Board Staff Interrogatory #245

Interrogatory

Reference:
Exhibit F2 / Tab 5 / Schedule 2 / pp. 2-5

Preamble:

OPG compared OEB-approved and actual / budgeted nuclear fuel costs between 2017 and 2021. Fuel utilization efficiency is noted as a contributor to variances between approved and actual / budgeted nuclear fuel costs (lower efficiency increases nuclear fuel costs).

Question(s):

a) Please clarify what is meant by fuel utilization efficiency in the context of nuclear fuel. Please indicate how fuel utilization efficiency is measured / expressed and please briefly outline its key determinants.

b) What was OPG's fuel utilization efficiency projection for the period 2017 to 2021 and how did OPG's actual efficiency compare?

c) Please explain why OPG had lower than expected fuel utilization efficiency in three out of the five years between 2017 and 2021.

d) How does OPG's projected nuclear fuel utilization efficiency for the period 2022 through 2026 compare to the projected efficiency and achieved efficiency between 2017 and 2021?

e) Please describe the efforts that OPG is making to achieve nuclear fuel utilization performance, including any efforts to improve utilization in the future.

Response

a) Fuel utilization efficiency is a measure of the amount of energy that can be extracted from the uranium fuel source. Fuel utilization efficiency is measured as the electricity energy generation (MWhe) / fuel consumption (KgU). Key determinants are the reactor's burnup rate (the amount of uranium required to generate a MWh), refueling activities (e.g. premature removal of fuel as may be required during a planned or forced outage), defective fuel bundles, and reactor efficiency.

b) Chart 1 below compares the projected fuel efficiency rate in EB-2016-0152 and actual for the period 2017-2020 plus budgeted 2021.

Chart 1

OPG's Fuel Utilization Efficiency (Mwhe / KgU)				
YEARS	Actual	Projected		Variance
2017	59.93	60.51		(0.57)
2018	59.43	60.49		(1.06)
2019	60.79	60.52		0.27
2020	58.25	56.65		1.60
2021	n/a	60.54		n/a

c) The question states that OPG experienced lower than expected fuel utilization efficiency for three of the five years in the period 2017-2021. As set out in Chart 1, as updated for 2020 actuals, there were two years in which fuel utilization efficiency exceeded forecast and two years in which fuel utilization efficiency was lower than forecast. OPG's 2020-2026 Business Plan projects lower fuel utilization efficiency in 2021 compared to EB-2016-0152 forecast.

The lower fuel utilization efficiencies experienced in 2017 and 2018 relative to EB-2016-0152 forecast were due to operational issues such as fuelling machine unavailability and fuel defects in the reactor core. Fuelling machine unavailability can result in fuel being consumed inefficiently, while fuel defects in the reactor can result in fuel being discharged and not being completely consumed.

d) The projected fuel efficiency for the period 2022 through 2026 is lower than the period 2017 through 2021. The main drivers of this are the premature removal of all fuel (resulting in incomplete burnup of the fuel) from Darlington Units 1 and 4 prior to the start of refurbishment as well as an expectation of higher initial short term burnup rates when Unit 3, Unit 1 and Unit 4 return to service during the period 2023-2026.

e) All OPG reactor fueling strategies strive to maximize fuel reactor efficiency or fuel burnup rates. OPG's long-term trends of fuel efficiency remain relatively steady but can be affected by such unpredictable operational issues such as fuel defects in the reactor and fueling machine unavailability and the impact of Darlington refurbishment, as discussed above. OPG efforts to maximize fuel efficiency include limiting the discharge of fuel prematurely from the reactor while adhering to the overriding objective of nuclear safety.