • Purchase of services for the deconversion of EUP to enriched UO₂; and
 - 8 • The purchase of services for the fabrication of the fuel assemblies.

9

10 In 2023 and 2024, OPG undertook procurements and contract negotiations necessary to

11 establish its first nuclear fuel contracts for the DNNP facilities.

12

13 SMR nuclear fuel inventories are set out in Ex. B1-1-1, Section 3.2.3.

14

15 **6.2 Uranium Concentrate Procurement**

16 OPG will follow its existing uranium procurement program, discussed in Section 4.2 above, to

17 ensure an adequate supply of uranium is available to meet the operational requirements of the

18 DNNP facilities, while minimizing the price, market, and credit risks associated with this supply.

19 This includes the application of physical coverage limits and financial coverage limits,

20 maintaining strategic inventory targets (for UF₆ and EUP, as discussed below), and employing

21 competitive and fair procurement practices. OPG also must ensure quality standards are met.

22

23 OPG will procure uranium concentrates for the DNNP facilities by combining its uranium

24 concentrate requirements for the CANDU units and the SMR units. In approaching the market

25 with this consolidated demand, OPG will seek to leverage these larger volumes for more

26 favourable contractual terms.

27 OPG will establish a separate uranium concentrate account at each of its uranium hexafluoride

28 conversion service providers for the purpose of receiving and holding uranium concentrates to

29 be used exclusively for the production of nuclear fuel for the DNNP facilities. OPG will arrange

30 for the delivery of such uranium concentrates to these providers from its uranium concentrates

31 suppliers.

1 Based on industry benchmarking, carry inventories for the DNNP facilities will be held in the
2 form of both EUP and natural UF₆, rather than in the form of U₃O₈, to provide for protection
3 against supply disruption at either the UF₆ converter or the enricher.¹³
4

5 **6.3 Uranium Hexafluoride Conversion Services Procurement**

6 Uranium hexafluoride providers will provide natural UF₆ meeting the latest revision of the
7 specification American Society for Testing and Materials Standard Specification for Uranium
8 Hexafluoride Enrichment (currently C-787-20).
9

10 Between 2023-2025, pursuant to an invitational competitive procurement process, OPG
11 entered contracts with two uranium hexafluoride conversion services suppliers (Cameco
12 Corporation and Orano USA, LLC) for the provision of natural UF₆ (including the costs of both
13 the contained U₃O₈ and UF₆ conversion services) for initial core and certain subsequent fuel
14 requirements, including carry inventory, for DNNP Unit 1.
15

16 Supply of additional UF₆ conversion services requirements beyond the scope provided in the
17 above natural UF₆ supply contracts is arranged through a long-term UF₆ conversion services
18 contract with Cameco for future uncovered requirements of the DNNP facilities.
19

20 Based on an industry benchmarking consultation completed, OPG seeks to maintain a carry
21 inventory equivalent to approximately one half of one forward refueling cycle worth of natural
22 UF₆ per DNNP Unit.
23

24 **6.4 Uranium Enrichment Services Procurement**

25 Uranium hexafluoride enrichment services providers will provide enrichment services
26 producing EUP meeting the latest revision of the specification American Society for Testing
27 and Materials Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ²³⁵U
28 (designated C996).

¹³ While no long-term inventories of U₃O₈ are expected to be carried, short-term inventory levels of U₃O₈ will be required for the purpose of providing feed for the conversion services contracts. For example, the U₃O₈ inventory forecast in 2029 at Ex. B1-1-1, Chart 2 is a year-end carryover for supply of feed material for conversion services in 2030 and is not long-term carry inventory for the DNNP facilities.

1 Between 2023-2025, OPG entered contracts with two uranium hexafluoride enrichment
2 services suppliers (Louisiana Energy Services, LLC and Orano USA, LLC) for the provision of
3 natural UF₆ enrichment services for initial and early fuel requirements, including carry inventory
4 for the DNNP Unit 1. Additional UF₆ enrichment services contracts will be needed to supply
5 those services for future uncovered requirements of the DNNP facilities.

6
7 Based on an industry benchmarking consultation completed, OPG seeks to maintain a carry
8 inventory equivalent to approximately one forward refueling cycle of EUP per DNNP Unit.

9 10 **6.5 Deconversion and Fuel Assemblies Fabrication Services Procurement**

11 While CANDU reactors operate on a continuous online refueling basis, BWRX-300 reactors
12 require refueling outages. For this SMR fuel, OPG works with the fuel designer/fabricator to
13 determine both long-term nuclear material requirements (quantity of natural UF₆ feed and
14 quantity of enrichment services) for the purpose of entering strategic nuclear material
15 contracts, and cycle-specific detailed nuclear material quantities needed to fabricate the fuel
16 assemblies designed specifically for each refueling cycle. To this end, between 2023 and early
17 2025, OPG and its fuel designer/fabricator developed approximate long-term multi-cycle
18 operating plans for the DNNP facilities units.

19
20 In 2024, OPG entered a contract with the SMR fuel assembly fabricator, Global Nuclear Fuel
21 – Americas, LLC, for the provision of deconversion services, fuel assembly fabrication services
22 as well as certain related technical services and products.

23
24 Similarly to the CANDU fuel bundle manufacturer, the SMR fuel assembly manufacturer must
25 maintain a quality program which conforms to a rigorous Canadian quality standard (CSA
26 N299.1-2016).

27
28 DNNP facilities' fuel assemblies will not be held in inventory because each fuel assembly is
29 uniquely designed for the respective outage cycle.

Numbers may not add due to rounding.

Table 1a
OPG Nuclear Facilities Fuel Costs (\$M)

Line No.	Description	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)
	CANDU:												
1	Darlington NGS ¹	98.2	74.0	53.0	63.4	61.8	111.2	127.6	121.2	181.6	183.9	209.3	221.9
2	Pickering NGS ¹	79.9	78.4	80.3	83.9	91.4	80.5	65.4	0.0	0.0	0.0	0.0	28.2
3	Total CANDU Fuel Bundle Cost	178.1	152.4	133.3	147.2	153.2	191.8	193.0	121.2	181.6	183.9	209.3	250.2
4	Total CANDU Fuel Bundle Cost² (\$/MWh)	4.05	3.85	3.78	4.08	4.65	5.08	5.95	6.49	6.80	7.33	7.80	8.64
5	CANDU Used Fuel Storage & Disposal³	55.2	76.7	82.7	66.5	52.7	58.1	41.8	26.8	38.5	38.0	50.2	54.2
6	Fuel Oil	1.5	2.9	6.6	4.7	5.9	5.2	4.4	2.9	1.7	1.7	1.7	1.8
7	Total OPG Nuclear Facilities CANDU Fuel Costs	234.9	232.0	222.5	218.4	211.8	255.1	239.2	150.9	221.7	223.6	261.2	306.1

Notes:

- 1 Includes fuel expense of 50% total refueling cost for each refurbished Darlington and Pickering unit applied during the first three months after return to service.
- 2 Line 3 divided by nuclear production from Ex. E2-1-1 Table 1.
- 3 Used Fuel Storage & Disposal is discussed in Ex. C2-1-1.

Numbers may not add due to rounding.

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 Exhibit F2
 Tab 5
 Schedule 1
 Table 1b

Table 1b
Darlington New Nuclear Program (DNNP) Facilities Fuel Costs (\$M)

Line No.	Description	2026 Budget	2027 Plan	2028 Plan	2029 Plan	2030 Plan	2031 Plan
		(a)	(b)	(c)	(d)	(e)	(f)
	SMR:						
1	Total SMR Fuel Assembly Cost	0.0	0.0	0.0	0.0	7.2	27.8
2	Total SMR Fuel Assembly Cost (\$/MWh)	0.0	0.0	0.0	0.0	14.4	14.4
3	Fuel Oil	0.0	0.0	0.0	0.0	0.0	0.0
4	Total DNNP Facilities SMR Fuel Costs	0.0	0.0	0.0	0.0	7.2	27.8

Notes:

- 1 The energy portion of the fuel acquisition cost for the initial core load in 2030 is projected to be 31% which is prorated over the planned energy production period. The energy portion of the fuel acquisition cost for the first fuel reload outage in 2031 is projected to be 74% which is prorated over the planned energy production period. Refer to Ex. F2-5-1, Section 5.0 for further details.

COMPARISON OF NUCLEAR FUEL COSTS

1.0 PURPOSE

This evidence presents period-over-period comparisons¹ for: (i) the Canadian Deuterium Uranium (“CANDU”) nuclear fuel costs for 2020-2031 for OPG’s nuclear facilities, and (ii) the Low-Enriched Uranium nuclear fuel consumption costs for the Darlington New Nuclear Program (“DNNP”) facilities for 2026-2031, which form part of the forecast nuclear fuel service fee expected to be charged by OPG as the owner of such fuel to DNNP LP. This information is presented in support of the approvals sought in this Application for the nuclear fuel costs for OPG’s nuclear facilities and the nuclear fuel service fees for the DNNP facilities.

The accompanying tables also include used fuel storage and disposal costs and fuel oil costs. Used fuel storage costs are discussed in Ex. C2-1-1. Comparisons for fuel oil are not discussed as the changes are immaterial.

2.0 OVERVIEW

Period-over-period variances are presented in Ex. F2-5-2, Table 1a and 1b for OPG’s nuclear facilities and Table 1c for the DNNP facilities. Refer to Ex. F2-5-1 for a discussion of key drivers associated with the CANDU and DNNP nuclear fuel costs.²

3.0 PERIOD-OVER-PERIOD CHANGES – IR TERM, OPG NUCLEAR FACILITIES

2027 Plan versus 2026 Budget

The nuclear fuel bundle consumption cost decrease of \$71.8M is primarily attributed to -\$83.1M for decreased fuel usage to generate 13.9 TWh less energy and +\$16.6M due to a

¹ Attributions provided for period-over-period changes are statements of equivalent impacts on nuclear fuel expense if only one attribution factor is altered, for example holding uranium, conversion, and manufacturing costs (i.e., unit value of fuel bundle inventory) and station fuel efficiency/mix constant while comparing only the difference in energy production between periods of comparison.

² As discussed in Ex. F2-5-1, year-over-year nuclear fuel costs are impacted by the requirement for a one-time full load of new fuel into the reactor core of refurbished units prior to start-up. One half of the nuclear fuel bundle cost of the new fuel load for each unit is expensed over the first three months of operation after each unit is returned to service, e.g., Pickering Unit 5 in 2031. The nuclear fuel expense figures shown include this impact.

1 higher average unit price of fuel consumed. The decrease in energy production reflects
2 Pickering Units 5-8 coming offline in September 2026 for refurbishment.

3

4 **2028 Plan versus 2027 Plan**

5 The nuclear fuel bundle consumption cost increase of \$60.3M is primarily attributed to +\$51.9M
6 for increased fuel usage to generate 7.9 TWh more energy and +\$13.4M due to a higher
7 average unit price of fuel consumed.

8

9 **2029 Plan versus 2028 Plan**

10 The nuclear fuel bundle consumption cost increase of \$2.3M is primarily attributed to -\$10.5M
11 for decreased fuel usage to generate 1.5 TWh less energy, +\$11.6M due to a higher average
12 unit price of fuel consumed, and +\$1.2M for increased fuel usage due to a lower fuel utilization
13 efficiency³.

14

15 **2030 Plan versus 2029 Plan**

16 The nuclear fuel bundle consumption cost increase of \$25.4M is primarily attributed to +\$13.0M
17 for increased fuel usage to generate 1.8 TWh more energy and +\$15.1M due to a higher
18 average unit price of fuel consumed.

19

20 **2031 Plan versus 2030 Plan**

21 The nuclear fuel bundle consumption cost increase of \$40.9M is primarily attributed to +\$17.9M
22 for increased fuel usage to generate 2.1 TWh more energy, +\$9.3M due to a higher average
23 unit price of fuel consumed, and +\$13.7M for increased fuel usage due to a lower fuel utilization
24 efficiency. There is an impact on fuel utilization efficiency related to the new fuel load for
25 Pickering Unit 5 returning to service in 2031 with an associated fuel cost of \$23.7M to be
26 expensed in 2031.

³ Fuel utilization efficiency is measured as the electricity energy generation (MWhe) / fuel consumption (KgU).

1 **4.0 PERIOD-OVER-PERIOD CHANGES – BRIDGE YEARS, OPG NUCLEAR**
2 **FACILITIES**

3 **2026 Budget versus 2026 OEB-Approved**

4 The nuclear fuel bundle consumption cost increase of \$89.5M is primarily attributed to +\$52.4M
5 for increased fuel usage to generate 10.5 TWh more energy and +\$43.2M due to a higher
6 average unit price of fuel consumed. The increase in energy production reflects the extended
7 operation of Pickering Units 5-8 in 2026, versus OEB-approved forecast of planned shutdown
8 at the end of 2025.

9

10 **2026 Budget versus 2025 Budget**

11 The nuclear fuel bundle consumption cost increase of \$1.2M is primarily attributed to -\$27.1M
12 for decreased fuel usage to generate 4.4 TWh less energy, +\$26.2M due to a higher average
13 unit price of fuel consumed, and +\$2.1M for increased fuel usage due to a lower fuel utilization
14 efficiency.

15

16 **2025 Budget versus 2025 OEB-Approved**

17 The nuclear fuel bundle consumption cost increase of \$51.2M is primarily attributed to +\$32.3M
18 more for increased fuel usage to generate 5.8 TWh more energy, +\$27.5M due to a higher
19 average unit price of fuel consumed, and -\$8.6M for decreased fuel usage due to a higher fuel
20 utilization efficiency. There is an impact on fuel utilization efficiency related to the one-time
21 requirement for a new fuel load for Darlington Unit 1 returned to service in 2024. The OEB-
22 approved plan had forecasted that Unit 1 would be returned to service in year 2025.

23

24 **2025 Budget versus 2024 Actual**

25 The nuclear fuel bundle consumption cost increase of \$38.6M is primarily attributed to +\$21.7M
26 for increased fuel usage to generate 3.9 TWh more energy, +\$23.7M due to a higher average
27 unit price of fuel consumed, and -\$6.8M for decreased fuel usage due to a higher fuel utilization
28 efficiency. There is an impact on fuel utilization efficiency related to the new fuel load for
29 Darlington Unit 1 returning to service in 2024 with an associated partial fuel cost of \$5.9M
30 expensed in 2024 and remainder of \$9.7M expensed in 2025.

1 **5.0 PERIOD-OVER-PERIOD CHANGES – HISTORICAL YEARS, OPG NUCLEAR**
2 **FACILITIES**

3 **2024 Actual versus 2024 OEB-Approved**

4 The nuclear fuel bundle consumption cost increase of \$7.3M is primarily attributed to -\$3.3M
5 for decreased fuel usage to generate 1.1 TWh less energy and +\$9.9M due to a higher average
6 unit price of fuel consumed.

7

8 **2024 Actual versus 2023 Actual**

9 The nuclear fuel bundle consumption cost increase of \$6.0M is primarily attributed to -\$12.4M
10 for decreased fuel usage to generate 3.1 TWh less energy, +\$12.9M due to a higher average
11 unit price of fuel consumed, and +\$5.5M for increased fuel usage due to a lower fuel utilization
12 efficiency. There is an impact on fuel utilization efficiency related to the new fuel load for
13 Darlington Unit 1 returned to service in November 2024 with an associated partial fuel cost of
14 \$5.9M expensed in 2024, and the new fuel load for Darlington Unit 3 returned to service in
15 2023 with an associated fuel cost of \$13.9M expensed in 2023.

16

17 **2023 Actual versus 2023 OEB-Approved**

18 The nuclear fuel bundle consumption cost increase of \$26.1M is primarily attributed to +\$19.5M
19 for increased fuel usage to generate 5.0 TWh more energy, +\$2.3M due to a higher average
20 unit price of fuel consumed, and +\$4.3M for increased fuel usage due to a lower fuel utilization
21 efficiency. There is an impact on fuel utilization efficiency related to the new fuel load for
22 Darlington Unit 3 returned to service in 2023 with an associated fuel cost of \$13.9M expensed
23 in 2023, versus OEB-approved forecast of zero fuel cost to be expensed in 2023. The OEB-
24 approved plan had forecasted that Unit 3 would be returned to service in 2024.

25

26 **2023 Actual versus 2022 Actual**

27 The nuclear fuel bundle consumption cost increase of \$13.9M is primarily attributed to +\$3.1M
28 for increased fuel usage to generate 0.8 TWh more energy, +\$6.8M due to a higher average
29 unit price of fuel consumed, and +\$4.0M for increased fuel usage due to a lower fuel utilization
30 efficiency. There is an impact on fuel utilization efficiency related to the one-time requirement

1 for a new fuel load for Darlington Unit 3 returning to service in 2023 with an associated fuel
2 cost of \$13.9M expensed in 2023.

3

4 **2022 Actual versus 2022 OEB-Approved**

5 The nuclear fuel bundle consumption cost increase of \$7.1M is primarily attributed to +\$7.0M
6 for increased fuel usage to generate 1.7 TWh more energy.

7

8 **2022 Actual versus 2021 Actual**

9 The nuclear fuel bundle consumption cost decrease of \$19.1M is primarily attributed to -
10 \$16.7M for decreased fuel usage to generate 4.3 TWh less energy

11

12 **2021 Actual versus 2021 OEB-Approved**

13 The nuclear fuel bundle consumption cost increase of \$4.0M is primarily attributed to +\$17.8M
14 for increased fuel usage to generate 4.3 TWh more energy, -\$19.5M due to a lower average
15 unit price of fuel consumed, and +\$5.7M for increased fuel usage due to a lower fuel utilization
16 efficiency.

17

18 **2021 Actual versus 2020 Actual**

19 The nuclear fuel bundle consumption cost decrease of \$25.7M is primarily attributed to
20 -\$17.4M for decreased fuel usage to generate 4.3 TWh less energy, and -\$7.7M due to a lower
21 average unit price of fuel consumed.

22

23 **2020 Actual versus 2020 OEB-Approved**

24 The nuclear fuel bundle consumption cost increase of \$14.2M is primarily attributed to +\$28.9M
25 for increased fuel usage to generate 6.6 TWh more energy, -\$9.2M due to a lower average
26 unit price of fuel consumed, and -\$5.5M for decreased fuel usage due to a higher fuel utilization
27 efficiency.

28

29 **6.0 PERIOD-OVER-PERIOD CHANGES – IR TERM, DNNP FACILITIES**

30 **2027 Plan versus 2026 Budget**

31 There are no costs planned during this timeframe.

1 **2028 Plan versus 2027 Plan**

2 There are no costs planned during this timeframe.

3

4 **2029 Plan versus 2028 Plan**

5 There are no costs planned during this timeframe.

6

7 **2030 Plan versus 2029 Plan**

8 The DNNP facilities' fuel consumption cost increase of \$7.2M is attributed to planned
9 generation upon DNNP facilities' Unit 1 entering commercial operation in October 2030.

10

11 **2031 Plan versus 2030 Plan**

12 The DNNP facilities' fuel consumption cost increase of \$20.6M is primarily attributed to
13 increased planned energy production from Unit 1 during its first full year of commercial
14 operation in 2031.

Table 1a
 Comparison of OPG Nuclear Facilities Fuel Costs (\$M)

Line No.	Business Unit	2020 OEB Approved	(c)-(a) Change	2020 Actual	(g)-(c) Change	2021 OEB Approved	(g)-(e) Change	2021 Actual	(k)-(g) Change	2022 OEB Approved	(k)-(i) Change	2022 Actual
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
	CANDU:											
1	Darlington NGS ¹	83.8	14.5	98.2	(24.2)	70.4	3.6	74.0	(21.0)	53.5	(0.5)	53.0
2	Pickering NGS ¹	80.1	(0.2)	79.9	(1.5)	78.0	0.4	78.4	1.9	73.8	6.5	80.3
3	Total CANDU Fuel Bundle Cost	163.9	14.2	178.1	(25.7)	148.4	4.0	152.4	(19.1)	127.3	6.0	133.3
4	Nuclear Fuel Settlement Adjustment*									(1.1)		
	Total CANDU Fuel Bundle Cost	163.9	14.2	178.1	(25.7)	148.4	4.0	152.4	(19.1)	126.2	7.1	133.3
5	Total CANDU Fuel Bundle Cost² (\$/MWh)	4.39	(0.3)	4.05	(0.2)	4.19	(0.3)	3.85	(0.1)	3.83	(0.1)	3.78
6	CANDU Used Fuel Storage & Disposal^{3,4}	43.3	12.0	55.2	21.5	43.9	32.9	76.7	5.9	46.2	36.5	82.7
7	CANDU Fuel Oil	4.6	(3.1)	1.5	1.4	4.7	(1.8)	2.9	3.6	4.8	1.7	6.6
8	Total OPG Nuclear Facilities CANDU Fuel Costs	211.8	23.1	234.9	(2.8)	197.0	35.1	232.0	(9.5)	177.3	45.3	222.5

Line No.	Business Unit	2022 Actual	(e)-(a) Change	2023 OEB Approved	(e)-(c) Change	2023 Actual	(i)-(e) Change	2024 OEB Approved	(i)-(g) Change	2024 Actual	(k)-(i) Change	2025 Budget
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
	CANDU:											
9	Darlington NGS ¹	53.0	10.3	40.3	23.1	63.4	(1.6)	60.1	1.7	61.8	49.4	111.2
10	Pickering NGS ¹	80.3	3.5	81.7	2.2	83.9	7.6	85.7	5.8	91.4	(10.9)	80.5
11	Total CANDU Fuel Bundle Cost	133.3	13.9	122.0	25.2	147.2	6.0	145.8	7.4	153.2	38.6	191.8
12	Nuclear Fuel Settlement Adjustment*			(0.8)				0.1				
13	Total CANDU Fuel Bundle Cost	133.3	13.9	121.1	26.1	147.2	6.0	145.9	7.3	153.2	38.6	191.8
13	Total CANDU Fuel Bundle Cost² (\$/MWh)	3.78	0.3	3.91	0.2	4.08	0.6	4.28	0.4	4.65	0.4	5.08
14	CANDU Used Fuel Storage & Disposal^{3,4}	82.7	(16.1)	55.2	11.3	66.5	(13.8)	58.6	(5.9)	52.7	5.4	58.1
15	CANDU Fuel Oil	6.6	(1.9)	5.0	(0.3)	4.7	1.2	5.1	0.8	5.9	(0.7)	5.2
16	Total OPG Nuclear Facilities CANDU Fuel Costs	222.5	(4.1)	181.3	37.1	218.4	(6.6)	209.5	2.3	211.8	43.3	255.1

Notes:

- Includes fuel expense of 50% total refueling cost for each refurbished Darlington and Pickering unit applied during the first three months after return to service.
- Nuclear fuel bundle costs (2020-2021 OEB approved) reflects 2% downward adjustment per partial settlement as described in EB-2016-0152 Decision and Order, p. 52.
- From Ex. C2-1-1 Table 2, line 2. Used Fuel Storage & Disposal is discussed in Ex. C2-1-1.
- For 2020-2021 OEB approved, adjustments to used fuel storage and disposal variable expenses to reflect actual year-end 2016 asset retirement obligation adjustment and discount rate as reflected in Ex. J21.2 (OEB Decision and Order p. 98).
- Per EB-2020-0290 OEB Decision and Order, Schedule A, p. 26, nuclear fuel bundle costs are reduced by 2% per year and include the flow through impacts of the production forecast adjustments, for 2022-2026 OEB approved.

Table 1b
 Comparison of OPG Nuclear Facilities Fuel Costs (\$M)

Line No.	Business Unit	2025 OEB Approved	(c)-(a) Change	2025 Budget	(g)-(c) Change	2026 OEB Approved	(g)-(e) Change	2026 Budget	(i)-(g) Change	2027 Plan	(k)-(i) Change	2028 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
CANDU:												
1	Darlington NGS ¹	67.6	43.6	111.2	16.3	103.7	23.9	127.6	(6.3)	121.2	60.3	181.6
2	Pickering NGS	71.6	9.0	80.5	(15.1)	0.0	65.4	65.4	(65.4)	0.0	0.0	0.0
3	Total CANDU Fuel Bundle Cost	139.2	52.6	191.8	1.2	103.7	89.4	193.0	(71.8)	121.2	60.3	181.6
4	Nuclear Fuel Settlement Adjustment ³	1.3				(0.2)						
	Total CANDU Fuel Bundle Cost	140.5	51.2	191.8	1.2	103.5	89.5	193.0	(71.8)	121.2	60.3	181.6
5	Total CANDU Fuel Bundle Cost (\$/MWh)	4.61	0.5	5.08	0.9	4.82	1.1	5.95	0.5	6.49	0.3	6.80
6	CANDU Used Fuel Storage & Disposal ²	44.1	14.0	58.1	(16.3)	42.9	(1.1)	41.8	(15.0)	26.8	11.7	38.5
7	CANDU Fuel Oil	5.2	0.0	5.2	(0.8)	1.6	2.8	4.4	(1.5)	2.9	(1.2)	1.7
8	Total OPG Nuclear Facilities CANDU Fuel Costs	189.9	65.2	255.1	(15.9)	148.0	91.2	239.2	(88.3)	150.9	70.8	221.7

Line No.	Business Unit	2028 Plan	(c)-(a) Change	2029 Plan	(e)-(c) Change	2030 Plan	(g)-(e) Change	2031 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
CANDU:								
9	Darlington NGS ¹	181.6	2.3	183.9	25.4	209.3	12.6	221.9
10	Pickering NGS	0.0	0.0	0.0	0.0	0.0	28.2	28.2
11	Total CANDU Fuel Bundle Cost	181.6	2.3	183.9	25.4	209.3	40.9	250.2
12	Total CANDU Fuel Bundle Cost (\$/MWh)	6.80	0.5	7.33	0.5	7.80	0.8	8.64
13	CANDU Used Fuel Storage & Disposal ²	38.5	(0.5)	38.0	12.2	50.2	4.0	54.2
14	CANDU Fuel Oil	1.7	0.0	1.7	0.0	1.7	0.0	1.8
15	Total OPG Nuclear Facilities CANDU Fuel Costs	221.7	1.8	223.6	37.7	261.2	44.9	306.1

Notes:

- Includes fuel expense of 50% total refueling cost for each refurbished Darlington and Pickering unit applied during the first three months after return to service.
- From Ex. C2-1-1 Table 2, line 2. Used Fuel Storage & Disposal is discussed in Ex. C2-1-1.
- Per EB-2020-0290 OEB Decision and Order, Schedule A, p. 26, nuclear fuel bundle costs are reduced by 2% per year and include the flow through impacts of the production forecast adjustments, for 2022-2026 OEB approved.

Table 1c
 Comparison of Darlington New Nuclear Program (DNNP) Facilities Fuel Costs (\$M)

Line No.	Business Unit	2025 OEB Approved	(c)-(a) Change	2025 Budget	(g)-(c) Change	2026 OEB Approved	(g)-(e) Change	2026 Budget	(i)-(g) Change	2027 Plan	(k)-(i) Change	2028 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
	SMR:											
1	Total SMR Fuel Assembly Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	Total SMR Fuel Assembly Cost (\$/MWh)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
3	SMR Fuel Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	Total DNNP Facilities SMR Fuel Costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Line No.	Business Unit	2028 Plan	(c)-(a) Change	2029 Plan	(e)-(c) Change	2030 Plan	(g)-(e) Change	2031 Plan
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
	SMR:							
5	Total SMR Fuel Assembly Cost	0.0	0.0	0.0	7.2	7.2	20.6	27.8
6	Total SMR Fuel Assembly Cost (\$/MWh)	0.00	0.0	0.00	14.4	14.44	(0.0)	14.43
7	SMR Fuel Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	Total DNNP Facilities SMR Fuel Costs	0.0	0.0	0.0	7.2	7.2	20.6	27.8

Notes:

- The energy portion of the fuel acquisition cost for the initial core load in 2030 is projected to be 31% which is prorated over the planned energy production period. The energy portion of the fuel acquisition cost for the first fuel reload outage in 2031 is projected to be 74% which is prorated over the planned energy production period. Refer to Ex. F2-5-1, Section 5.0 for further details.