Board Staff Interrogatory #205

Interrogatory

Reference:
Exhibit F2 / Tab 1 / Schedule 1 / Attachment 5 / pp. 3, 7-10

Question(s):

a) Please identify whether any of OPG's peers in the EUCG normalize their TGC using the same factors that are used by OPG for any benchmarking they may do. Please identify whether any of OPG's peers in the EUCG normalize their TGCs by other factors not used by OPG for any benchmarking they may do.

b) Please provide the analysis of variance (ANOVA) results from the multiple linear regression used to quantify the relationship between variables for the predictive TGC model. Specifically, please comment on the statistical significance of the results.

c) The multiple linear regression used to develop the mathematical model for TGC included variables for reactor type, site capacity, and unit age. However, site capacity was not used when calculating Pickering NGS and Darlington NGS's normalized TGC. Please comment as to why this variable was not included in the regression for normalized TGC and how the results would have differed had it been included. In the response, please elaborate further on why an adjustment to station MWhs produced would be required if site capacity were considered in the results.

d) Please provide a directional indication of benchmarking results for each of Pickering NGS and Darlington NGS (i.e. does it result in a higher or lower ranking) due to the application of a normalization to TGC / MWh on the basis of site capacity.

e) Please provide how much above / below the median each of Darlington NGS and Pickering NGS are relative to the median age (used to determine the age-related adjustment).

f) ScottMadden stated that "we were unable to develop a sufficiently predictive model for cost performance (TGC / MWh)" (Exhibit F2 / Tab 1 / Schedule 1 / Attachment 5 / p. 7). However, a comparative figure of adjusted TGC / MWh for the EUCG panel, including Pickering NGS and Darlington NGS, is provided on page 10 at Exhibit F2 / Tab 1 / Schedule 1 / Attachment 5. Considering this, please explain how the noted figure was produced.

Response

a) OPG does not have knowledge of the benchmarking normalization of its EUCG peers and whether they normalize or adjust their total generating cost ("TGC") either using the same factors that are used by OPG or any other factors for any benchmarking they may do. See Ex. L-F2-01-Staff 202(f).

b) The following response has been provided by ScottMadden:

Summary output including analysis of variance (ANOVA) table

Regression Statistics	
Multiple R	0.8919
R Square	79.6%
Adjusted R Square	79.4%
Standard Error	136841
Observations	567

R Square indicates what percent of the variability in the dependent variable (TGC) is explained by changes in the independent variables (PWR, BWR, Site Capacity, and Unit Age)

Adjusted R Square adjusts R Square to account for the number of variables in the model and is always lower than R Square

Nine years of data for 63 plants (9 x 63 = 567)

ANOVA

	df	SS	MS	F	Significance F
Regression	4	4.09E+13	1.02E+13	546.57	4.47E-192
Residual	562	1.05E+13	1.87E+10		
Total	566	5.15E+13			

In general, to test that all of the slope parameters in a multiple linear regression model are 0, we use the overall F-test reported in the analysis of variance table.

Large values of the test statistic provide evidence against the null hypothesis.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	302477	51587.11	5.8634	7.74E-09	201150	403804	201150	403804
PWR	-255421	33037.83	-7.7312	4.95E-14	-320313	-190528	-320313	-190528
BWR	-283946	34751.52	-8.1708	2.04E-15	-352205	-215687	-352205	-215687
Site Capacity (MWe)	261	8.04	32.4357	7.39E-131	245	277	245	277
Unit Age (Months)	346	70.33	4.9211	1.13E-06	208	484	208	484

These coefficients are used to adjust TGC

This coefficient is not used to adjust TGC to be more conservative and avoid simultaneous, corresponding adjustments to MWh of generation

Very small p-values indicate coefficients very likely non-zero

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c) The following response has been provided by ScottMadden:

We do not adjust costs for differences in site capacity, despite this being a significant driver of cost, since this would also have required a complex adjustment to generation. Adjusting for site capacity would follow the logic of other adjustments to cost. In this model, that would mean adjusting costs by ~C$261k per MW per year for each site by a multiple of (median capacity in MW across all sites minus the capacity of the specific site in MW). However, such an adjustment for site

capacity would also require that we adjust the MWhs produced by the site in kind. This adjustment would require determination of, for example, the capacity factor to use when determining the change in MWh, further complicating the adjustment and magnifying differences across sites in certain periods. ScottMadden thus felt it more conservative and intuitive to adjust only for technology and age of equipment. The ScottMadden response to subpart "d" addresses the question of how the results would have differed had the adjustment included site capacity.

d) The following response has been provided by ScottMadden:

ScottMadden did not perform an adjustment for site capacity due to the reasons stated in subpart c. However, we can comment on the range of site capacities in the dataset and compare those to site capacities for OPG. In the dataset, 25% of the sites had 1,041 or fewer MWe of capacity, 50% had 1,737 MWe or fewer, 75% had 2,250 MWe or fewer, and 6,381 MWe represented the maximum site capacity. PNGS and DNGS had 3,094 MWe and 3,512 MWe of site capacity, respectively. Higher site capacities are related to higher costs, raising TGC/MWh, but higher site capacities also allow for greater MWh of generation, lowering TGC/MWh. The amount of additional MWh of generation produced depends on how consistently the plant operates and at what percentage of capacity.

e) The median age (used to determine the age-related normalization adjustment) was 396.5 months. Darlington's age was 305.9 months (90.6 months below median). Pickering's age was 449.5 months (53 months above median).

f) Following ScottMadden's statement that they "were unable to develop a sufficiently predictive model for cost performance (TGC/MWh)", ScottMadden goes on to state that they "were able to develop a powerful predictive model for site costs (TGC)" (Ex. F2-1-1, Attachment 5, p. 8). Based on that model, ScottMadden established a normalization methodology that included cost adjustments related to reactor type and unit age. ScottMadden then divided these adjusted costs by the actual MWh of production to arrive at the figure shown at Ex. F2-1-1, Attachment 5, p. 10.