K10.6

REGULATED HYDROELECTRIC PAYMENT AMOUNT

1.0 PURPOSE

This evidence presents OPG's requested 2017 payment amount for the company's regulated hydroelectric generation facilities.

2.0 COMBINED HYDROELECTRIC RATE

In OPG's previous payment amounts application (EB-2013-0321), the OEB approved payment amounts independently for the company's previously-regulated hydroelectric generation facilities and the facilities that were newly-regulated at the time of that application. Rather than maintaining two distinct payment amounts in this application, OPG has combined the previously and newly-regulated hydroelectric payment amounts into a single production-weighted average payment amount for the regulated hydroelectric facilities. For comparison purposes, the production-weighted average of the current approved 2015 payment amount is $40.72/MWh, as calculated in Ex. I1-2-1 Table 1a.

3.0 REGULATED HYDROELECTRIC PAYMENT AMOUNT

OPG is seeking approval of a payment amount for the company's regulated hydroelectric facilities of $41.71/MWh, effective January 1, 2017, for the average hourly net energy production (MWh) from the regulated facilities in any given month (the "hourly volume") for each hour of that month. Where production is over or under the hourly volume, regulated hydroelectric incentive revenue payments will be consistent with the OEB's Payment Amounts Order in EB-2013-0321.

The requested payment amount is calculated in Ex. I1-2-1 Table 1. This table also presents the proposed regulated hydroelectric payment rider of $1.44/MWh effective January 1, 2017, as calculated in Ex. H1-2-1 Table 1.

As described in Ex. A1-3-2, section 2.3.2, the hydroelectric "going in" rate is corrected to remove the one-time allocation of nuclear tax losses to the hydroelectric business in the EB-2013-0321 payment amounts order; this calculation is presented in Ex. I1-2-1 Table 2.

Numbers may not add due to rounding

Filed: 2016-05-27
EB-2016-0152
Exhibit I1
Tab 2
Schedule 1
Table 2

Table 2
Adjusted Previously Regulated and Newly Regulated Hydroelectric Payment Amounts

Line No.	Description	EB-2013-0321 Order	Tax Loss Adjustment	Adjusted Payment Amounts
		(a)	(b)	(c)
	PREVIOUSLY REGULATED PAYMENT AMOUNT:	Note 1	Note 3	
1	**Revenue Requirement ($M)**	1,652.8	13.1	1,665.8
2	**Forecast Production (TWh)**	41.1	-	41.1
3	**Payment Amount ($/MWh)** (line 1 / line 2)	40.20	0.32	40.52
	NEWLY REGULATED PAYMENT AMOUNT:	Note 2	Note 4	
4	**Revenue Requirement ($M)**	751.9	8.6	760.5
5	**Forecast Production (TWh)**	17.9	-	17.9
6	**Payment Amount ($/MWh)** (line 4 / line 5)	41.9	0.47	42.40

Notes:
1 From Payment Amounts Order, Appendix B, col. (a), lines 1 and 2
2 From Payment Amounts Order, Appendix C, col. (c), lines 1 and 2
3 Tax loss adjustment to EB-2013-0321 revenue requirement from Ex. I1-2-1, Table 2a, col. (a), line 15
4 Tax loss adjustment to revenue requirement from Ex. I1-2-1, Table 2a, col. (b), line 15

Numbers may not add due to rounding.

Filed: 2016-05-27
EB-2016-0152
Exhibit I1
Tab 2
Schedule 1
Table 1a

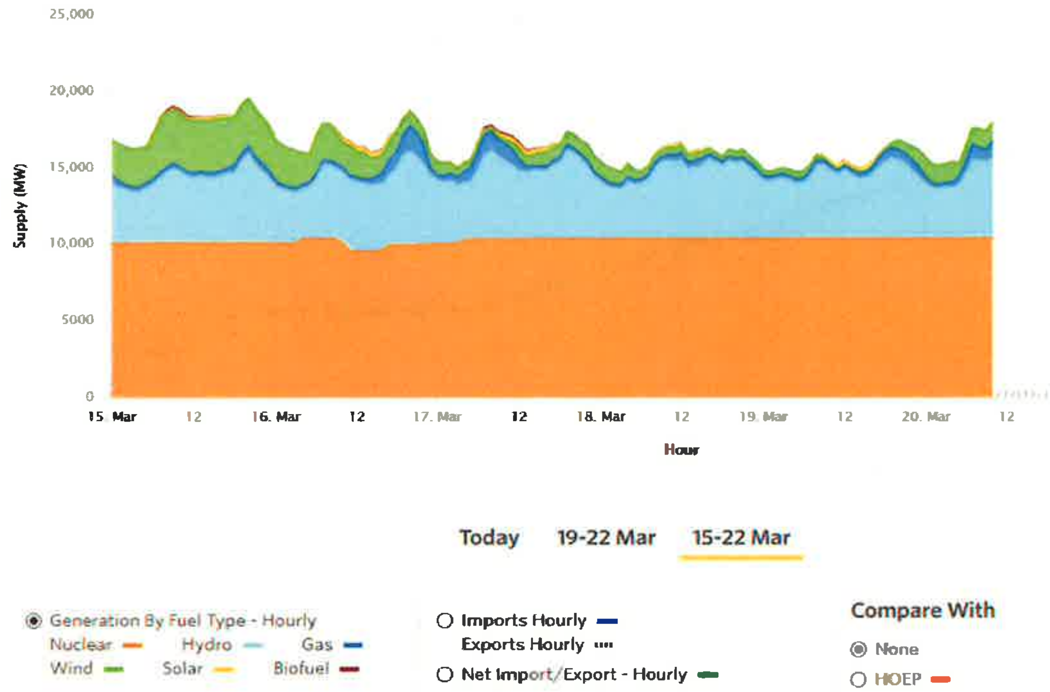
Table 1a
Notes to Table 1, Combined Hydroelectric Payment Amount

Line No.	Description	Note	EB-2013-0321	Tax Adjusted EB-2013-0321
			(a)	(b)
1	Previously Regulated Hydroelectric Payment Amount ($/MWh)	1	40.20	40.52
2	Newly Regulated Hydroelectric Payment Amount ($/MWh)	2	41.93	42.40
3	2014-2015 OEB Approved Production (Previously Regulated Hydroelectric) (TWh)	3	41.1	41.1
4	2014-2015 OEB Approved Production (Newly Regulated Hydroelectric) (TWh)	4	17.9	17.9
5	Total 2015 OEB Approved Regulated Hydroelectric Production (line 3 + line 4)		59.0	59.0
6	Previously Regulated Portion of Production-Weighted Average Payment Amount ($/MWh) (line 1 x line 3 / line 5)		28.00	28.23
7	Newly Regulated Portion of Production-Weighted Average Payment Amount ($/MWh) (line 2 x line 4 / line 5)		12.72	12.86
8	Production-Weighted Regulated Hydroelectric Payment Amount ($/MWh) (line 6 + line 7)		40.72	41.09
9	Deferral and Variance Account Recovery Payment Rider	5	3.19	3.19
10	Interim Period Shortfall Rider	6	0.64	0.64
11	Production-Weighted Regulated Hydroelectric Payment Amount ($/MWh) (Including Riders) (line 8 + line 9 + line 10)		44.55	44.92

Notes:
1 See Ex. I1-2-1 Table 2, line 3
2 See Ex. I1-2-1 Table 2, line 6
3 Per EB-2013-0321 Payment Amounts Order, Appendix B, Table 1
4 Per EB-2013-0321 Payment Amounts Order, Appendix C, Table 1
5 Per EB-2014-0370 Payment Amounts Order, Appendix A, Table 1, line 12
6 Per EB-2014-0370 Payment Amounts Order, Appendix A, Table 3, line 4

Question: If the actual production is greater than the forecast does that result in extra income to OPG?

Question: The IESO data indicates that the total hydro output (36 TWh) is only about half of the theoretical value (8500 MW x 24x365 = 74.5 TWh). Could this be improved?



Question: The graph appears to show that the hydro generators are handling the demand variations. Does this result in an impairment of their energy conversion efficiency?

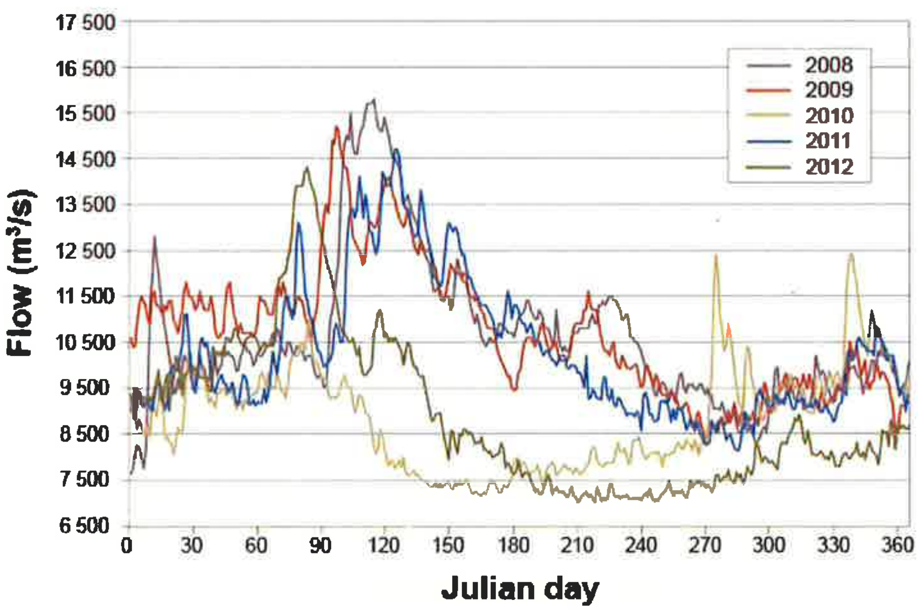
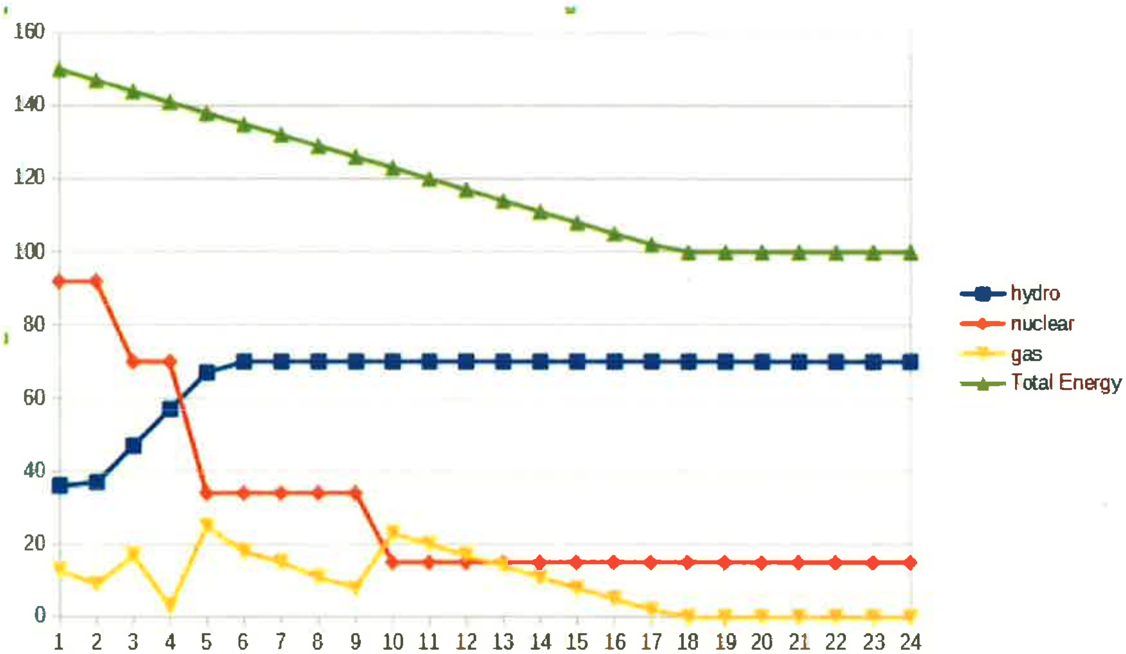


Figure 6. Annual flow pattern in the St. Lawrence River at Sorel from 2008 to 2012

Question: The river flow rates typically vary over a wide range. Could the station outputs be increased by increasing the turbine capacity if a means of using or storing the production is available?

Power Generation from the principal supply sources (TWh)



Question: If consumers reduce their power consumption for heating, air conditioning and hot water will that reduce the total power consumption as qualitatively shown by the green line?

Question: If consumers employ storage that accumulates both heat and electricity would the latter enable the spring hydro generation to be increased, as qualitatively shown by the blue line?

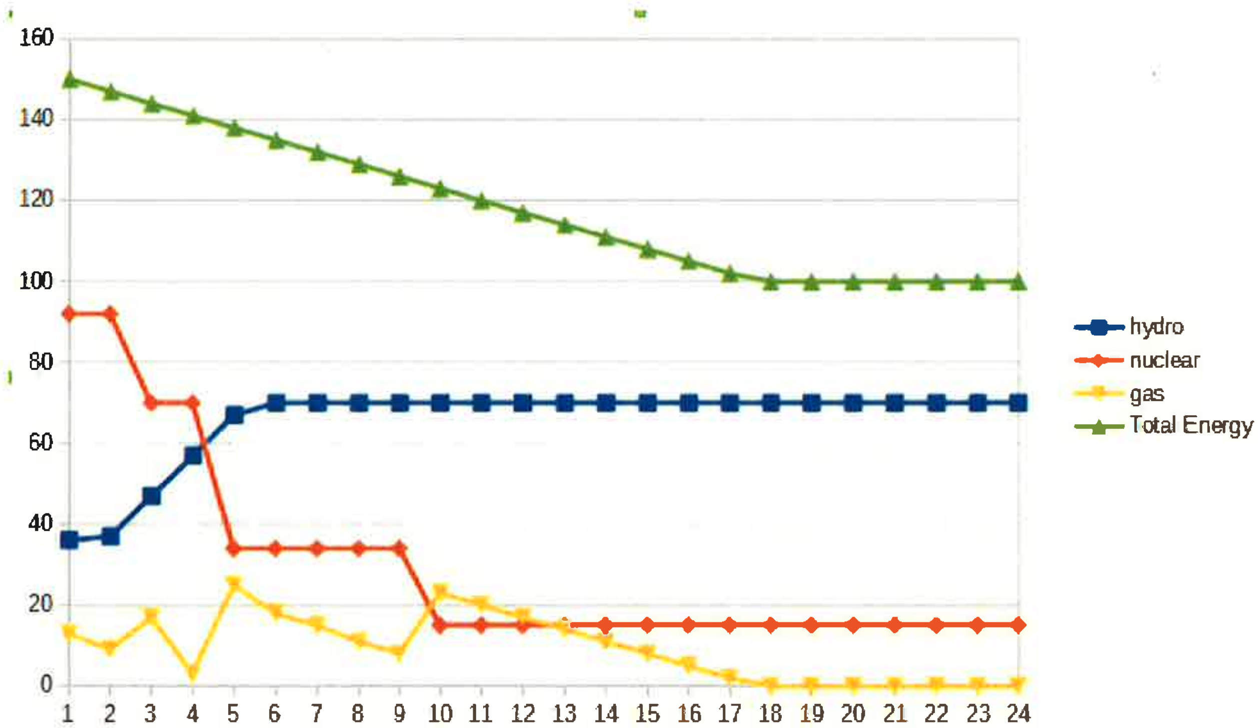
Question: If consumers employ procedures that shift the demand from high demand periods to low demand periods will that reduce the power capacity requirements?

Question: If the demand is decreased and the hydro generation is increased how will the demand/supply be rebalanced?

Question: If all 10 Darlington and Bruce reactors are refurbished and the power demand declines in response to the green energy initiatives how will the choice be made between cutbacks for hydro, nuclear and wind power?

Appendix 1 – Basis of supply projections

Ontario electricity supply to 2040



The premise of this projection is that the majority of Ontario's buildings will switch from gas to exergy storage for heating (and cooling and DHW) over the coming 20 years, and that change will not be under the control of the electricity generators. That reduces the electricity demand by one third (to 100 TWh/y) and it flattens the seasonal demand peaks, leaving just the daily demand variations to be handled. Nominally that requires an average of 8,000 MW of power capacity but we want to use the ponding for storage so that increases the maximum power demand by a factor of 1.125, bringing it to 9,000 MW, which happens to be the current power rating of Ontario's hydro generation network.

However, the rivers do not deliver that power output at all times of the year so there is a need to provide a means of storing electricity produced during the high flow seasons, or alternatively to provide some extra power during the low flow periods. Exergy stores provide sufficient storage capacity to handle that extra energy but they return it in the form of heat rather than electricity so we will need to employ repurposing to use some of the hydro ponding storage to handle the supply variations. The hydro stations are likely to require a modest increase in the generation capacity of a few of the stations, both to accumulate the extra energy available in the spring and to increase the power delivery capacity from the stored ponding energy but that is the only anticipated expense for the generators. There isn't enough information presently available to calculate the amount of the increase needed in the power output.

One of the available alternatives is to increase the amount of wind capacity from its end value of 15 TWh to a higher value. That is attractive in systems that provide electricity storage because it ensures that the wind power is always efficiently employed. Another alternative would be to import a little bit of electricity from Quebec, particularly at night. Quebec has a hydro capacity of 36,000 MW and they will have a considerable surplus to share if they also begin to make use of exergy stores.

Part of the required boost will come from simply making better use of Ontario's existing hydro capacity. As things stand when the nuclear stations are producing more power than the grid needs the output from the hydro stations is cut back, representing a substantial loss in the station efficiencies. Any form of electricity storage, including combined electricity + heat storage (i,e, exergy storage) can be used.

The graph shows the nuclear stations being shut down (all but Darlington 2 and Bruce 4) on the dates at which their CNSC licences expire. OPG has proposed that the shutdown of the Pickering station should be delayed until 2024 and that would be of considerable help in providing a surplus of power to stretch out the rapid rise in the annual energy output of the hydro stations that is shown in the graph. It would also flatten out both of the first two peaks in the gas-fired generation graph, but not the third peak. The existing gas-fired generation capacity is sufficient to handle that peak and to provide a margin to ensure that adequate power is available at other times, particularly considering that the primary cause of the grid demand variations is the thermal demand that is progressively removed by the exergy stores.

The primary challenge of this solution is the primary premise outlined in the opening sentence – persuading building owners to switch to exergy stores. Such stores cost almost nothing to run but they entail a substantial capital cost for their construction. Although they should pay for themselves in 5-10 years they have to compete with cheap, plentiful shale gas for heating applications. To overcome that differential the owners of exergy stores should be exempted from the payment of the Global Adjustment, which is mostly a subsidy for nuclear power that is unfair to exergy storage, which is otherwise much cheaper, cleaner, safer and more permanently sustainable. That could be done by rating them as Class A customers.

Since the output of the hydro stations would be nearly doubled over the coming five years the hydro rate per MWh paid to OPG should be reduced commensurately, and during the period 2021 to 2026 the nuclear power rates for both Bruce and OPG could likewise be reduced, hopefully resulting in a rate reduction for ratepayers as well. In addition, up to 200 TWh of energy that is presently being supplied via natural gas would be replaced by GHG-free, permanently sustainable energy sources. That reform should be considered to be mandatory. There are numerous additional advantages: the energy is all from local Ontario sources rather than being imported, the transmission costs for both electricity and natural gas are reduced, the hazards of both gas and nuclear radiation are eliminated, and the systems will continue to function even if the transmission lines are damaged by storms.

Ontario Regulation 53/05 states that "the Board shall accept the need for the Darlington Refurbishment Project in the light of the Plan of the Ministry of Energy known as the 2013 Long Term Energy Plan..." This projection therefore assumes that the refurbishment of Darlington Unit 2 will continue and its licence will be extended. The Ministry instructions have Off Ramp provisions for the remaining reactors that may be exercised in the future, especially since the adoption of more recent commitments like the Paris Framework Agreement may supersede the plans made under the 2013 LTEP. The Bruce reactors, wind turbines and gas-fired stations are not subject to this OEB hearing but to consider the merits of the OPG plans it is necessary to have an overview of the electricity supply plans to ensure that the supplies will meet future demands without incurring duplication, overlap or unnecessary costs.

This review raises the potential that the payment rates proposed by OPG may be excessive for hydro power because the generation potential may be underestimated and may also be excessive for the nuclear power because the assumptions made for both the nuclear generation costs and the expenditures on refurbishment may not be reasonable.

Projections prepared by Ron Tolmie, Sustainability-Journal.ca, based on IESO reports for 2016 data.