NUCLEAR NON-ENERGY REVENUES

1.0 PURPOSE

This evidence describes OPG's non-energy revenue derived from its nuclear operations, the regulatory treatment of these revenues and the forecast of nuclear non-energy revenues for the IR term.

2.0 OVERVIEW

Actual and planned nuclear non-energy revenues (net of related costs) for the period 2016-2026 are presented in Ex. G2-1-1, Table 1. The forecast of nuclear non-energy revenues for the IR term is included as an offset in the calculation of OPG's revenue requirement. Nuclear non-energy revenues during the IR term are associated with isotope sales (Cobalt-60 at Pickering and tritium), Heavy water sales and processing, and Ancillary Services (Reactive Support and Voltage Control).

Historical, bridge and test years' isotope sales revenues fluctuate due to the nature of outage work and timing of isotope harvesting. Isotope sales changes year-over-year are due to the scheduling of the cobalt harvest windows and planned Pickering shutdown schedule. Significant changes in heavy water processing and sales year-over-year are due to production fluctuations at the Tritium Removal Facility ("TRF") which are based on required outages as well as pricing assumptions.

Differences between forecast and actual revenues associated with ancillary services are recorded in the Ancillary Services Net Revenue Variance Account – Nuclear Sub Account (Ex. H1-1-1).

3.0 NUCLEAR NON-ENERGY REVENUE SOURCES

3.1 Isotope Sales

3.1.1 Pickering Cobalt-60

Cobalt-60 is a critically important medical isotope used for radiation therapy, sterilization of medical equipment, food irradiation and specialized industrial uses. OPG currently produces Cobalt-60 at Pickering (Units 6, 7 and 8) for use in the sterilization of surgical and medical supplies. OPG sells Cobalt-60 to Nordion (Canada) Inc. ("Nordion") under a long-term agreement.

Total revenues from isotope sales over the period 2016-2026 are shown in Ex. G2-1-1, Table 1. Electricity generating activities take precedence over Cobalt-60 processing. Cobalt-60 harvesting is tied to the outage schedule of the Pickering units. This results in fluctuating annual revenues over the historical and plan period. OPG is not proposing any change to the treatment of revenues from Cobalt-60 production at Pickering from that approved in prior applications.

Sales volumes are constrained by OPG's ability to produce Cobalt-60. The direct costs and other support costs for this activity are discussed in Section 4 below. Cobalt-60 production at Pickering will cease with the station's planned shutdown, with sales of the final harvest occurring after 2025.

3.1.1.1 Cobalt-60 Production at Darlington

In EB-2016-0152, OPG indicated it was examining an opportunity to develop Cobalt-60 at Darlington.[1] OPG committed to returning to the OEB with more information if OPG proceeded with the opportunity.

OPG is moving forward with the opportunity to produce Cobalt-60 at Darlington. However, the first harvest and associated revenues and related operating costs will not occur until after the end of the IR term. Subject to the Canadian Nuclear Safety Commission's regulatory

[1] EB-2016-0152, Ex. G2-1-1, Section 3.1.1.1, pp. 2-3.

approvals, OPG, with its partner Nordion, plans to make capital expenditures during the IR term; however, these amounts would not be placed in service until after the end of the IR term. OPG will bring forward a proposal regarding revenues, operating costs and capital amounts for the production of Cobalt-60 at Darlington in the next nuclear payment amounts application.

No revenue, operating costs or capital in-service amounts for Cobalt-60 production at Darlington are included in the proposed revenue requirements in this application.

3.1.2 Tritium Sales

Tritium is a by-product of electricity generation using CANDU (Canadian Deuterium Uranium) technology. It is produced by the irradiation of heavy water. In order to stay within specified limits, and to lower radiation exposure to workers and the environment, tritium is removed from the heavy water via the TRF.

OPG has entered into short-term contracts to sell tritium to government-approved and licensed organizations. Commercial use of tritium includes safety and security products like land-mine markers and emergency exit signs, tritium labeled chemicals for medical research and research into future power sources.

Tritium sales have been relatively stable over time, with some variation due to competition, fluctuating demand and variations in the value of the Canadian dollar. Total revenues from isotope sales over the period 2016-2026 are shown in Ex. G2-1-1, Table 1. OPG is not proposing any change to the treatment of revenues from tritium sales from that approved in prior applications. The direct costs and other support costs are described in Section 4 below.

3.2. Heavy Water Sales and Processing

Heavy water is a manufactured product required for CANDU reactor operations. Heavy water is required as a moderator for sustaining a nuclear reaction and as a heat transport medium in CANDU nuclear reactors.

3.2.1 Heavy Water Sales

OPG seeks opportunities to sell surplus quantities of heavy water from its heavy water inventory. Surplus quantities are defined as those quantities of heavy water not required to meet OPG's current and future needs (including contractual obligations to Bruce Power). This surplus makes up the sales pool inventory. In 2016, OPG's assessment of non-tritiated heavy water inventory expected that the sales pool would be depleted after the forecasted sales were completed in 2017. OPG was able to realize sales of non-tritiated heavy water into 2019 as described in G2-1-2. In the EB-2016-0152 Settlement Proposal approved by the OEB, the parties agreed to increase the sales forecast by $12.2M over the period 2017-2021.[2]

Based on current assessment, the sales pool has zero inventory of non-tritiated heavy water available for sale. As such, no commercial transactions of non-tritiated heavy water are expected over the IR term. Planned total revenues for heavy water sales and processing over the period 2016-2026 are shown in Ex. G2-1-1, Table 1.

3.2.2 Heavy Water Processing

Heavy water processing is primarily comprised of tritium removal (detritiation) at the TRF. The bulk of the heavy water processing revenue is earned from the provision of detritiation services to Bruce Power. Opportunities to provide detritiation services to others are limited because of storage and capacity restrictions at the TRF. The forecast of heavy water processing over the IR term includes increased revenues relative to 2017-2021 due to a combination of the availability of additional volumes and a higher unit price from the provision of detritiation services to Bruce Power.

Provision of detritiation services is affected by the ability to ship heavy water to the TRF and the availability of the TRF, which fluctuates according to its maintenance cycle. TRF outages typically follow a three-year cycle, with the first year requiring a long outage, the second year

[2] EB-2016-0152 Ex. O-1-1, p.11.

requiring a shorter one and the third year requiring no outage at all. As a result, revenues fluctuate from year to year.

On occasion, OPG is able to lease/loan small quantities of heavy water to third parties; revenues from these transactions are also recorded under heavy water processing as "heavy water services." Planned total revenues for heavy water sales and processing over the period 2016-2026 are shown in Ex. G2-1-1, Table 1. OPG is not proposing any change to the treatment of revenues from heavy water processing from that approved in prior applications. Cost of goods sold and other support costs are described in Section 4 below.

3.3 Ancillary Services

OPG's nuclear assets are able to supply the IESO with reactive support and voltage control. Reactive support service allows the IESO to maintain the reactive power levels required by the IESO-controlled grid. Voltage control service allows the IESO to maintain the voltage levels required by the IESO-controlled grid.

The ancillary services are provided pursuant to a Reactive Support and Voltage Control Service Agreement ("RSVCSA") with the IESO. OPG and the IESO have negotiated a RSVCSA effective from February 1, 2019 to February 28, 2021.[3] OPG earns revenue under the RSVCSA tied to production losses resulting from provision of the reactive support and voltage control services to the IESO. The most recent February 1, 2019 agreement incorporated a change in the valuation of production losses to use the OEB-approved nuclear payment amount, compared to the previous calculation using the Hourly Ontario Energy Price.

OPG's 2020-2026 Business Plan assumes similar revenue terms for ancillary services provided during the IR term post February 28, 2021. Ancillary services revenues are lower in 2026 than in earlier years of the IR term due to the planned Pickering shutdown. OPG is not proposing any change to the treatment of ancillary services revenues from that approved in prior applications.

[3] Previous agreements included the period January 1, 2013 to May 31, 2016; June 1, 2016 to May 31, 2018 and June 1, 2018 to January 31, 2019.

4.0 OPERATING COSTS OF NUCLEAR NON-ENERGY BUSINESSES

The operating costs of the nuclear non-energy business are made up of direct costs (costs directly associated with producing or generating the product or service) and other support costs (costs associated with sales, administration and other overheads). The direct costs of the nuclear non-energy business are shown in Ex. G2-1-1, Table 1 on an aggregated basis and are discussed below. Other support costs are included in Nuclear Base OM&A (Ex. F2-2-1, Table 1, Operations and Project Support).

4.1 Cobalt-60

The direct costs for Cobalt-60 production at Pickering include installation, removal, processing, storage, and packaging of Cobalt-60. Direct costs also include a cost item for the long-term storage of the spent (but still radioactive) cobalt, as the third party agreement provides for the return of the spent cobalt to OPG for storage as nuclear waste. Under the Amended and Restated Used Fuel Waste and Cobalt-60 Agreement between Bruce Power and OPG, OPG has accepted liability for the interim storage and future disposal of Bruce Power's spent Cobalt-60, and in return OPG receives payments from Bruce Power. The associated revenues are included in the Bruce Lease net revenues and are set out in Ex. G2-2-1, Table 2.

In addition to direct costs, there are other support costs for Cobalt-60 production at Pickering included in Nuclear Base OM&A (Ex. F2-2-1, Table 1), which consist primarily of labour costs related to sales and administration.

4.2 Tritium Sales

The direct costs for the tritium sales program are primarily Canadian Nuclear Laboratories' dispensing fees, packaging, and shipping costs. The product itself is a pure by-product of the detritiation process and no production cost is attached to what is sold.

In addition to direct costs, there are other support costs for the tritium sales program included in Nuclear Base OM&A (Ex. F2-2-1, Table 1), which consist primarily of labour costs related to sales and administration.

4.3 Heavy Water Sales

The direct costs for heavy water sales include labour for handling, testing, loading, unloading, and packaging, the cost of containers, and transportation costs.

4.4 Heavy Water Processing

Direct costs for heavy water processing services are for estimated incremental direct labour costs attached to processing heavy water for Bruce Power at the TRF and direct labour (e.g., handling, testing, packaging) and other costs (e.g., shipping) attached to the provision of other services (e.g., loans, swaps, upgrading) to third parties.

Other support costs for heavy water detritiation processing services relate to sales and support staff dedicated to serving this market, all of which is included in Nuclear Base OM&A (Ex. F2-2-1, Table 1).