RATE BASE

1.0 PURPOSE

This evidence presents the rate base for the nuclear facilities, including drivers of period-over-period differences. In addition, it provides a description of each of the components of rate base and the methodology by which these components are determined.

2.0 OVERVIEW

This evidence supports OPG's request for approval of a rate base for the nuclear facilities for the IR term. The forecast of rate base for the nuclear facilities is $8,720.4M in 2022, $8,788.7M in 2023, $11,260.7M in 2024, $12,468.5M in 2025, and $13,312.0M in 2026 (Ex. B1-1-1, Table 2). The evidence also presents the rate base for the nuclear facilities for 2016-2019 (actual) and 2020-2021 (budget).

The components of rate base and the methodology used to calculate them are the same as those reflected in the rate base approved by the OEB in prior OPG proceedings.

OPG's forecast of rate base for the bridge years and IR term is based on a forecast of net fixed/intangible in-service assets (including nuclear asset retirement costs, or "ARC") and working capital associated with the nuclear facilities. The rate base amounts for the historical period are based on actual balances for those years. As in prior OPG applications, working capital consists of cash working capital, fuel inventory, and materials and supplies.

Nuclear rate base including ARC is forecast to increase over the 2022-2026 period, primarily due to the in-service additions in respect of the Darlington Refurbishment Program ("DRP"). As shown in Ex. B3-1-1, Table 2, nuclear rate base reflects DRP-related net plant (other than the D2O Storage Project) increasing from $4,979.4M in 2022 to $8,849.1M in 2026 as Units 3, 1 and 4 return to service following refurbishment. The D2O Storage Project net plant rate base amount peaks at $478.9M in 2020, depreciating thereafter. The net plant rate base value for the Pickering station is shown as close to fully depreciated by the end of the IR term in line

with the current accounting end-of-life ("EOL") dates of December 31, 2022 for Units 1 and 4 and December 31, 2024 for Units 5 to 8.

As discussed in Ex. D2-2-2, for the purposes of setting payment amounts in this application, OPG proposes to limit the DRP-related net plant in rate base for projects completed prior to 2022 (other than the D2O Storage Project) to the values approved in EB-2016-0152 as of December 31, 2021, with the revenue requirement impact of the differences continuing to be recorded in the Capacity Refurbishment Variance Account ("CRVA"). This results in a lower proposed rate base of $84.5M as of the beginning of the IR term.[1] OPG proposes to address any resulting DRP-related balances in the CRVA in a future application, which would allow an assessment of the recoverability of DRP-related variances, if any, in the context of the overall performance of the four-unit refurbishment. The rate base values for the historical and bridge years reflect the actual/forecasted DRP-related net plant amounts.

D2O Storage Project in-service additions were excluded from the rate base approved in EB-2016-0152 and their revenue requirement impacts have been recorded in the CRVA (see Ex. H1-1-1).[2] As discussed further in Ex. D2-2-10, OPG is requesting the full amount of the project to be included in rate base in this application. The D2O Storage Project net plant is included in the rate base values for the historical, bridge and IR term years.

The treatment of Pickering EOL dates is discussed in further detail in Ex. F4-1-1, Section 3.5 and Ex. H1-1-1, Section 6.2. As noted in those exhibits, OPG is applying for a deferral account related to future changes to Pickering station EOL dates for accounting purposes as part of this application, in line with the OEB's accounting order requirements, effective January 1, 2021.

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[1] The $84.5M amount is calculated as: Ex. B3-3-1, Table 2, col. (c), line (2) less Ex. B3-4-1, Table 2, col. (d), line (18).

[2] An amount of $14.6M placed in service in 2014 for the D2O Storage Project has been approved for inclusion in rate base and was reflected in the rate base approved in EB-2016-0152. In the EB-2013-0321 Decision with Reasons (pp. 58-59), the OEB originally approved a forecast in-service amount greater than $14.6M over 2014-2015 and subsequently approved the Capacity Refurbishment Variance Account balances at December 31, 2014 (EB-2014-0370) and December 31, 2015 (EB-2016-0152) that trued up the revenue requirement impacts to the $14.6M actual in-service amount (e.g., see EB-2016-0152: Ex. L-2.2-1 Staff-008 and Ex. L-9.1-1 Staff-210).

By 2021, the non-DRP net plant rate base is projected to be $558.1M higher than the OEB approved amount, primarily due to cumulatively higher non-DRP capital in-service additions for the Darlington station.

The fixed/intangible asset component of rate base is discussed in Section 3.1. Working capital is discussed in Section 3.2. A more detailed comparison of rate base over the 2016-2026 period is presented in Section 4.0.

3.0 COMPONENTS OF RATE BASE

3.1 Fixed and Intangible Assets

3.1.1 Overview

The forecast net plant rate base values for the nuclear facilities, including ARC, are projected at $8,032.1M in 2022**,** $8,103.1M in 2023**,** $10,623.1M in 2024**,** $11,884.4M in 2025 and $12,778.9M in 2026. The net plant for the nuclear facilities is presented separately for each of Darlington, DRP excluding the D2O Storage Project, the D2O Storage Project, Pickering, Nuclear Support Divisions, and ARC in Ex. B3-1-1, Tables 1 and 2. All fixed assets under construction and intangible assets under development are excluded from the rate base for the 2016-2026 period for the nuclear facilities.

As in prior OPG proceedings, fixed and intangible assets used by both the regulated and unregulated generating businesses continue to be held centrally. These assets are not included in rate base. Instead, the corresponding generating businesses are charged an asset service fee for the use of these assets, as discussed in Ex. F3-2-1.

3.1.2 Forecast Methodology and In-Service Additions

OPG is using the same rate base forecast methodology as in prior proceedings. The forecast of net fixed/intangible in-service asset values for 2020 to 2026 is based on OPG's property, plant, and equipment values (including intangible assets) as at December 31, 2019. In order to determine forecasts for 2020-2026, these values are rolled forward based on a forecast of in-service additions (including adjustments to ARC, if any), retirements/transfers, and depreciation/amortization on these assets.

Exhibit D2-1-3, Tables 4a & 4b, Ex. D2-2-9, Tables 5a & 5b, and Ex. D3-1-2, Table 4 summarize the forecast in-service additions for nuclear operations, DRP, and support services, respectively. Exhibit D3-1-2, Table 5 separately presents forecast support services in-service additions that are included in nuclear rate base, and those that impact the IR term asset service fees and therefore are not included in rate base.

A summary of the forecast in-service additions from the above capital projects exhibits (Ex. D) and those presented in the rate base exhibits (Ex. B) for 2020-2026 is provided below in Chart 1.

Chart 1

Forecast In-service Capital Additions* ($M)

	Reference	2020	2021	2022	2023	2024	2025	2026
Nuclear operations capital projects	Ex. D2-1-3 Table 4a, line 26 and Table 4b, lines 38 & 52	282.2	331.8	434.3	461.6	489.0	477.3	348.3
Darlington Refurbishment Program	Ex. D2-2-9 Table 5a, line 20 and Table 5b, lines 33 & 46	4,796.6	8.6	0.0	1.4	2,505.5	1,907.3	2,028.3
Support services capital projects entering nuclear rate base	Ex. D3-1-2 Table 5a, sum of lines 9 & 11; Table 5b, sum of lines 17 & 19 and sum of lines 25 & 27	43.8	58.8	68.3	38.0	34.4	47.8	30.9
Total nuclear in-service additions, excluding ARC	**Ex. B3-3-1 Table 1 & 2, col. (b)**	**5,122.7**	**399.2**	**502.6**	**501.0**	**3,028.9**	**2,432.5**	**2,407.5**

*Amounts may not add due to rounding

The depreciation and amortization forecasts for 2020 to 2026 are determined by applying the estimated service lives and depreciation and amortization policy to the opening in-service fixed/intangible asset values and planned additions during the year. These depreciation/amortization forecasts are presented in Ex. F4-1-1, Table 2. The depreciation/amortization policy is described in Ex. F4-1-1.

The net fixed/intangible asset portion of rate base is determined using a mid-year average methodology. For large in-service additions or adjustments, where the in-service addition

amount or the amount of an adjustment exceeds $50M, the month in which the addition or adjustment is reflected is used, instead of a mid-year average, to improve accuracy. There are nine nuclear in-service additions forecasted during the bridge years and IR term in the amount of greater than $50M, the details of which are found in Ex. B3-3-1, Table 2a, Note 1.

For example, the nuclear rate base reflects a forecasted in-service amount of $2,504.0M on January 24, 2024 related to the return to service of Darlington Unit 3. Accordingly, the nuclear rate base forecast for 2024 reflects a weighting of 12/12th for this in-service amount.

Supporting continuity schedules for the gross plant, gross in-service fixed/intangible assets and related accumulated depreciation and amortization for the nuclear facilities are provided in Ex. B3-3-1, Tables 1 and 2 and Ex. B3-4-1, Tables 1 and 2, respectively.

A downward adjustment to the gross plant and accumulated depreciation and amortization amounts is included in the continuity schedules for 2022 to effect OPG's proposal of limiting the DRP-related net plant in rate base for projects completed prior to 2022 (other than the D2O Storage Project) to the values approved in EB-2016-0152 as of December 31, 2021. A weighting of 12/12th is applied to the adjustment to achieve an effective date of January 1, 2022. Depreciation expense on these amounts is projected over the IR term using the same assumptions as in EB-2016-0152.

The DRP-related gross plant downward adjustment amount of $134.6M is found at Ex. B3-3-1, Table 2, Col. (c), Line 22. The DRP-related accumulated depreciation and amortization downward adjustment of $38.5M is found at Ex. B3-4-1, Table 2, Col. (d), Line 18. The gross plant and accumulated depreciation and amortization continuity schedules for the historical and bridge years reflect actual/forecasted DRP-related net plant without adjustment.

3.1.3 Asset Retirement Costs

Asset retirement costs for 2016-2026 are discussed in Ex. C2-1-1, with detailed continuity schedules of ARC and ARO for the prescribed facilities presented in Ex. C2-1-1, Table 2. This includes a decrease in ARC of $258.3M recorded at the end of 2016 related to the change in

ARO reflecting the 2017 ONFA Reference Plan, and an increase in ARC of $143.7M recorded at the end of 2017 related to the change in the ARO reflecting revised accounting EOL assumptions for the Pickering station effective December 31, 2017.

3.2 Working Capital

3.2.1 Overview

As in prior OPG applications, the working capital included in rate base consists of cash working capital, fuel inventory and materials and supplies. The fuel inventory and materials and supplies values for rate base continue to be determined using a mid-year average of opening and closing balances during the period. Cash working capital continues to be determined using a lead/lag analysis. Total working capital for OPG's nuclear facilities is forecasted to be $688.2M in 2022, $685.6M in 2023, $637.7M in 2024, $584.0M in 2025 and $533.2M in 2026 (Ex. B3-5-1, Table 2).

3.2.2 Cash Working Capital

The methodology for calculating cash working capital is the same as in prior OPG proceedings. Cash working capital is the average amount of capital needed to bridge the gap between the time expenditures are made to produce output and the time payment is received for that output. Cash working capital is calculated using net lag days, which is the difference between the time that revenue is received by OPG and the time that expenses are paid. The net lag is applied to each of OPG's expenses in determining the cash working capital amount.

In EB-2016-0152, EB-2013-0321, EB-2010-0008 and EB-2007-0905, the net lag days used in the cash working capital calculations were determined by a lead/lag study conducted by OPG in 2006, the results of which were accepted by the OEB in EB-2007-0905. Since EB-2016-0152, OPG determined that the passage of time since the 2006 study supported an updated assessment of the lead/lag days used to determine the cash working capital allowance. OPG retained Navigant Consulting Inc. to prepare a study of OPG's lead/lag days for cash working capital purposes. The results of the study are reflected in the cash working capital amounts beginning in 2019 and are discussed at Ex. B1-1-2. The study itself is found at Ex. B1-1-2, Attachment 1.

Given the modest size of cash working capital relative to the total rate base, OPG continues to use the cash working capital amount of the most recent historical year (i.e., 2019) as the amount for the bridge years and the IR term.

3.2.3 Fuel Inventory

The nuclear generating stations maintain a nuclear fuel inventory as well as an inventory of fuel oil for standby generators. The cost of the inventory of fuel oil remains minimal compared to that of nuclear fuel.

Chart 2 below provides details of the year-end nuclear fuel inventory for 2016 to 2026.

Chart 2

Summary of Year End Inventory – 2016 to 2026

Line No.	Types	Units	2016 Actual	2017 Actual	2018 Actual	2019 Actual	2020 Budget	2021 Budget	2022 Plan	2023 Plan	2024 Plan	2025 Plan	2026 Plan
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
1	Uranium Concentrate	K$	53,548	53,038	46,528	35,894	40,600	54,885	44,626	35,278	38,688	41,685	34,253
2		MgU	312	324	326	305	380	483	379	288	288	288	225
3		$/KgU	171.48	163.78	142.87	117.78	106.72	113.71	117.71	122.30	134.12	144.51	152.23
4	Uranium Dioxide[1]	K$	13,312	11,457	11,098	13,165	7,005	7,634	13,172	13,307	7,684	7,312	7,052
5		MgU	74	63	65	86	50	51	86	85	45	40	37
6		$/KgU	180.39	182.94	170.02	153.62	141.03	148.32	153.41	157.25	172.49	184.67	192.25
7	Finished Bundles	K$	204,783	195,879	190,136	142,321	131,789	128,388	157,648	144,589	129,035	136,480	119,150
8		MgU	767	738	740	568	566	556	665	595	508	505	426
9		$/KgU	267.0	265.6	257.0	250.7	232.7	230.8	237.8	242.8	253.8	270.3	279.6
10	Fuel Oil	M$	4.2	4.9	4.8	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
11	**Total**	**M$**	**275.9**	**265.3**	**252.6**	**196.9**	**184.9**	**196.4**	**220.9**	**198.7**	**180.9**	**191.0**	**165.9**

As described in Ex. F2-5-1, the supply chain for nuclear fuel continues to consist of the purchase of uranium concentrate, the purchase of services to convert the uranium concentrate into uranium dioxide, and the purchase of services to manufacture fuel bundles that contain the uranium dioxide. OPG maintains inventories at each stage and maintains ownership of the work-in-process throughout this supply chain. The nuclear fuel inventory costs represent the accumulation of costs incurred by OPG during the supply chain process. Fuel inventory continues to be valued using the weighted average costing method.

The nuclear fuel inventory amounts for 2020 to 2026 are forecasted based on the closing nuclear fuel inventory quantities and values as of December 31, 2019, and expected purchases and usage during the forecast period. The purchases reflect OPG's current target levels for the inventory, including the requirement for a one time full load of new fuel into the reactor core of each refurbished Darlington unit prior to start-up, and are reflective of the planned shutdown of the Pickering station at the end of 2025, as discussed in Ex. F2-5-1. Pricing assumptions for the nuclear fuel supply chain components over the forecast period are also discussed in Ex. F2-5-1.

3.2.4 Materials and Supplies

Materials and supplies consist of consumable supplies and spare parts. OPG's nuclear facilities are required to maintain substantial amounts of materials and supplies. The rate base materials and supplies value is net of a provision for accumulated obsolescence discussed below. OPG's inventory management system uses an average costing basis, whereby the value of the materials and supplies inventory is based on the average unit price of each item times the quantity on hand.

In accordance with US GAAP, materials and supplies continue to be valued at the lower of average cost and market value. The determination of the market value of materials and supplies takes into account various factors including technological obsolescence, the remaining life of the related facilities in which the materials and supplies are expected to be used, and adjustments required as a result of performing physical inventory counts. Charges incurred as a result of valuing nuclear materials and supplies at the lower of cost and market value are reflected in the inventory adjustments (charged to nuclear base OM&A) that reduce the nuclear materials and supplies rate base amount.

The 2020-2026 Business Plan assumes a declining growth rate in material and supplies inventory during the IR term (Ex. B3-5-1, Table 2). The nuclear materials and supplies values for 2020 to 2026 are forecasted based on the closing materials and supplies balance as of December 31, 2019 and expected utilization, purchases, charges related to valuation at the lesser of cost and market value during the forecast period, and assumed recovery for the

residual inventory balance following the planned Pickering shutdown. This methodology is unchanged from prior applications. Inventory gross growth rates targeted for the IR term are shown in Chart 3 below.

Annual nuclear materials and supply inventory targets in 2020-2026 have been established to optimize inventory and mitigate costs, as well as reflect the planned Pickering shutdown. The Pickering annual inventory gross growth targets are negative starting in 2022 as Pickering will focus on reducing the level of inventory stocking by using existing spare parts and other inventories in the final years of commercial operations. Through a continuous review process leading up to the planned Pickering shutdown, OPG intends to minimize the potential for future obsolete and over stocked inventory by reviewing demand signals, reducing maximum stocking parameters and minimizing surplus where practical.

Darlington's annual inventory gross growth rate is expected to decline over the IR term, from 4.27% to 1.52%, in conjunction with the decline in the level of capital expenditures at Darlington. Darlington's growth rates will also be favourably impacted by the completion of the DRP, reducing operational spares/inventory transfers.

Chart 3
Targeted Inventory Gross Growth Rates

	2022	2023	2024	2025	2026
PNGS	(5.21)%	(10.33)%	(17.35)%	(32.79)%	(44.11)%
DNGS	4.27%	3.17%	1.99%	0.00%	1.52%
All Facilities	**(0.24)%**	**(2.83)%**	**(5.86)%**	**(11.69)%**	**(10.94)%**

4.0 COMPARISON OF RATE BASE

A comparison of rate base amounts for the nuclear facilities for the 2016-2026 period is presented at Ex. B3-2-1, Table 1. The EB-2016-0152 rate base amounts shown in the comparison reflect the adjustments ordered by the OEB.

As noted above, the overall increase in rate base over the period is driven primarily by in-service additions for the DRP. The year over year increase in rate base in 2020 is driven by the return to service of the refurbished Darlington Unit 2. The major year over year increases in rate base during the IR term, in each of 2024, 2025 and 2026, are due to the return to service of Darlington Unit 3, Unit 1 and Unit 4, respectively.

The impact of in-service plant additions, net of depreciation and amortization, for non-DRP Darlington capital is also contributing to an increasing rate base trend over the period, partially offset by the declining Pickering net plant, which is close to fully depreciated toward the end of the IR term based on the current accounting EOL dates. The non-DRP Darlington net plant rate base amount increases from $760.1M in 2016 to $3,200.9M in 2026, while the Pickering net plant declines from $664.5M in 2016 to $38.7M in 2026. The ARC rate base also decreases over the period, primarily due to depreciation, from $825.7M in 2016 to $94.6M in 2026.

Adjusting for the D2O Storage Project not included in the EB-2016-0152 rate base and excluding ARC, rate base is forecasted to be $661.9M higher than the OEB approved value by 2021. On the same basis, for 2019, the actual rate base is $353.7M higher than the OEB approved value. These variances primarily reflect cumulatively higher capital in-service additions, and lower depreciation expense due to an extension of the accounting EOL dates

for the Pickering station at the end of 2017.[3] For 2020, the budget rate base (as adjusted per above) is temporarily lower than the OEB approved amount due to revised timing for the return to service of Unit 2, which gives rise to a lower weighting to the associated in-service addition during the year.

Additional detail regarding in-service additions is provided in Exhibits D2 (for both non-DRP and DRP nuclear facilities projects) and D3 (for support services projects entering nuclear rate base).

[3] The accounting EOL dates were extended to December 31, 2022 for Pickering Units 1 and 4 and December 31, 2024 for Pickering Units 5-8, effective December 31, 2017. The revenue requirement impact of the extension is being recorded in the Impact Resulting from Changes to Pickering Station End-of-Life Dates (December 31, 2017) Deferral Account until the next payment amounts order that reflects this impact in nuclear payment amounts. See Ex. F4-1-1 for further discussion.