ASSESSMENT OF COMMERCIAL STRATEGIES DEVELOPED FOR THE OVERALL DARLINGTON REFURBISHMENT PROJECT AND THE RETUBE & FEEDER REPLACEMENT WORK PACKAGE

PREPARED FOR ONTARIO POWER GENERATION

SEPTEMBER 2013
TABLE OF CONTENTS

I. EXECUTIVE SUMMARY .......................................................... 1

II. SUMMARY OF CONCLUSIONS ........................................ 2

III. STANDARD OF REVIEW .................................................. 2

IV. INFORMATION SOURCES .................................................. 3

V. GENERAL LIMITATIONS OF OUR OPINION ....................... 3

VI. OVERALL PROJECT OPINION .......................................... 4

VII. RETUBE AND FEEDER REPLACEMENT .......................... 8

VIII. CONCLUSIONS .............................................................. 14
I. EXECUTIVE SUMMARY

On September 9, 2011, Tory's LLP retained Concentric Energy Advisors, Inc. ("Concentric") to review the commercial strategies and contracts developed and implemented for the refurbishment of four CANDU heavy water reactors at Ontario Power Generation, Inc.'s ("Ontario Power Generation's" or the "Company's") Darlington Nuclear Generating Station ("Darlington" or the "Plant").1 The Darlington Refurbishment Project (the "Project") will include removal and replacement of the reactor calandria tubes and pressure tubes from each reactor, replacement of all feeders (referred to together with the calandria and pressure tube replacement as the "Retube & Feeder Replacement work package"), refurbishment of the existing fuel handling equipment, refurbishment of the existing turbine generators, refurbishment of the existing steam generators, and a set of supporting refurbishment projects aligned with existing station systems. The plant modifications are currently planned to be made during overlapping 36-month outages for each of the four Darlington units between October 2016 and 2024.2 However, the Company is currently conducting an evaluation of the business case for un-lapping the refurbishment execution of the first two units. Under this scenario, the first refurbishment outage would be conducted on Unit 2 between Fall 2016 and Fall 2019. The remaining outages will occur between Fall 2019 and Fall 2025 with approximately 17 to 19 months of overlap between each successive outage. The Company expects to reach a decision on whether to proceed with this revised Project calendar in November 2013.

Prior to commencing the execution phase work, Ontario Power Generation has committed to undertaking significant planning activities, which include working to develop and implement appropriate commercial strategies to prepare for a project of this magnitude. Concentric was engaged to review the Company’s commercial strategies and how these strategies are being implemented. This letter summarizes Concentric’s review and opinion of the overall Project commercial strategy, as well as the commercial strategy of the Retube & Feeder Replacement work package.

The Project is following a standard megaproject progression that includes the following phases: (1) project initiation; (2) definition; (3) execution; (4) commissioning; and (5) project closeout. In the project initiation phase, a project is evaluated for its initial feasibility based on relatively high-level information that is readily available. Should a project prove feasible during the project initiation phase, it will proceed into the definition phase. During the definition phase, the project team undertakes detailed reviews of the project’s anticipated scope, cost, and schedule to begin to define the activities that must be completed during the project, when those activities must be completed, and how much those activities are expected to cost. Concurrently, the project team begins to define the commercial strategies expected to be employed. Later during the definition phase, the project team is responsible for: (1) identifying, procuring and fabricating all long lead materials, components and tooling; (2) executing all of the necessary agreements to proceed with the major work packages; (3) completing the detailed scope and project schedule; and (4) developing a “release quality” cost and schedule estimate from which the project’s performance can be measured. The release quality estimate and the integrated schedule available at the conclusion of the definition phase are more defined than prior iterations of the cost estimate and integrated schedule, yet both still contain uncertainty. Following the definition phase, a project enters the execution phase during which the actual plant modifications will take

---

1 As used in this context, “commercial strategies” refers to the processes by which Ontario Power Generation will procure goods and services for the Darlington Refurbishment Project.

2 As a practical matter, initial planning for the Project began in 2006 with the initiation of feasibility studies and plant technical assessments. Thus, from the Project’s initiation to closeout, the Project will span nearly 20 years.
place. This stage is followed by the commissioning and project closeout phases. During these phases, the project team brings the project online and completes all of the recordkeeping associated with the project.

The initiation phase of the Project began in late 2007 with the preparation of a business case that evaluated, at a high level, the overall feasibility of completing the Project. In November 2009, the Project sought and received authorization from the Ontario Power Generation Board of Directors to proceed with the planning portion of the definition phase. In February 2010, the Ministry of Energy concurred with the Board of Directors’ decision. To execute the work, Ontario Power Generation will retain multiple contractors for discrete portions of the Project work known as work packages. Consistent with this approach, Ontario Power Generation has proposed dividing the work into multiple major work packages, of which the Retube and Feeder Replacement work package is one.

The Retube & Feeder Replacement work package portion of the Project entered the detailed planning portion of the definition stage with the execution of an agreement with a qualified vendor responsible for completely replacing the pressure and calandria tubes and the feeders, should the Project proceed to execution. During the definition phase of the project, Ontario Power Generation and its vendors will complete the planning and design of the Project, execute the remaining project agreements, complete site preparations and a mock-up of the Darlington reactors, develop a release quality estimate, design and fabricate tooling, and test the tooling on mock-ups, among many other activities. Likewise, while the Project has completed a high level scope development process, the detailed design of the Project is still under development, and Ontario Power Generation is continuing to define and refine the Project’s integrated schedule.

II. SUMMARY OF CONCLUSIONS

As outlined below, Concentric has concluded that, based on Ontario Power Generation’s activities from late 2009 through August 1, 2013, the commercial strategies employed by the Project are appropriate and reasonable and meet the regulatory standard of prudence, given the current status of the Project. With regard to the commercial strategy for the Retube & Feeder Replacement work package specifically, we believe the activities of Ontario Power Generation to date, including Ontario Power Generation’s use of Owner’s Support Services, are reasonable and prudent.

Concentric’s opinion is not without certain caveats and limitations, which are discussed in the sections that follow. Similarly, the basis for our opinions are described throughout the remainder of this document.

III. STANDARD OF REVIEW

To conduct our review of commercial strategies selected by Ontario Power Generation, Concentric sought to answer three primary questions:

1) Are the commercial strategies selected by Ontario Power Generation for the Project reasonable?
2) Are these commercial strategies being executed in a reasonable manner?
3) Do the selected commercial strategies and the execution of those strategies meet the regulatory standard of prudence?
To answer these questions, Concentric adopted a definition for the regulatory standard of prudence based on Concentric’s work before state, provincial and federal energy regulators in both Canada and the United States. The definition utilized by Concentric is consistent with decisions rendered by the Ontario Superior Court of Justice,3 the Court of Appeal for Ontario,4 the Ontario Energy Board5 and the U.S. Supreme Court,6 among other jurisdictions. Specifically, Concentric defined the prudence standard as examining the range of actions that a reasonable manager would take given the facts or circumstances that were known or knowable at the time of the decision or action. That definition rejects the use of hindsight as a basis for determining the prudence of a decision or action. In addition, that definition relies on an evaluation of decisions or actions. Project costs are neither prudent nor imprudent; instead, costs are prudently or imprudently incurred as a consequence of the decisions and actions of management.

IV. INFORMATION SOURCES

Our review and the development of our opinions relied on three primary information sources. The first source included data request responses from Ontario Power Generation. Concentric submitted multiple rounds of data requests for information related to the Project and the Retube & Feeder Replacement work package. Second, Concentric performed outside research on topics including lessons learned and the experiences of other CANDU operators performing similar projects, the Canadian nuclear safety regime, and industry trends and practices for other large nuclear refurbishment projects. Finally, Concentric conducted on-site interviews during which Concentric met with members of the Darlington Refurbishment Project team. Follow-up telephone conversations were used to clarify certain facts and supplement the information Concentric received during our on-site interviews.

V. GENERAL LIMITATIONS OF OUR OPINION

The following are general limitations regarding the scope of our review:

- First, our review is limited to Ontario Power Generation’s actions and documents prepared between late 2009 and August 1, 2013.7 Concentric did not complete a thorough review of Ontario Power Generation’s actions related to the Project prior to or after that time period.
- Next, Concentric did not independently verify the appropriateness, sufficiency, or correctness of the Project schedules, cost estimates, or scope. Concentric was informed of the processes used to develop and to define further these planning assumptions. As such, we have considered these processes in the context of our review.

---

3 2005 CanLII 4941 (Ont. Div. Ct.).
4 Court of Appeal for Ontario Decision, Docket: C55602, C55641 and C55633, June 4, 2013.
5 Decision with Reasons, RP-2001-0032, December 13, 2002. This Decision deals with Enbridge Gas Distribution Inc.’s (formerly Enbridge Consumers Gas or ECG) application for a Board Order approving rates for the 2002 Test Year.
7 The beginning of the period Concentric reviewed is roughly concurrent with Ontario Power Generation’s completion of the Economic Feasibility Assessment of Darlington Refurbishment dated November 13, 2009. However, portions of the operational experience material reviewed by Concentric were prepared prior to this time.
In addition, Concentric assumed Ontario Power Generation will retain adequately qualified personnel to complete the Project generally and the Retube & Feeder Replacement work package specifically. Those resources are critical to the success of the project, and may be sourced internally, hired directly, or engaged through contracts with third parties.

Concentric did not perform a compliance audit to determine whether Ontario Power Generation and the Project were in compliance with Ontario Power Generation’s internal policies, procedures, instructions and guidelines, or applicable provincial and federal regulations. Similarly, Concentric did not conduct a legal review of Ontario Power Generation’s agreements or proposed agreements with any contractors. Notwithstanding that limitation, Concentric did review relevant Ontario Power Generation internal policies and procedures, and relevant provincial and federal laws and regulations when developing our opinion. Concentric also notes that Ontario Power Generation has separately retained outside counsel to advise it on the terms of the agreement with the vendor performing the Retube & Feeder Replacement work package.

Finally, Concentric’s review is not an assessment of the Project’s likelihood of success. Successful execution of the Project generally and the Retube & Feeder Replacement work package specifically will require the efforts of many entities and individuals over many years, and the development and implementation of the Project’s commercial strategies is only one contributor to project success.

VI. OVERALL PROJECT OPINION

A. GENERAL OBSERVATIONS

In performing our review, Concentric developed certain general observations that relate to our opinion:

• First, the Canadian marketplace for the procurement of qualified nuclear engineering, fabrication and construction services is very limited. Of the pool of vendors, only one vendor, Atomic Energy of Canada, Limited (“AECL”), recently provided a full turn-key refurbishment of a CANDU reactor, and the commercial reactor division of this vendor was acquired by SNC Lavalin Group in October 2011. A limited number of other vendors, including General Electric Hitachi – Canada (“GEH-C”) and Babcock & Wilcox Canada Ltd (“B&W”), have performed limited scopes of work on prior refurbishment projects under direct agreements with the project sponsors, or as sub-vendors and consortia members. With regard to certain work packages, only a single supplier has ownership or access to the original design basis documentation necessary to complete the work. Thus, creating competitive tension to produce optimal contractual terms can be difficult.

• Second, no Canadian CANDU refurbishment or return to service project to date represents a model of a successful commercial strategy. Concentric researched and reviewed operational experiences from the three recent Canadian CANDU refurbishment or return to service projects. A summary of Concentric’s research and review is included as Exhibit D2-2-1.

---

8 SNC-Lavalin Nuclear, Inc., through its affiliate, CANDU Energy, recently acquired AECL’s commercial reactor division from the Canadian Government. (SNC Lavalin Third Quarter 2011 Conference Call Notes, 4 November 2011, Pg. 7.)
service projects: 1) Pickering A, Units 1 and 4 in Pickering, Ontario (“Pickering A”); 2) Bruce A, Units 1-4 in Inverhuron, Ontario (“Bruce A”); and 3) Point Lepreau in Point Lepreau, New Brunswick (“Point Lepreau”). These three projects represent the most recent attempts to successfully plan, design, and execute significant refurbishment or repair work on Canadian CANDU reactors, and each project utilized a different commercial strategy. Each project encountered challenges to the successful completion of the refurbishment work. We also reviewed limited information from a refurbishment project at the Wolsong Generating Station in South Korea (“Wolsong”). The Wolsong project was completed in July 2011 and represents the most successful (e.g., cost and schedule performance) CANDU refurbishment project yet. Although Wolsong employed a commercial strategy similar to that employed by NB Power at Point Lepreau, we believe certain differences in the labor and nuclear services markets account for at least a portion of the success at Wolsong. Ontario Power Generation examined, and continues to examine, these prior projects, and plans to incorporate the lessons learned from these projects in the planning, definition, and execution activities of the Project.

Third, the Project is confronted generally with two types of risk: 1) extrinsic risk (i.e., risks that are outside of Ontario Power Generation’s control); and 2) intrinsic risk (i.e., risks that are within Ontario Power Generation’s control) that largely relate to the technical and commercial aspects of the project. With regard to extrinsic risk, the scale and duration of the Project make it vulnerable to changes in the economic, financial, political, regulatory and social assumptions that support the Project. While certain commercial strategies can result in vendor agreements that mitigate a portion of extrinsic risks, no economically viable commercial strategy can be expected to eliminate the bulk of those risks. In response, Ontario Power Generation is taking steps to mitigate the extrinsic risks through the use of a “gated” review and approval process. This gated review and approval process will phase Ontario Power Generation’s commitment to the Project into discrete periods and costs and will allow Ontario Power Generation to evaluate the ongoing feasibility of the Project at each interval. As it relates to the intrinsic risk, Ontario Power Generation is undertaking several activities to mitigate these risks. These activities include, but are not limited to, completing the Project’s design in advance of construction, evaluating long lead procurement items, constructing full scale reactor mock-ups to test the specialized tooling that must be designed and fabricated for the project, and evaluating the operational experiences of other recent refurbishment projects. When combined with Ontario Power Generation’s gated approval process, these steps will lower the Project’s intrinsic risk as it proceeds into each new phase of the Project, although, inevitably, certain intrinsic risks will remain for the Project and all similar projects.

B. OVERALL PROJECT COMMERCIAL STRATEGY

The overall commercial strategy selected by the Project team is the multi-prime contractor model. Under this model, Ontario Power Generation will retain project management responsibility and design authority for the Project. To execute the work, Ontario Power Generation will retain multiple contractors for discrete portions of the Project work known as work packages. Consistent with this approach, Ontario Power
Generation has divided the work into multiple major work packages, of which Retube & Feeder Replacement is one.

Ontario Power Generation’s selection of the multi-prime strategy was based on the recognition that alternative models have not been successful, and that there is a reasonable need to retain control of, and project management responsibility for, the Project. Specifically, Ontario Power Generation will retain control over deliverables, work processes, the scope of work, and the ultimate design of station modifications and replacements. Ontario Power Generation will also retain responsibility for planning and permitting, coordinating the interfaces between each of the prime vendors selected to complete the work packages, and overseeing the Project’s multiple prime contractors. Finally, Ontario Power Generation will be responsible for vendor claims for scope changes, owner-caused delays and vendor-caused delays that affect other vendors (setting aside the Company’s recourse to the vendor causing the delay). Importantly, the multi-prime strategy will provide Ontario Power Generation with additional flexibility to transfer work between major vendors if such a transfer promotes efficiency and value for money.

By using this model, Ontario Power Generation is accepting the challenge of managing each of the prime vendors and ensuring that each vendor is able to complete its work according to its plan. Given the complexity of the Project and the limited working space within the Darlington site, Ontario Power Generation’s coordination of the various work tasks will require extensive planning to prevent claims of delay or increased costs caused by Ontario Power Generation’s failure to adequately plan and coordinate the work or interference from another vendor.

C. CONCENTRIC’S OPINION OF THE OVERALL PROJECT COMMERCIAL STRATEGY

Concentric believes Ontario Power Generation has acted prudently in selecting the multi-prime contractor model strategy. Ontario Power Generation’s selection of this commercial strategy appropriately and reasonably considered the operational experiences of refurbishment projects at the Bruce A and Point Lepreau refurbishment projects, and the restart of Pickering A. This model provides Ontario Power Generation with the necessary control over the design and planning of the Project and allows Ontario Power Generation to utilize the expertise of specialty vendors in a cost effective manner. We note that a variation of this model is being used to successfully deploy new nuclear facilities in China. In that model, a Chinese state-owned entity is sponsoring nuclear construction projects at Sanmen and Haiying. A local construction company is being utilized to construct the projects while a consortium of the Shaw Group, Inc. and Westinghouse Electric Company, LLC is providing engineering, procurement and construction (“EPC”) oversight services. Finally, a recent analysis has shown that this model is likely to result in total project costs that are at least competitive with, if not lower than, alternative commercial strategies.9

While Concentric is in agreement with the selected commercial strategy, we do note that this model does not mirror Ontario Power Generation’s previous experience with significant projects and that the Project team has limited experience in managing vendors under this model. Ontario Power Generation’s limited experience in managing the vendor oversight function in a large, diverse, multi-prime contracting model will increase the importance of accessing external resources. Ontario Power Generation is appropriately meeting this need through a combination of Owner’s Support Services vendors, and other outside consultants and

---

experts. Those vendors will assist Ontario Power Generation with the oversight function by providing relevant expertise developed from other major projects.

Consistent with Ontario Power Generation’s gated review and approval process for proceeding with each phase of the Project, Concentric believes all of the agreements that result from this strategy should include sufficient off-ramps and hold points at which continuing with the Project will be fully reconsidered. These milestones include, but are not limited to:

- Issuance of a release quality estimate,
- The start of each unit outage, and
- Instances when prime vendor performance is substantially below expectations.

D. ALTERNATIVES CONSIDERED

Prior to selecting its multi-prime contractor model strategy, Ontario Power Generation considered several alternative commercial strategies. Those alternative strategies included partnering, a lump sum turnkey agreement, and a project management organization structure. Ontario Power Generation rejected each of those strategies for the reasons described below.

Beginning in December 2009, the Project team was focused on a partnering concept that would seek to utilize a single agreement with multiple vendors, possibly combined in a joint venture, for the purpose of designing and executing the work packages. That agreement would have tied the vendors’ financial performance to the overall success of the entire project rather than just a vendor’s performance on its scope of work. The partnering concept was initially favored because, in its optimal form, the concept would better align the interests of all involved vendors and potentially promote a cooperative work environment. This concept was advocated in the 1990s by several industry participants, but experience with the partnering model has shown that alignment is difficult to achieve, and vendors largely rejected this model due to their inability to “control their own fate.” That is to say, vendors have expressed a concern that their financial performance is tied to actions that are beyond their own control (i.e., the performance of another vendor on the project). As a result, projects that utilized the partnering strategy often fostered less cooperative project environments where vendors were engaged in disputes with each other over the cause of delays or cost over-runs.

The Darlington Refurbishment Project team also considered a fixed price, lump sum, turnkey model similar to that employed by NB Power at Point Lepreau. At a basic level, this strategy would have turned over the entire Project to a single vendor and required the vendor to complete the entire scope of work and return an operable unit back to Ontario Power Generation. This strategy, when coupled with a fixed or target price, is expected to provide greater price certainty and greater risk transfer. However, the fixed-price, lump sum, turnkey strategy would have largely eliminated Ontario Power Generation’s control over the final design, pace, and management of the Project. In addition, recent experience with this strategy has demonstrated that although the model proposes to transfer significant risk to a vendor, such risk transfer is largely unachievable in a nuclear safety environment due to exemptions for excused events and force majeure, the owner’s liability for nuclear safety, and a lack of complete, detailed designs. As a result, the price premium paid to transfer risk is usually not commensurate with actual risk transferred to a vendor. At Point Lepreau, the fixed price, lump sum, turnkey strategy has largely protected NB Power from cost overruns, but has provided limited protection from schedule slippage and the extensive cost of replacement power that resulted. Lastly, a fixed-
price, lump sum, turnkey agreement for a nuclear power project of this magnitude is not likely to be commercially feasible in the current market. SNC Lavalin, the acquirer of the commercial reactor division assets of Point Lepreau’s contractor (AECL), has indicated that it is unwilling to accept the same level of risk that AECL accepted in past contracts.10

Finally, Ontario Power Generation considered retaining a project management organization similar to the strategy initially employed by Bruce Power for the refurbishment of Bruce A. Pursuant to this model, Ontario Power Generation would have retained a qualified firm experienced in the management of megaprojects similar to this Project. The project management organization would have been responsible for planning the Project, negotiating agreements with prime contractors for the execution of the Project work, and managing the various work packages. This strategy would allow Ontario Power Generation to rely on an experienced project management organization that is expected to utilize industry best practices to plan and implement the Project. However, a project management organization strategy often suffers from a lack of alignment between the project management organization, the owner, and the prime contractors responsible for completing the work. This is particularly true in a tight market for such services, as is the case in Canada’s market for nuclear services, because the project management organization may also be responsible for a portion of the execution phase work. Consequently, other vendors would have been expected to reject a project management organization due to concerns over future disputes between the vendors and the project management organization. Even if the model was accepted by capable vendors, Ontario Power Generation could expect to pay a substantial premium for the risk of project management organization and contractor disputes. Bruce Power has encountered difficulties with the project management organization strategy related to conflicts between the project management organization and its vendors and the project management organization’s alignment with Bruce Power’s interests. As a result, Bruce Power largely abandoned the project management organization strategy after approximately two years and moved to a multi-prime strategy.

As discussed above, Concentric agrees with Ontario Power Generation that it was reasonable and prudent to select the multi-prime model under the current market circumstances and to reject the alternatives considered by the Company.

VII. RETUBE AND FEEDER REPLACEMENT

A. OVERVIEW

The Retube & Feeder Replacement work package is expected to determine the Project’s critical path11 and includes the removal and replacement of each reactor’s 480 pressure tubes and calandria tubes and the removal and replacement of the existing feeders. Because of the critical nature of this work, Ontario Power Generation has focused significant resources on selecting a reasonable commercial strategy and securing a vendor to perform the Retube & Feeder Replacement work prior to advancing the other work packages. Just

---

10 In June 30, 2011 article in *Canadian Business*, SNC Lavalin Executive Vice President Patrick Lamore was quoted as saying, “We don’t want to go backwards but obviously we would only bid the projects that have acceptable terms and conditions to our risk profile and where we make the margins that are expected for a commercial business to survive.”

11 At a basic level, the critical path of a project is made up of those activities that must be completed on time in order for the project to proceed to each new phase of the project on schedule.
as Ontario Power Generation selected from available contracting strategies at the Project level, it must do the same for the selection of a vendor for the Retube & Feeder Replacement work package.

**B. ONTARIO POWER GENERATION’S RETUBE & FEEDER REPLACEMENT COMMERCIAL STRATEGY**

The commercial strategy selected by Ontario Power Generation for the Retube & Feeder Replacement agreement is a hybrid EPC agreement that combines elements of fixed/firm pricing for known or highly definable tasks and a target price for the remaining scope of the Retube & Feeder Replacement work package where less detailed information is available. Additionally, Ontario Power Generation’s commercial strategy has incorporated a phased project schedule that will divide the work into a definition phase, an execution phase and a commissioning phase. During the definition phase, Ontario Power Generation and its selected vendor will complete the detailed design of the Project, procure long lead materials, fabricate long lead components and tools, test the specialized tooling and complete final planning activities. At the conclusion of the definition phase work, Ontario Power Generation and its selected vendor will complete a cost estimating process to determine the “execution phase target price.” The execution phase target price will create an estimate of the total cost to complete the execution phase work with upper and lower cost sharing bands. Within these cost sharing bands, Ontario Power Generation and the selected vendor will jointly share in cost over-runs or under-runs. Outside of these cost sharing bands, the Retube & Feeder Replacement agreement reverts to a cost reimbursable agreement, excluding vendor profit and overhead. Ontario Power Generation will, likewise, include financial incentives for early completion of each unit outage and financial penalties for failure to complete unit outages within the agreed upon schedule. If Ontario Power Generation and the selected vendor are unable to agree on an execution phase target price and schedule, Ontario Power Generation will retain the tooling in order to conduct the execution phase work with an alternate contractor.

Concentric’s review of the Project’s Retube & Feeder Replacement contracting strategy has highlighted the following advantages and disadvantages of this approach:

- **Advantages:** Flexibility to adapt to the project’s evolving project scope; incentives are created to limit cost increases and schedule delays; control over the design of station modifications.
- **Disadvantages:** Creates substantial oversight responsibilities; once the cost for each unit exceeds the target price and caps for each unit, the contract is essentially a cost reimbursable (excluding vendor overhead and profit) agreement with a more limited risk transfer relative to a fixed price agreement.

**C. BASIS FOR SELECTION**

The current hybrid EPC strategy for the Retube & Feeder Replacement work package was selected in order to fulfill several objectives. Specifically, Ontario Power Generation reviewed prior operating experience from similar refurbishment projects and determined the need to retain overall control and responsibility for project management and design authority. The operational experience reviewed included specific lessons learned

---

12 This EPC agreement differs from the Engineering, Procurement and Construction agreement employed by NB Power at Point Lepreau in that the agreement relates to only a single work package and includes a hybrid pricing structure.
from refurbishments at Point Lepreau, Bruce A and Wolsong; the restarts of Pickering A and Browns Ferry Unit 1; and the steam generator and reactor vessel head replacement at Fort Calhoun. In addition, consistent with the Ontario Procurement Directive to consider value for money, Ontario Power Generation considered the risk premium expected to be paid to a vendor relative to the actual risk transferred. As a result of these considerations, Ontario Power Generation specifically sought a commercial strategy that would allocate risk to the party with control over that risk, provide transparency of the vendor’s expenses, reduce the total number of vendor interfaces to be managed, and integrate planning, design and construction of critical path activities.

D. CONCENTRIC’S OPINION ON THE RETUBE & FEEDER REPLACEMENT PROCUREMENT STRATEGY

We have concluded that Ontario Power Generation’s Retube & Feeder Replacement procurement strategy is reasonable and prudent in the context of the Project and current market conditions for these services. While at the present time the general scope of the Retube & Feeder Replacement work package is known, the precise process, materials, and tooling required to complete the work will continue to be defined throughout the definition phase. The limited detailed definition of the technical scope necessitates a commercial strategy with sufficient flexibility to adapt to changes in the detailed scope during the definition phase of the Project.

Additionally, the Retube & Feeder Replacement work package is being proposed in a market that lacks sufficient depth to create adequate competition to support a fixed price agreement that meaningfully transfers the risk of price increases and schedule over-runs to a vendor. In this context, Concentric believes that a proposal for a fixed-price Retube & Feeder Replacement agreement is likely to include provisions for force majeure, excused performance, and a claims process for owner-directed changes or owner-caused delays that would allow the vendor to transfer much of the pricing, schedule and operability risk back to Ontario Power Generation. Otherwise, such an agreement is expected to contain a substantial financial risk premium.13 Similarly, given the recent and ongoing experiences at other CANDU refurbishments and recent statements by vendor executives, Concentric does not believe an acceptable fixed price for the entire Retube & Feeder Replacement scope of work is achievable in the current market.

In addition, Ontario Power Generation has recognized the need to supplement its internal resources to provide appropriate oversight of the Retube and Feeder Replacement work. This will be accomplished through a combination of Owner’s Support Services vendors and other external expertise.

E. COMMERCIAL STRATEGY ALTERNATIVES CONSIDERED

Before selecting the hybrid EPC structure, Ontario Power Generation considered four alternative procurement strategies including self-performing the project, a design-bid-build model, a fixed price, lump sum turnkey agreement, and partnering.

The self-perform model would have allowed Ontario Power Generation to retain complete control over the project by directly employing and managing the resources required to complete the Retube & Feeder Replacement work package. This model would have required Ontario Power Generation to recruit, hire and

---

train thousands of new employees exclusively for the Retube & Feeder Replacement work. As a result, this option was ultimately not considered a viable strategy given the high cost and the significant number of direct hire employees required to complete the project with this strategy.

The design-bid-build strategy would allow Ontario Power Generation and its design engineering vendor to define the Retube & Feeder Replacement scope of work and complete the detailed design before issuing a competitive solicitation for the execution phase work, potentially under a fixed or target price. That aspect of the design-bid-build strategy is similar to Ontario Power Generation’s selected strategy. However, due to the lack of constructor involvement during the definition phase, the design produced under the design-bid-build model may not have been executable. This would ultimately lead to a risk of substantial rework to fix designs that could not be constructed. Additionally, the actual risk transferred to the construction vendor under a fixed price agreement may be less than expected despite the risk premium Ontario Power Generation would expect to pay for the price certainty.

Ontario Power Generation also considered seeking a fixed price, lump sum turnkey agreement for the Retube & Feeder Replacement work package in order to achieve greater price certainty and risk transfer. This model was deemed to be unavailable at a reasonable cost based on market feedback and recent experiences at Point Lepreau. In addition, Ontario Power Generation previously entered into fixed price, lump sum turnkey agreements, yet the Company’s experience was that those agreements failed to achieve actual price and schedule certainty due to undefined and unknown scope. Thus, Ontario Power Generation rejected this model as failing to provide sufficient value for money.

As discussed previously, the partnering strategy was considered due to the anticipated ability to align Ontario Power Generation’s interests with those of the vendor and its sub-vendors. The partnering model was rejected due to Ontario Power Generation’s prior experience employing a similar model during the Pickering A Return to Service Project as documented by Ontario Power Generation in its operational experiences for that project. In addition, many vendors have rejected the partnering strategy due to the additional risk posed to each vendor by the partnering model.

F. STRATEGY EXECUTION

During 2010 and 2011, Ontario Power Generation began executing the Retube & Feeder Replacement commercial strategy. To do so, Ontario Power Generation initially conducted market outreach in spring 2010. This included the identification of seven vendors who could potentially execute the Retube & Feeder Replacement scope of work. From this information, Ontario Power Generation issued a request for expressions of interest to the seven potential vendors (“Proponents”). Ontario Power Generation received limited responses and proposed feedback on Ontario Power Generation’s terms and conditions from four of the seven Proponents regarding the Retube & Feeder Replacement work package. Two of those Proponents later joined the teams of the remaining two Proponents as either consortium members or sub-vendors of the lead Proponent.

In March 2011, Ontario Power Generation issued a request for proposals (“RFP”) to the remaining two Proponents: 1) a consortium consisting of B&W, GEH-C, and Black & MacDonald (the “B&W Consortium”); and 2) a consortium of SNC-Lavalin Nuclear Incorporated and AECON Industrial, a division of AECON Construction Group Incorporated (the “SNC/AECON Consortium”). A meeting with both Proponents was held following the issuance of the RFP and the Proponents were provided with an
opportunity to submit both confidential and non-confidential questions to Ontario Power Generation. The responses to the confidential questions were provided to the Proponent submitting the question while the responses to non-confidential questions were provided to both Proponents.

Responses to the RFP were received from both Proponents on June 26, 2011. Ontario Power Generation then conducted a confidential bid evaluation process in late June and July 2011. At that time, the bid evaluation teams classified both responses as alternative or non-conforming bids, and recommended Ontario Power Generation enter into negotiations with both Proponents due to the significant number of exceptions to the commercial terms noted by both Proponents.

Ontario Power Generation began meeting with the Proponents in July 2011 and agreed to “contract principles” with both parties in mid-August. Those high level principles expressed Ontario Power Generation’s fundamental requirements for the Retube & Feeder Replacement agreement. Ontario Power Generation continued negotiations with both Proponents in an effort to negotiate an acceptable commercial agreement with each Proponent (“Negotiated RFR Project Agreement”). Those negotiations were carried out in accordance with Ontario Power Generation’s Retube & Feeder Replacement Project RFP Submission Negotiation Plan (the “Negotiation Plan”).14 The Negotiation Plan established a Negotiation Team made up of Ontario Power Generation personnel and a member of Ontario Power Generation’s outside counsel, and was led by Ontario Power Generation’s Director, Commercial Strategy. This team was supported by the Negotiations Support Team consisting of several Ontario Power Generation staff members and Ontario Power Generation’s outside counsel. A Steering Committee provided oversight of the Negotiation Team’s activities throughout the negotiation period and consisted of several senior members of the Darlington Refurbishment Project team and Ontario Power Generation’s staff.

To evaluate the final Proponent submissions, Ontario Power Generation developed a detailed evaluation plan.15 This plan required the creation of an Evaluation Team to review the final Proponent submissions, an Executive Advisory Committee and commercial, financial, risk, project management, and technical support teams (“Functional Support Teams”). The Evaluation Team was responsible for scoring the Proponent submittals and called upon the Functional Support Teams for additional information or support. For strategic advice, the Evaluation Team could seek advice from the Executive Advisory Committee. Throughout the evaluation process, the Evaluation Team had access to the Process Advisor (external counsel) to ensure the evaluation process was conducted fairly and in compliance with applicable laws and regulations. The Executive Advisory Committee was permitted to request additional assistance from outside consultants on an as-needed basis.

In its request for final proposals, Ontario Power Generation required each Proponent to submit final pricing for the Negotiated RFR Project Agreements and option pricing for three additional scopes of work. Ontario Power Generation also encouraged each Proponent to provide two additional pricing submittals: 1) a Preferred Innovation Submission that described the fixed fee reduction a Proponent could offer if the Proponent’s fixed fee at risk was reduced from 90 percent to either 80 or 70 percent of the fixed fee that is at risk, and 2) an Innovation Submission that described a cost reduction in exchange for a specific exception or amendment to the terms of the Negotiated RFR Project Agreement (collectively, the “Alternative Pricing Submissions”). The Evaluation Team ultimately selected an Alternative Pricing Submission from the

---

14 Retube & Feeder Replacement Project RFP Submission Negotiation Plan, R0.
SNC/AECON consortium. This Alternative Pricing Submission lowered the consortium’s fee at risk in exchange for a reduction in pricing. Finally, the Evaluation Team and Executive Vice President, Nuclear Projects, provided a final recommendation to proceed with the preferred proposal on December 15, 2011. That recommendation was accepted by Ontario Power Generation, and Ontario Power Generation executed a final agreement with the SNC/AECON consortium on March 1, 2012.

Since the execution of the final agreement with SNC/AECON, four Project Change Directives (“PCD’s”) have been issued by Ontario Power Generation. The first PCD was for a change to the mock-ups scope based on a proposal by the contractor to reduce the cost of the mock-ups work. The second PCD was to award bulkhead and associated isolations work scope to SNC/AECON. The bulkhead and associated isolations work scope was an optional component of SNC/AECON’s proposal, and the Company was exercising that option before it expired. Due to the size of this additional scope, Ontario Power Generation developed a separate contracting strategy for this work and evaluated alternatives using a Kepner-Tregoe decision analysis, among other assessments. The Company determined that awarding the bulkhead and associated isolations work to the Retube & Feeder Replacement contractor was appropriate given the critical path dependency of this work, the significant interaction that will be required between the bulkhead design/installation and Retube & Feeder Replacement teams, the fact that bringing this work under the Retube & Feeder Replacement contract would allow for a single point of contact and accountability, and the fact that a contract was already negotiated and executed with the Retube & Feeder Replacement contractor. The Project sought the approval of Ontario Power Generation’s Chief Executive Officer, in accordance with the Company’s Organizational Authority Register (“OAR”).

The third PCD was for the engineering, procurement, and construction of the retube and waste processing building. This scope of work also was an optional component of SNC/AECON’s proposal, and the Company was exercising that option before it expired. Similar to the bulkhead and associated isolations scope of work, the Company performed an analysis of its alternatives, including a Kepner-Tregoe decision analysis, and sought the requisite approvals in accordance with the OAR. The Company determined that awarding the retube and waste processing building work to the Retube & Feeder Replacement contractor was appropriate given dependencies between the waste reduction tooling work performed under the Retube & Feeder Replacement agreement and the retube and waste processing building, the single point of contact and accountability permitted under this proposed structure, and the fact that negotiating a new contract with a third party would not be required.

The fourth PCD was for additional inspections and testing related to the bulkhead and associated isolations work.

G. CONCENTRIC’S OPINION OF THE EXECUTION OF THE RETUBE & FEEDER REPLACEMENT COMMERCIAL STRATEGY

Concentric believes that Ontario Power Generation has reasonably and prudently executed the Retube & Feeder Replacement commercial strategy to date, including the development and implementation of its competitive solicitation process, pre-defined offer evaluation process, the retention of a capable Process Advisor for the competitive solicitation and a detailed negotiation process that first identified Ontario Power Generation’s fundamental requirements, sought and obtained final agreements that complied with those requirements, and conducted a fair and reasonable evaluation of the Proponent Submissions. Ontario Power Generation’s evaluation and selection process for the final Retube & Feeder Replacement offers was, in
Concentric’s opinion, reasonable and prudent. In addition, in making modifications to the scope of work under the contract, the Company has been using a formalized and robust process to identify alternatives and seek necessary internal approvals.

VIII. CONCLUSIONS

Concentric was retained to review Ontario Power Generation’s development and implementation of its commercial strategies for the Project. At a cost of $6 to $10 billion in 2009 dollars, excluding inflation and interest, and a duration of more than 18 years from the start of planning to the conclusion of commissioning and project closeout activities, the Project is clearly a major undertaking for Ontario Power Generation, and it is subject to financial, economic, regulatory, political, and execution risks. While effective commercial strategies are necessary to assist Ontario Power Generation in mitigating these risks, no commercial strategy can fully eliminate these risks.

To conduct our review of the Project’s commercial strategies, Concentric undertook a detailed process to determine whether the strategies selected by the Darlington Refurbishment Project were reasonable, whether the strategies were executed in a reasonable manner and whether Ontario Power Generation’s actions related to the selection and execution of those strategies meet the regulatory prudence standard. Our opinion of these strategies relies upon information provided by Ontario Power Generation in response to our data requests, in-person interviews, our independent research and Concentric’s experience advising other megaproject sponsors. Overall, our review confirmed the reasonableness and prudence of Ontario Power Generation’s selected procurement strategies.