DRIVERS OF DEFICIENCY

1.0 PURPOSE

This evidence presents the major drivers of revenue deficiency for the nuclear facilities over the 2017-2021 period as determined in Ex. I1-1-1 Table 3 and updated in Ex. N1-1-1 Attachment 2 and EX. N2-1-1.

2.0 OVERVIEW

The revenue deficiency for the nuclear facilities over the 2017-2021 period is driven in largely equal parts by (i) lower nuclear production, which reflects the commencement of Darlington refurbishment outages and outage days related to Pickering Extended Operations[1], and (ii) increases in revenue requirement relative to the annual average of the 2014 and 2015 revenue requirement approved in EB-2013-0321.

The largest drivers of changes in revenue requirement are described below, the largest of which is the Darlington Refurbishment Program ("DRP"). The annual revenue deficiency impact of the production and revenue requirement drivers are detailed in Chart 1 and explained in section 3.0 below.

3.0 DRIVERS OF DEFICIENCY FOR THE NUCLEAR FACILITIES

3.1 Lower Production (53 per cent of revenue deficiency)

Relative to the annual average of the OEB-approved nuclear production for 2014 and 2015, forecast nuclear production declines by 9.7TWh for 2017, 9.3TWh for 2018, 8.8TWh for 2019, 10.4TWh for 2020, and 12.4TWh for 2021. The comparison of production forecasts in Ex. E2-1-2 identifies the drivers of production forecast changes. The primary drivers of lower production are the units taken out of service for DRP,[2] and the incremental outage requirements resulting from Pickering Extended Operations between 2017 and 2020.

[1] The overall impact of Pickering Extended Operations is to increase production in the 2017-2021 test period relative to the original planned end of commercial operations in 2020. Pickering Extended Operations is a driver of deficiency relative to 2014/15 payment amounts due to decreased production and increased costs in 2017-2020 in order to execute outages to enable extension.

[2] Unit 2 in 2016, Unit 3 in 2020 and Unit 1 in 2021.

3.2 Darlington Refurbishment (17 per cent of revenue deficiency)

The DRP impacts primarily reflect an increase in the cost of capital and depreciation expense, and related income taxes resulting from rate base in-service additions for refurbishment capital projects. OPG forecasts approximately $370M in such rate base additions over the 2016-2019 period, and approximately $4.8B in 2020 when Unit 2 returns to service.[3] The DRP impacts also include DRP-related nuclear OM&A expenses, which are related to the removal activities associated with existing structures or facilities including re-tube and feeder replacement and waste management costs.[4]

3.3 Pickering Extended Operations Enabling Costs (5 per cent of revenue deficiency)

The positive economic evaluations of Pickering Extended Operations from OPG and the IESO are provided at Ex. F2-2-3. Forecast OM&A expenses to 2020 to enable Pickering Extended Operations are another driver of the higher revenue requirement relative to EB-2013-0321 approved levels. These costs total $292M over the 2017 to 2020 period as presented in Ex. F2-2-3 Chart 2.

3.4 Impact of Changes in Nuclear Station End-of-Life Dates on Nuclear Liabilities (7 per cent of revenue deficiency)

Accounting changes in nuclear station end-of-life dates[5] impact OPG's nuclear decommissioning and nuclear used fuel and waste management liability ("nuclear liabilities") costs. As further discussed in Ex. C2-1-1 and detailed in Ex. C2-1-1 Table 5, the net impact (for both prescribed and Bruce facilities and including associated income taxes) relates to the increase in the nuclear asset retirement obligation ("ARO") and corresponding increase in nuclear asset retirement costs ("ARC") of approximately $2.3B recorded by OPG at the end of 2015. This increase was primarily driven by the extension of the accounting service life for

[3] Ex. D2-2-10 Table as updated in N2-1-1Table 3.
[4] Ex F2-7-1 Table 1, footnote 1.
[5] Effective December 31, 2015. Discussed in Ex. F4-1-1.

the Bruce B nuclear units to recognize the Province's December 2015 announcement of an updated refurbishment agreement between the IESO and Bruce Power L.P. The net increase in the revenue requirement consists of an increase related to the Bruce facilities (through a reduction in Bruce Lease net revenues) and a decrease related to the prescribed nuclear facilities.

3.5 Impact of Changes in Nuclear Liabilities Reflecting 2017 ONFA Reference Plan (-5 per cent of revenue deficiency)

On December 20, 2016, OPG filed Ex. N1-1-1 Impact Statement updating its pre-filed evidence. This update included changes to forecast costs associated with OPG's nuclear liabilities since the pre-filed evidence, reflecting the projected accounting impact of the 2017-2021 ONFA Reference Plan approved by the Province in December 2016 with an effective date of January 1, 2017. The projected accounting impact is a year-end 2016 decrease in the nuclear ARO of approximately $1.5B and a corresponding decrease in nuclear ARC. The resulting revenue requirement decrease is mainly driven by the decrease in the nuclear liabilities costs for the Bruce facilities, primarily due to the impact of the lower Used Fuel Disposal program cost estimates. The updated nuclear liabilities costs are discussed in Ex. N1-1-1 and detailed in Ex. N1-1-1 Table 6.

3.6 Remaining Depreciation and Amortization Expense (7 per cent of revenue deficiency)

Remaining nuclear depreciation and amortization expense is the change in depreciation and amortization expense excluding that related to DRP and nuclear liability costs, which are discussed above. Remaining nuclear depreciation and amortization expense for prescribed facilities (including the associated tax gross-up) is forecast to be higher over the 2017-2020 period, reflecting nuclear operations capital in-service additions to rate base. Depreciation and amortization expense declines significantly in 2021, as Pickering reaches the facility's assumed end of life date of December 31, 2020. Depreciation and amortization expense is presented in Ex. F4-1-1.

3.7 Outage OM&A Expenses (3 per cent of revenue deficiency)

Forecast nuclear outage OM&A expenses[6] are higher in the test period, primarily due to a number of planned outages in accordance with OPG's aging and life cycle management programs, in addition to and separate from the refurbishment of the Darlington units. The outage work in 2017-2019 effectively replaces two scheduled planned outages for Unit 2 in 2016 and 2019 which would otherwise have been undertaken absent Unit 2 refurbishment. In addition, Pickering's outage OM&A forecast in 2021 includes expenditures associated with a six-unit Vacuum Building Outage (planned every 12 years). Additional detail on outage activities and costs is provided in Ex. F2-4-1 and Ex. F2-4-2.

3.8 Remaining/Other OM&A Expenses (13 per cent of revenue deficiency)

Remaining/Other OM&A expenses changes in OM&A expenses that do not include DRP-related increases in OM&A, Pickering Extended Operations enabling costs or nuclear outage costs. Drivers of the increase in remaining/other OM&A include an increase in nuclear base OM&A costs due to labour costs, including escalation reflecting collective agreement provisions, as well as purchased services and new CNSC requirements. Purchased services increase to fund work programs to maintain asset reliability, address equipment aging issues and for fire hazard assessment and emergency management. New CNSC requirements related to Fitness for Duty are discussed in Ex. N1-1-1, pp. 20-21. Nuclear base OM&A costs are presented in Ex. F2-2-1 and Ex. F2-2-2. Compensation and benefits are discussed in Ex. F4-3-1.

3.9 Fuel Costs (-4 per cent of revenue deficiency)

Fuel costs discussed here exclude those related to the nuclear liabilities adjustment discussed above. The forecast decrease in fuel costs for the prescribed nuclear facilities over the 2017-2021 period reflects lower generation, as discussed above, and lower fuel bundle costs. The lower forecast fuel bundle costs are primarily due to lower cost of uranium concentrate partially offset by higher prices for conversion services and fuel bundle manufacturing. Nuclear fuel costs are discussed in Ex. F2-5-1 and Ex. F2-5-2.

[6] Other than enabling costs for Pickering Extended Operations discussed in section 3.6 above.

3.10 Other (4 per cent of revenue deficiency)

The “Other” revenue requirement driver category includes a number of factors. The two main causes of the increase in this cost driver are a decline in non-energy revenue and lower Bruce Lease net revenues (other than the impact of the 2015 nuclear liabilities adjustment and station end-of-life changes discussed in section 3.4 and the impact of the 2016 nuclear liabilities adjustment discussed in section 3.5). The decline in non-energy revenue is primarily the result of lower heavy water sales due to the depletion of inventory. Lower Bruce Lease net revenues are due to a combination of factors including lower forecast lease revenues and higher used fuel expenses. Non-energy revenue is discussed in Ex. G2-1-1 and Ex. G2-1-2. Bruce Lease net revenues are discussed in Ex. G2-2-1, as updated in Ex. N1-1-1.

The remaining costs in this category consist of a residual decrease in the cost of capital and associated tax gross-up, lower property taxes, and a residual decrease in income taxes not included in the drivers discussed above. The residual decrease in the cost of capital is mainly due to a lower allowable return on equity value published by OEB in October 2016 compared to that reflected in the EB-2013-0321 payment amounts as discussed in Ex. N1-1-1. The residual decrease in income taxes primarily reflects the impact of higher forecast cash expenditures on nuclear waste management and decommissioning, net of forecast disbursements from the nuclear segregated funds, for the prescribed nuclear facilities. Taxes are discussed in Ex. F4-2-1, as updated in Ex. N1-1-1. The cost of capital is discussed in Ex. C1-1-1, as updated in Ex. N1-1-1, as well as Ex. C1-1-2 and Ex. C1-1-3.

Chart 1: Nuclear Deficiency for 2017 - 2021 Period

Line No		($M) 2017	($M) 2018	($M) 2019	($M) 2020	($M) 2021	Reference
1	**EB-2013-0321 Average Approved 2014 & 2015 Revenue Requirement**	**2,834.0**	**2,834.0**	**2,834.0**	**2,834.0**	**2,834.0**	Note 1a
2	Revenue at EB-2013-0321 Payment Amount ($59.29/MWh)	**2,258.9**	**2,280.9**	**2,313.9**	**2,214.8**	**2,097.9**	Note 2a
3	Lower Production (line 1 - line 2)	**575.2**	**553.1**	**520.2**	**619.2**	**736.1**	
	Changes in Revenue Requirement:						
4	Darlington Refurbishment	46.7	(15.9)	(51.0)	487.9	519.3	Note 3a
5	Pickering Extended Operations Enabling Costs	25.6	55.3	107.1	104.3	0.0	Ex. F2-2-3 Chart 2
6	Impact of Changes in Nuclear Station End-of-Life Dates on Nuclear Liabilities	31.8	36.2	42.2	129.7	132.2	Ex. C2-1-1 Table 5, line 18
7	Impact of Changes in Nuclear Liabilities Reflecting 2017 ONFA Reference Plan	(22.9)	(32.8)	(3.7)	(84.8)	(127.0)	Ex. N1-1-1 Chart 3.2.1 line 8
8	Remaining Depreciation and Amortization Expense *(other than lines 4, 6 & 7)*	99.9	136.9	143.7	132.4	(141.7)	Note 4a
9	Outage OM&A Expenses *(other than line 5)*	75.8	59.8	29.9	12.2	11.8	Note 5a
10	Remaining/Other OM&A Expenses *(other than lines 4, 5, 6, & 7)*	81.8	103.5	164.4	182.2	194.6	Note 6a
11	Fuel Costs *(other than lines 6 & 7)*	(49.8)	(47.8)	(37.5)	(41.4)	(56.7)	Note 7a
12	Other	38.6	61.5	54.2	42.3	51.9	Note 8a
13	**Total Change in Revenue Requirement** (lines 4 through 12)	**327.4**	**356.6**	**449.4**	**964.8**	**584.4**	
14	**Total Revenue Deficiency** (line 3 + line 13)	**902.5**	**909.7**	**969.5**	**1,584.0**	**1,320.5**	

Notes

1a Ex. I1-1-1 Table 2, Line 11

OEB APPROVED 2014	OEB APPROVED 2015	AVERAGE
2,790.4	2,877.6	2,834.0

2a

REDUCED PRODUCTION	2017	2018	2019	2020	2021
Test Period Production (Ex. E2-1-1 Table 1, line 3, cols. (e) to (i)) **(TWh)**	38.1	38.5	39.0	37.4	35.4
Nuclear Base Payment Amount (EB-2013-0321 Payment Amount Order, App D, line 3) **($/MWh)**	$59.29	$59.29	$59.29	$59.29	$59.29
Forecast Revenue ($M)	2,258.9	2,280.9	2,313.9	2,214.8	2,097.9

Note	Driver of Revenue Requirement Change	**EB-2016-0152** *(references shown are to EB-2016-0152 exhibits)*		**EB-2013-0321** *(references shown are to EB-2016-0152 exhibits unless otherwise noted)*	
3a	**Impact of Darlington Refurbishment Program (DRP)**	**DRP revenue requirement impact comprises:**		**DRP revenue requirement impact comprises:**	
		OM&A Expenses	Ex. F2-1-1 Table 1, line 5, cols. (e) to (i)	OM&A Expenses	Ex. H1-1-1 Table 11a, Table to Note 1, col. (a), line 4a
		Cost of Capital	Ex. N2-1-1, Chart 3, line 4 x Ex. N2-1-1 Chart 1, line 2	Cost of Capital	Ex. H1-1-1 Table 11a, Table to Note 6, col. (c), line 3b
		Depreciation	Ex. F4-1-1 Table 2, line 2, cols. (e) to (i) less Ex. N2-1-1, Chart 2, line 5	Depreciation	Ex. H1-1-1 Table 11a, Table to Note 6, col. (c), line 5b
		Income Tax	((Ex. N2-1-1 Chart 3, line 4 x Ex. C1-1-1 Tables 1-5, col. (b), line 5 x Ex. N1-1-1 Chart 3.4, line 6) + (Ex. F4-1-1 Table 2, line 2, cols. (e) to (i) less Ex. N2-1-1, Chart 2, line 5, less Ex. F4-2-1 Table 3b, Note 3)) x 25% / (1-25%)	Income Tax	(Ex. H1-1-1 Table 11a, Table to Note 6, col. (c), lines 4b+5b-6b) x 25% / (1-25%)
4a	**Impact of Other Depreciation and Amortization Expense**	**Impact of Other Depreciation and Amortization Expense is calculated as:**		**Impact of Other Depreciation and Amortization Expense is calculated as:**	
		Total Depreciation and Amortization	Ex. N2-1-1 Table 1, line 17, cols. (a) to (e)	Total Depreciation and Amortization	Ex. I1-1-1 Table 2, line 4, (cols. (a)+(b))/2
		Less: Darlington Refurbishment Depreciation	Ex. F4-1-1 Table 2, line 2, cols. (e) to (i) less Ex. N2-1-1, Chart 2, line 5	Less: Darlington Refurbishment Depreciation	Ex. H1-1-1 Table 11a, Table to Note 6, col. (c), line 5b
		Less: Nuclear Liabilities Impact Reflecting 2017 ONFA Reference Plan	Ex. N1-1-1 Table 6, line 1, cols. (a) to (e) less cols. (f) to (j)		
		Less: Nuclear Liabilities Impact of 2015 Station Life Changes	Ex. C2-1-1 Table 5, line 1, cols. (a) to (e) less cols. (f) to (j)		
5a	**Increase in Outage OM&A Expenses**	**Outage OM&A expenses are calculated as:**		**Outage OM&A expenses are calculated as:**	
		Total Outage OM&A	Ex. F2-4-1 Table 1, line 7, cols. (e) to (i)	Total Outage OM&A	EB-2013-0321: Ex. F2-4-1 Table 1, line 6 (cols. (e)+(f))/2
		Less: Pickering Extended Operations Enabling Costs (Outage OM&A)	Ex. F2-2-3 Chart 2, line 5		
6a	**Other OM&A Expenses**	**Other OM&A Expenses are calculated as:**		**Other OM&A Expenses are calculated as:**	
		Total OM&A Expenses	Ex. N2-1-1 Table 1, line 15, cols. (a) to (e)	Total OM&A Expenses	Ex. I1-1-1 Table 2, line 2 (cols. (a)+(b))/2
		Less: Outage OM&A Expenses	As calculated in Note 5a	Less: Outage OM&A Expenses	EB-2013-0321: Ex. F2-4-1 Table 1, line 6 (cols. (e)+(f))/2
		Less: Pickering Extended Operations Enabling Costs	Line 5		
		Less: Nuclear Liabilities Impact Reflecting 2017 ONFA Reference Plan	Ex. N1-1-1 Table 6, line 3, cols. (a) to (e) less cols. (f) to (j)		
		Less: Darlington Refurbishment OM&A Expenses	Ex. F2-1-1 Table 1, line 5, cols. (e) to (i)	OM&A Expenses	Ex. H1-1-1 Table 11a, Table to Note 1, col. (a), line 4a
		Less: Nuclear Liabilities Impact of 2015 Station Life Changes	Ex. C2-1-1 Table 5, line 3, cols. (a) to (e) less cols. (f) to (j)		
7a	**Decrease in Fuel Costs**	**Fuel Costs are calculated as:**		**Fuel Costs are calculated as:**	
		Total Fuel Expense	Ex. N2-1-1 Table 1, line 16, cols. (a) to (e)	Total Fuel Expense	Ex. I1-1-1 Table 2, line 3 (cols. (a)+(b))/2
		Less: Nuclear Liabilities Impact of 2015 Station Life Changes	Ex. C2-1-1 Table 5, line 2, cols. (a) to (e) less cols. (f) to (j)		
		Less: Nuclear Liabilities Impact Reflecting 2017 ONFA Reference Plan	Ex. N1-1-1 Table 6, line 2, cols. (a) to (e) less cols. (f) to (j)		
8a	**Other**	**Impact of Other is calculated as:**		**Impact of Other is calculated as:**	
		Total Revenue Requirement	Ex. N2-1-1 Table 1, line 24, cols. (a) to (e)	Total Revenue Requirement	Ex. I1-1-1 Table 2, line 11 (cols. (a)+(b))/2
		Less: Revenue requirement change factors identified	Notes 3a to 7a + Line 5 + Line 6 + Line 7	Less: Revenue requirement change factors identified	Notes 3a to 7a