EB-2007-0905

BEFORE THE ONTARIO ENERGY BOARD

Application Ontario Power Generation Inc. for Determination of Payment Amounts for the Output of Certain of Its Generating Facilities

GEC-Pembina-OSEA Cross Materials

Pollution Probe Interrogatory #1

Ref: Ex. C2-T1-S1

Issue Number: 2.1
Issue: What is the appropriate capital structure for OPG's regulated business for the 2008 and 2009 test years? Should the same capital structure be used for both OPG's regulated hydroelectric and nuclear businesses? If not, what capital structure is appropriate for each business?

Interrogatory

If the Board does not approve OPG's proposal to recover 25% of its nuclear revenues via a capacity charge, please provide your recommended capital structure for OPG's regulated assets. Please also justify your response.

Response

Historical variances from forecast in production from 2005 - 2007 indicate that the average short-fall has been approximately 2.5 TWh (shortfalls of approximately 0.2, 2.5 and 5 TWh respectively in 2005, 2006 and 2007); the standard deviation of the three short-falls is also approximately 2.5%. With the proposed fixed payment of 25% of the nuclear revenue requirement, a 2.5 TWh reduction from forecast nuclear production would reduce total regulated earnings (assuming a 34% tax rate) by approximately $62 million and the ROE (based on 2009 regulated equity) by approximately 1.5%.

If the fixed payment were not approved, the same reduction from forecast production would reduce total regulated earnings by approximately $84 million, a reduction in the regulated ROE of approximately 2%. The corresponding reductions at short-falls of 0.2 and 5 TWh result in reductions to the ROE of approximately 0.8% and 3% with the fixed payment and 1% and 4% without the fixed payment.

The standard deviations of the reduction in ROEs under the three scenarios with and without the fixed payment are approximately 1.1% and 1.5% respectively, a difference of 0.4%. The increase in the potential variability of returns would in principle increase the cost of capital, but there is no documented empirical relationship between the variability in earned returns on book value and the cost of capital. In Ms. McShane's judgment, the increase in the required ROE could be approximately half the increase in the variability, i.e., approximately 25 basis points. In the alternative, a 25 basis point increase in return on equity could be reflected in the capital structure, resulting in an equity ratio of approximately 60%.

Board Staff Interrogatories for GEC

INTERROGATORY #2

2) On page 10, it states McShane estimated a 25 basis point increase in ROE would be required in the absence of the 25% fixed payment for nuclear. How did Mr. Chernick arrive at the conclusion that "since nuclear represents only 45% of OPG investment" then the entire nuclear risk would be four-fold higher than 25 basis points (or 100 basis points)? Also, please explain why Mr. Chernick then states on page 11 that the 25% fixed payment for nuclear would reduce the cost of capital by 32 basis points.

Response

The question conflates two adjustments.

First, I started with Ms. McShane's estimate that offloading 25% of nuclear revenue risk onto ratepayers would reduce OPG's composite required return of equity by 25 basis points. Assuming that the risk-return relationship is linear, I extrapolated 100% of the nuclear revenue risk to 100 basis points on OPG's composite required return of equity.

Second, I recognized that the 100 basis points on OPG's composite required return of equity is not due to all of OPG's capital investment, but only the 45% of its investment that is nuclear. If 45% nuclear investment imposes revenue risk worth 100 basis point, 100% nuclear investment (e.g., in OPG's nuclear division, not mixed with the hydro operations) would impose risks worth $100 \div 0.45 = 222$ basis points.

Pollution Probe Interrogatory #2

Ref: Ex. C2-T1-S1

Issue Number: 2.1
Issue: What is the appropriate capital structure for OPG's regulated business for the 2008 and 2009 test years? Should the same capital structure be used for both OPG's regulated hydroelectric and nuclear businesses? If not, what capital structure is appropriate for each business?

Interrogatory

Assuming the Board determines that OPG's regulated nuclear and hydro-electric businesses should have two distinct stand-alone capital structures, please state your recommended capital structures for each of these two businesses. With respect to the nuclear business, please state your recommended capital structure assuming that:

(a) the Board approves OPG's proposal to recover 25% of its nuclear revenues via a capacity charge; and

(b) the Board does not approve OPG's proposal to recover 25% of its nuclear revenues via a capacity charge.

Please also justify all of your responses.

Response

The determination of stand-alone capital structures for the nuclear and hydroelectric businesses requires significant judgment for two reasons:

(1) There are no direct proxies for the regulated hydroelectric business. There are no publicly traded electric utilities in Canada that have significant hydroelectric generation. All of the major hydroelectric intensive utilities are government-owned. FortisBC, the only investor-owned utility with significant hydroelectric generation, is a small subsidiary of a larger company with a broad base of utility assets and real estate properties. While Brookfield Asset Management owns significant hydroelectric generation assets, directly and through its ownership interest in Great Lakes Hydro Income Fund, the hydroelectric assets are a relatively small piece of the business.

In the U.S., hydroelectric generation is a significantly less important source of generation than in Canada. In 2005, it accounted for less than 7% of total electricity generated. The proportion of total electricity generated by conventional hydroelectric facilities has been declining since the mid-1990s. Further, just under 25% of hydroelectricity generation capacity is owned by investor-owned

utilities; federal government agencies own over 50% of the total capacity, no trading information is available for that capacity. Of the investor-owned utilities that own hydroelectric generation capacity, there are only eight that have significant hydroelectric generation. Two are non-investment grade, one has only been publicly traded since mid-2006, four have very minor proportions of total assets devoted to hydroelectric generation, leaving only one company (IdaCorp) with a significant portion (approximately 25%) of total assets devoted to hydroelectric generation. In sum, there are insufficient hydroelectric-specific data from which to reliably estimate a stand-alone cost of equity for hydroelectric generation operations.

(2) An initial attempt (using data ending 2005) to quantitatively isolate the cost of capital for the nuclear business using samples of publicly-traded utilities produced results that were directionally reasonable (a risk premium based on the CAPM of approximately 2.0-2.5% higher than that applicable to the benchmark utility sample), but given the small sample of utilities used to represent the nuclear operations, the relatively small difference between the betas for the nuclear-intensive companies and the other-generation intensive companies, and thus the sensitivity of the results to small changes in beta, as well as other potential explanations for the beta differences between the nuclear-intensive and other generation-intensive companies, and the derived nuclear-only and other generation-only betas (e.g., regulatory framework), the results are not empirically robust. An update of the analysis using data ending 2006 produced results that were inconsistent with the qualitative business risk analysis, which, for nuclear operations, include the technical challenges and the high proportion of fixed costs. (See also discussion of nuclear risks as they pertain to OPG at pages 68 - 77 of Ms. McShane's report Ex. C2-T1-S1). Specifically, the updated analysis indicated that the cost of capital for nuclear operations was lower than for the composite of other generation (hydroelectric, fossil, and renewable resources).

In light of these results and considerations, the estimation of separate costs of capital (capital structures and ROEs) for the nuclear and hydroelectric businesses requires significant judgment. Ms. McShane's analysis of OPG's composite regulated operations supported a reasonable return on equity for OPG's composite regulated operations of 11.75% to 12.0% at a 45% common equity ratio, or a common equity ratio of 55%-60% (mid-point of 57.5%) at the benchmark ROE of 10.5%. If the intuitively reasonable 2.25% risk premium initially estimated for the nuclear business (at the average common equity ratio of the companies in the samples) were applied to the 10.5% benchmark ROE, the ROE for the nuclear business would be approximately 12.75%. The corresponding common equity ratio for the nuclear business at the benchmark ROE of 10.5% would be close to 65%.

The returns and capital structures are effectively a weighted average of the costs of capital of the hydroelectric and nuclear operations. The nuclear assets represent approximately 45% of OPG's total regulated assets and the hydroelectric assets comprise the remaining 55% (as measured by forecast 2009 rate base). The application

of a 45% weighting to the nuclear operations at a common equity ratio of 65% and an ROE of 10.5% to the common equity ratio of 57.5% and the same 10.5% ROE results in a common equity ratio for the hydroelectric operations of approximately 50%.

Alternatively, using the regulated hydroelectric operations as the point of departure, given its business risk profile, Ms. McShane's best estimate of the appropriate common equity ratio at the benchmark ROE would be 45%, equal to that of the benchmark (low risk) U.S. utility sample. The low risk U.S. utility sample used to establish the benchmark return on equity is largely a "wires" sample (average generation component, as percent of total assets, of less than 10%). Inherently, generation operations are more risky than "wires" operations, as they are not a natural monopoly and they face higher operating/physical risks. On the spectrum of generation technologies, hydroelectric operations are at the lower end of the scale (i.e., less risky than nuclear and fossil). Given the primarily baseload nature of the regulated hydroelectric operations and the mitigation of the inherent hydrology risks of OPG's regulated hydroelectric operations via the variance account, Ms. McShane views their level of business risk as similar to that of the benchmark low risk utility sample. Thus, a reasonable capital structure for the stand-alone hydroelectric operations on that basis would be similar to that of the sample, that is, a common equity ratio of approximately 45% at the benchmark ROE of 10.5%. With a return on equity for the composite regulated operations of 11.75% to 12.0% and a return on equity of 10.5% for the hydroelectric operations (both at a 45% common equity ratio), the implied return on equity for the nuclear operations is approximately 13.5% (11.875% = .55(10.5%) +.45x). Translating the indicated ROE of 13.5% on a common equity ratio of 45% to the indicated common equity ratio compatible with the benchmark ROE of 10.5% results in an equity ratio of close to 75% for nuclear operations.

The combination of the two approaches, while they are based on a number of assumptions and are subject to significant judgment, produce a range of results that are not unreasonable, that is, a range of common equity ratios of 45%-50% for the hydroelectric operations and 65%-75% for the nuclear operations at the 10.5% benchmark ROE. In Ms. McShane's view, the range of indicated equity ratios for the hydroelectric operations, in conjunction with the benchmark ROE is reasonable. With regard to the nuclear operations, an equity ratio of 65% to 75%, while common for unregulated companies, may be considered higher than necessary for a regulated business, even one with the risks faced by the nuclear operations. If the OEB were to deem separate costs of capital for the nuclear and hydroelectric businesses, the upper end of the recommended range of common equity ratios for the total prescribed assets (60%) would be reasonable, combined with an ROE in the approximate range of 11.0% to 11.5%, assuming that the fixed payment is approved. In the case the fixed payment is not approved, please see response to L-12-4.

Q: Do you believe that Ms. McShane's estimate of the cost of capital for OPG's hydro operations is reasonable?

A: While I have not attempted to independently verify Ms. McShane's estimate, it seems reasonable. Ms. McShane's estimated cost of capital for OPG's hydro operations is about 8%, which is similar to the costs of capital embedded in the bids in the current procurement of peaking capacity under cost-of-service contracts conducted by the Connecticut Department of Public Utility Control (Docket No. 08-01-01). Bidders were allowed to offer costs of equity up to 10.75%, indexed to allowed utility ROE (but with a 9.75% floor), and up to 60% equity. Bidders offered ROEs from 9.75% to 10.75%, and equity of 40% to 50%. With a 6% debt cost, these bids are equivalent to 7.8% to 9.1% overall return. The bids that have been recommended by experts for the Department and the Office of Consumer Counsel (including me) offered returns equivalent to 8.2% to 8.6%.

Q: How much greater might the cost of capital be for nuclear investments than for hydroelectric investments?

A: There are several distinct nuclear risks. Ms. McShane separately quantifies the cost of one risk—of variation in energy production—in estimating the effect on cost of capital of OPG's proposal to recover 25% of its nuclear revenues through a fixed charge. In Exhibit L-T12-S1, she estimates that "If the Board does not approve" that proposal "the increase in the required ROE could be approximately...25 basis points." If bearing 25% of the nuclear revenue risk requires 25 basis points, the entire nuclear revenue risk would be about 100 basis points, or a full 1% increase in ROE. Since nuclear represents only 45% of OPG's investment, Ms. McShane's quantification of the output risk over the next two years would require a 222-basis-point increase in the return on equity for the

nuclear operations alone, or (for a capital structure with 57.5% equity) 128 basis points on overall return for the nuclear operations compared to operations without output risks. The 25% fixed-cost recovery would reduce the cost of capital for nuclear investment by 32 basis points.

Ms. McShane (Exhibit L-T12-S1) also estimates that a nuclear-only operation, with the fixed-charge proposal, but exposed to other risks, would require a combination of higher equity returns and/or more equity in the capital structure, as about 70% equity at the base 10.75% ROE or 60% equity at 11.25% ROE. Either of these estimates, with a 6% debt cost, would result in a 9.15% overall return, 56 basis points more than the return with OPG's requested capital structure and ROE.

Q: Are these two factors additive?

A: Yes, as Ms. McShane acknowledges in Exhibit L-T12-S1. The resulting nuclear cost of capital would thus be about 32 basis points more than the return requested by OPG, or roughly 9.5 %.

Q: Are you endorsing Ms. McShane's estimate of the nuclear risks?

A: No. I believe that she may be understating the risk of nuclear investments by assuming that consumers would cover large parts of the risks.

The nuclear cost of capital I compute from Ms. McShane's estimates is about 100 basis points greater than that for the Connecticut peaking plants. This small differential is plausible only to the extent that ratepayers remain at risk for all prudent costs, including long-term outages and early retirement. The full risk of nuclear investment to OPG and consumers is almost certainly greater than the 9.5% regulated-nuclear cost.

Q: Have you estimated the cost of capital for an enterprise fully exposed to the risk of owning and operating nuclear capacity?

An inadequate return, on the other hand, undermines the ability of a utility to compete for investment capital. Moreover, inadequate returns act as a disincentive to expansion, may potentially degrade the quality of service or deprive existing customers from the benefit of lower unit costs that might be achieved from growth. In short, if the utility is not provided the opportunity to earn a fair and reasonable return, it may be prevented from making the requisite level of investments in the existing infrastructure in order to reliably provide utility services for its customers. The OEB has recognized the importance of a financially viable energy sector and the need for additional energy infrastructure, particularly generation and transmission, in its Strategic Business Objectives set out in its 2006-2009 Business Plan (December 2005). Fair and reasonable returns are central to the achievement of those objectives.

B. THE STAND-ALONE PRINCIPLE

A fair return for OPG's regulated operations, which encompasses both capital structure and return on equity, should respect the stand-alone principle. The stand-alone principle has been respected by virtually every Canadian regulator, including the OEB, in setting both regulated capital structures and allowed returns on equity.

The stand-alone principle is the notion that the cost of capital incurred by ratepayers should be equivalent to that which would be faced by the regulated operations if they were raising capital in the public markets on the strength of their own business and financial parameters. In other words, application of the stand-alone principle to OPG's regulated operations means they should be treated for regulatory purposes as if they were operating separately from the other activities of the firm. The cost of capital borne by ratepayers should reflect neither subsidies given to, nor taken from, other activities of the firm.

The evaluation of the appropriate capital structure and common equity return on a "stand-alone" basis avoids: (1) the misconception that the cost of raising capital to invest in a project (the financing decision) is the same as the cost of capital (required return) of the project (the

investment decision); and (2) the potential that hidden subsidies created by using an inappropriate cost of capital can distort the economics of the project itself. To illustrate, the Federal Government can raise long-term debt at relatively low interest rates because its taxing power assures the cash flows needed to reimburse investors. If the Federal Government were to consider investing either in natural gas exploration and development or a water utility, its evaluation of the two potential investments should be based on required returns that reflect the different business risks of the two projects, not the cost to the Federal Government of raising debt to finance its investment. A failure to do so, that is a failure to respect the "stand-alone" principle, could lead to the erroneous conclusion that the oil and gas development project was the superior project and thus to an uneconomic allocation of capital resources. Effectively, the Federal Government would be subsidizing natural gas exploration and development, while potentially allowing a superior project to fail to attract investment funds. Respect for the stand-alone principle ensures that scarce capital resources are efficiently allocated to their best use. The allowed return should thus represent the stand-alone risk and associated cost of capital of the operations, not the happenstance of ownership.

C. RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND COST OF CAPITAL

The stand-alone principle is grounded in the basic tenet of financial theory that the opportunity cost of capital to a firm, or division of a firm, is a function of its business risk. Business risk comprises the operating elements of the business that together determine the probability that future returns to investors will fall short of their expected and required returns. Business risk is a function of the fundamental characteristics of the operations, i.e., of the firm's assets. In the absence of income taxes and the added costs related to the loss of financial flexibility and financial distress or ultimately bankruptcy, the overall cost of capital would not change as the manner in which it was financed changed. The cost of capital would be the same if a firm were financed with 100% equity or 100% debt. In the absence of income taxes, the sum of the cash flows, available to both the debt holders and equity holders does not change as the capital

For Tx, I have relied on the approach that was adopted by the OEB for electricity distributors in 2000, and by the NEB (1995) and AEUB (2004). Specifically, I determined the appropriate capital structure for Tx, based on the principles set out in Section III.A below, that would equate Tx to a benchmark Canadian utility, and then estimated the fair return on equity for a benchmark Canadian utility.

III. DETERMINATION OF APPROPRIATE CAPITAL STRUCTURE

A. PRINCIPLES

The following principles should be respected when establishing the appropriate capital structure for Tx.

1. The stand-alone principle.
2. Compatibility of capital structure with business risks.
3. Maintenance of creditworthiness/financial integrity.

Each of these principles is defined below.

1. The Stand-Alone Principle:

The stand-alone principle encompasses the notion that the cost of capital incurred by the ratepayers should be equivalent to that which would be faced by each division raising capital in the public markets on the strength of its own business and financial parameters. The cost of capital should reflect neither subsidies given to, nor taken from, other activities of the firm. Application of the stand-alone principle to Tx means it should be treated as if it were operating as an independent entity. Respect for the stand-alone principle is intended to promote efficient allocation of capital resources among the various activities of the firm.

In the case of Hydro One (and notionally Tx), the utility's cost of debt benefits from a "halo" effect due to the identity of its shareholder, the Province of Ontario. The ratings of Hydro One on a purely stand-alone basis would be lower if it were not for the implied support of the Province as shareholder. The ratepayers receive the benefit of the "halo effect" at no cost (i.e., there is no fee paid to the Province for the implied potential financial support). The proper application of the stand-alone principle to the determination of capital structure for Tx ignores the halo effect; the capital structure should reflect Tx's own risks irrespective of the happenstance of ownership.

2. Business Risks:

The capital structure should be consistent with the business risks of the specific entity for which the capital structure is being set. The business risks to which investors in a utility are exposed are those that reflect the basic characteristics of the operating environment and regulatory framework of the utility that can lead to the failure to recover a compensatory return on, and/or the return of the capital investment itself.

3. Maintenance of creditworthiness/financial integrity:

A reasonable capital structure, in conjunction with the returns allowed on the various sources of capital, should provide the basis for stand-alone debt ratings in the A category. The importance of debt ratings in the A category for Hydro One and for Tx on a stand-alone basis is discussed in detail in Section III.C.

B. BUSINESS RISKS

Business risks have both short-term and longer-term aspects. The capital structure and fair return on equity should reflect both short- and long-term risks. Long-term risks are important because utility assets are long-lived. Because utilities are generally regulated on the basis of annual revenue requirements, there has been a tendency to downplay longer-term risks, essentially on the grounds that the regulatory framework provides the regulator an opportunity to compensate the shareholder for the longer-term risks when they are experienced. This premise may not hold. First, customer resistance may forestall higher returns rewards when the risk

With respect, Dr. Booth's view seemed to be analytical, and not data based. He referred to the approach taken by the Alberta Board in the case of Altalink, a comparator that was not demonstrated to be apt.

It is the Board's view that there really is no convincing quantitative evidence before us which suggests that transmission is more or less risky than distribution. It is true that distribution has greater and more immediate exposure to the possibility of bad debts. On the other hand, in absolute terms, the transmission system involves very large capital projects of significant complexity, which can be subject to delay in completion, and consequential delay in expected revenues. On balance, the Board concludes that the evidence before us does not provide a basis upon which we can make a finding that there is any meaningful difference in risk as between distribution and transmission.

The Company is in a unique position compared to other utilities in the province. It alone among all of the utilities in Ontario operates a major transmission business and an equally large distribution business. If the Company believes that there is a significant risk differential between its two business segments, it should have been able to present much more convincing evidence respecting the relative risks. The fact that it did not is telling.

It follows that the ROE for the transmission arm of the company should not enjoy a different ROE than that governing its distribution business.

Accordingly, the Board finds that the ROE formula for electricity distributors, as documented in the December 20, 2006 Report of the Board on Cost of Capital and 2nd Generation Incentive Regulation Mechanism, shall be applied to Hydro One Transmission. The Board has determined that Hydro One's ROE shall be derived based on an application of the Board's formula as of January 1, 2007, using December 2006 *Consensus Forecasts* and Bank of Canada data. This should result in an ROE of 8.35% for both 2007 and 2008.

Ontario Power Generation Inc. ("OPG")
Interrogatories for GEC

INTERROGATORY #7

Ref: Pages 15, lines 4 - 11

Preamble:
Q. "Can "building risk into cash flows" substitute for risk-adjusted cost of capital?
A. "In principle, revenues from a potential investment could be reduced and operating costs increased to reflect the risks. In practice, it is difficult to capture the many risks of a complex business segment in this fashion. Some risks result from small probabilities of large increases in cost components that are expected to be small, while other risks reflect smooth distributions around the best estimate of cost."

Interrogatory

Is there any reason to believe that adjustment to revenues and operating costs for a specific investment determined through techniques such as Monte Carlo simulations, combined with forecast costs of capital for OPG's regulated operations as a whole, will not yield more accurate investment analyses and decisions than using a technology-specific costs of capital?

Response

The Monte Carlo simulations would apparently require many assumptions for each project, including low-probability, high-consequence events. It is not clear how the question suggests these inputs would be estimated, how the simulated results would be incorporated in the analysis, how the analysis would be insulated from the advocates for a given project, or how the OEB or OPG Boards would review these complex studies. There is no reason to believe that the method proposed in the question would produce useful or meaningful results.