



**ASSESSMENT OF COMMERCIAL STRATEGIES
DEVELOPED FOR THE DARLINGTON REFURBISHMENT
PROJECT'S FUEL HANDLING WORK PACKAGE**

PREPARED FOR ONTARIO POWER GENERATION

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I. EXECUTIVE SUMMARY

On September 9, 2011, Torsys 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 the removal and replacement of the reactor calandria tubes and pressure tubes from each reactor and the replacement of all feeders (*i.e.*, the “Retube & Feeder Replacement work package”), the refurbishment of the existing turbine generators (*i.e.*, the “Turbine Generators work package”), the refurbishment of the existing fuel handling facilities (referred to herein as the “Fuel Handling work package”), and the refurbishment of the existing steam generators (*i.e.*, the “Steam Generators” work package), among many other tasks. 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 committed to undertaking significant planning activities, which includes working to develop and implement appropriate commercial strategies for the Project, 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 current Fuel Handling work package commercial strategy.

The Project is progressing within a typical megaproject lifecycle 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 the 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 place. This stage is followed by the commissioning and project closeout phases.

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.



During those 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 Director's decision. To execute the work, Ontario Power Generation intends to 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 Fuel Handling work package is one.

As part of that process, the Company is currently pursuing contracts with qualified vendors for two separate bundles of work related to the Fuel Handling work package. The first bundle of work, the defueling of the four Darlington reactors, has been negotiated on a single-source basis with General Electric Hitachi – Canada ("GEH-C"), the Original Equipment Manufacturer ("OEM") of the Darlington fuel handling facilities and the current Design Agent for those facilities. The second bundle is the refurbishment of the fuel handling facilities, and that scope has been further divided into five sub-bundles. Three of the five refurbishment sub-bundles will be pursued through competitive contracting processes, one will be contracted on a single-source basis to GEH-C, and one will be performed under an addition to the execution phase scope of work under the Retube & Feeder Replacement contract (executed in the first quarter of 2012). Throughout the balance of this phase of the Project, the Company and its vendors will complete planning and design for the Fuel Handling work package, execute project agreements, and develop a release quality cost estimate, among many other activities.

II. SUMMARY OF CONCLUSIONS

As discussed below, Concentric concluded that, based on activities that took place between late 2009 and August 1, 2013, the commercial strategy Ontario Power Generation is employing for the Fuel Handling work package is appropriate and reasonable and meets the regulatory standard of prudence.

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 the commercial strategy selected by Ontario Power Generation for the Fuel Handling work package, Concentric sought to answer three primary questions:

- 1) Is the commercial strategy selected by Ontario Power Generation for the Fuel Handling work package reasonable?
- 2) Is that commercial strategy being executed in a reasonable manner?
- 3) Do the selected commercial strategy and the execution of that strategy 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 provincial, state, 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 Board,⁵ 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.

In this letter, Concentric provides its assessment of the Company's development and execution of its commercial strategy for the Fuel Handling work package under the standard of prudence described above. In particular, Concentric is providing its opinion on the prudence and reasonableness of Ontario Power Generation's decisions to:

- 1) Unbundle the Fuel Handling work package into two bundles by the scope of work: (1) defueling of the four reactors; and (2) refurbishment of the fuel handling system;
- 2) Proceed with negotiations and executing a contract with GEH-C on a single source basis for the defueling scope of work; and
- 3) Further unbundle the refurbishment scope of work into five sub-bundles, and to competitively bid the majority of that work.

Those decisions are discussed in greater detail in the sections that follow.

IV. INFORMATION SOURCES

Our review and the development of our opinions relied primarily on data gathered through multiple sets of requests for information related to the Fuel Handling work package and interviews with members of the Fuel Handling refurbishment project team. Concentric also 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.

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.

⁶ Separate, concurring opinion of Justice Louis Brandeis, *Missouri ex. Rel. Southwestern Bell Telephone Co. v. Public Service Commission*, 262 U.S. 276 (1923).



V. GENERAL LIMITATIONS OF CONCENTRIC'S 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 review 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, scope, or from an engineering or technical perspective, the division of labor. However, Concentric was informed of the processes used to develop those parameters.
- Concentric evaluated the sub-bundling of the fuel handling refurbishment scope of work, but is not providing an opinion on the appropriateness of that division of responsibilities from an engineering perspective. Concentric's opinion does not consider whether the sub-bundling of work is practicable from the perspective of vendors that may respond to Requests for Proposals ("RFPs") for the sub-bundles. Further, we are not opining on the execution of those RFPs or resultant contracts at this time.
- In addition, Concentric assumed Ontario Power Generation will retain adequately qualified personnel to complete the Project generally and the Fuel Handling work package specifically. Those resources are critical to the success of the project, and they 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 reviewed Ontario Power Generation's internal policies and procedures, and provincial and federal laws and regulations when developing our opinion.
- Finally, Concentric's review is not an assessment of the Project's likelihood of success. Successful execution of the Project generally and the Fuel Handling 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.

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.



VI. DEVELOPMENT OF THE FUEL HANDLING WORK PACKAGE COMMERCIAL STRATEGY

A. OVERVIEW

The scope of work for the Fuel Handling work package has been bundled by Ontario Power Generation into two distinct scopes of work: (1) defueling of the reactors; and (2) refurbishment of the fuel handling equipment.

Defueling involves removing all irradiated fuel from each of the four Darlington reactors at the beginning of each refurbishment outage to allow for the performance of other Project activities, including the Retube & Feeder Replacement work package. Defueling is on the critical path for each refurbishment outage as no other refurbishment work can be undertaken before each reactor is defueled. The defueling work incorporates the following main tasks: (1) detailed engineering; (2) manufacturing of hardware; (3) testing and commissioning; and (4) technical support. Due to the fact that the other units will be operational during the defueling process, Ontario Power Generation, as the licensed operator, is required to perform the defueling field work. The Company negotiated and executed a contract on a single-source contracting strategy basis with a third party vendor – GEH-C – to perform the non-field work required for the defuel work scope (*i.e.*, engineering, manufacturing, and technical support). The method recommended by GEH-C, the OEM of the Darlington fuel handling equipment, is called “flow defuel,” in which the flow of the primary heat transfer system is used to push the fuel into the fuel handling machine assisted by flow restricting outlet bundles (“FROBS”; the current estimate requires 480 FROBS per unit). Other system components required for the defueling scope of work include an estimated 375 dummy fuel bundles per unit, 72 universal carriers, four fuel push tools, ten new fuel transfer mechanisms, and two complete sets of fuel handling software.⁸ At the time of Concentric’s review, the contract has an estimated value of approximately \$18 million. With optional scope (\$8.5 million) and contingency (\$8.5 million), the total estimated cost for the defueling bundle was \$35 million.

Refurbishment (*i.e.*, the second Fuel Handling work package bundle) involves the refurbishment of the fuel handling equipment installed on each unit, common equipment installed on the East and West Fuelling Facilities Areas, and equipment in the Central Service Area. The fuel handling refurbishment work has an anticipated cost of approximately \$170 million and will be performed in five sub-bundles:

1. Trolley, power track, and auxiliary replacement (*i.e.*, the “Main FH Refurbishment,” which is the largest of the sub-bundles in terms of scope and anticipated cost, and is planned to be competitively bid);
2. Irradiated fuel bay refurbishment, which has been further divided into two scopes of work: (1) irradiated fuel bay inspection tooling (planned to be competitively bid using the extended services master services agreements (“ESMSA”)⁹ with Black & McDonald (“B&M”) and

⁸ GEH-C was engaged by OPG to complete a study of the most effective method to defuel Darlington’s reactor cores for the Project. In cases in which flow defuel is not able to defuel a fuel channel, dummy fuel bundles will be used to displace irradiated fuel.

⁹ The ESMSAs are agreements that have been established with Black & McDonald (“B&M”) and E.S. Fox that have pre-established terms and conditions for any purchase orders that are issued under the ESMSAs. There are differences in rates between the two vendors, but otherwise the terms and conditions are fairly uniform between ESMSAs. Through the bidding process, Ontario Power Generation has the opportunity to request changes to



- E.S. Fox); and (2) irradiated fuel bay heat exchanger replacement (also planned to be competitively bid through the ESMSA);
3. Fuel handling control system refurbishment (planned to be competitively bid);
 4. Reactor area bridges and carriages refurbishment (planned to be performed by the Retube & Feeder Replacement contractor (*i.e.*, a joint venture between SNC-Lavalin (“SLN”) and Aecon Industrial) under an addition to the execution phase scope of work as part of the existing Retube & Feeder Replacement contract); and
 5. Fuel machine head overhaul (planned to be single-sourced to the OEM, GEH-C).

Per a May 3, 2012 memorandum, the current contingency for the refurbishment work is approximately \$20 million. As of the date of this letter, and as is typical of a project of this size as it becomes further developed, the contingency amount will be further refined as the work package progresses.

B. INITIAL STRATEGY DEVELOPMENT

Ontario Power Generation developed an initial contracting strategy for the Fuel Handling work package in 2011 that contemplated a non-competitively sourced contract for nearly the entire Fuel Handling work package with the OEM of the fuel handling equipment (*i.e.*, GEH-C). At that time, Ontario Power Generation analyzed the Fuel Handling work package by work type (*i.e.*, Design and Engineering, Inspection and Analysis, Procurement and Obsolescence, Replacement/Execution, and Defuel), identifying potential suppliers for each work type and documenting the rationale for each work type’s contracting strategy. Of the work types, Ontario Power Generation’s planned strategy was to sole source Design and Engineering, Procurement and Obsolescence, Replacement/Execution (with an EPC partner), and part of Defuel to GEH-C. Ontario Power Generation’s Project and Modifications group would manage Inspection and Analysis, and the supply of dummy fuel bundles would have been competitively bid.

In 2012, however, Ontario Power Generation performed a detailed scope optimization study of the Fuel Handling work package scope of work to better define the scope and reduce the formerly large contingency scope. That study focused on the refurbishment portion of the work package (*i.e.*, the non-defueling related scopes of work). The detailed scope optimization study was part of the normal progression of the Project. The result of that study was that the Company determined that it could significantly optimize the scope of work for fuel handling refurbishment, and, in the process, increase the degree to which the scope of work could be competitively bid. This was a fundamental change to the refurbishment scope in that the optimized scope had greatly reduced levels of specialty work that would require implementation by the OEM. Specifically, through a line-by-line examination of the fuel handling scope, the Company determined that, in some instances, there was a cost savings resulting from earlier component replacement versus future inspections. In other instances, detailed engineering analyses supported the continued operation through life extension of certain components. For that latter category, contingency scope for those components’ replacement was removed from the work package, significantly reducing total Fuel Handling work package contingency cost and scope. The original estimated cost for the refurbishment (*i.e.*, non-defueling) scope of work was greater than \$515 million, including \$450 million in contingency scope and “Station Improvement

certain of the ESMSA terms and conditions (*e.g.*, extending the warranty length). In addition, the ESMSA vendors can propose to sub-contract with other vendors as part of the bidding process.



Opportunities.”¹⁰ In total, Ontario Power Generation identified savings of \$370 million through its scope optimization review, refurbishment contingency scope was reduced to approximately \$20 million, and the Station Improvement Opportunities were either eliminated or reclassified to core scope. Major cost savings were identified in the areas of: (1) powertrack refurbishment (the Company determined that no large scale change in design was required); (2) fueling head machine refurbishment (the Company eliminated the purchase of additional fuel machine heads); (3) fuel handling equipment reliability (this scope item was eliminated entirely); and (4) service area bridge components (these components will now be replaced, resulting in cost savings). Ontario Power Generation also determined at that time that the procurement of dummy fuel bundles, which it formerly planned to do on a competitive basis, should be procured on a single-source basis from GEH-C, the designer of Darlington’s existing fuel bundles, due to the proprietary nature of that equipment and the fuel handling facilities’ design.

Based on the optimized scope, Ontario Power Generation revised its contracting strategy for the Fuel Handling work package in October 2012 to reflect the currently planned commercial strategy (*i.e.*, bundling of the work into two bundles: defueling and refurbishment), as described above.

C. DEVELOPMENT OF THE CURRENT FUEL HANDLING WORK PACKAGE CONTRACTING STRATEGY

Ontario Power Generation has made three significant decisions in its current Fuel Handling work package contracting strategy that are the focus of Concentric’s review:

1. The decision to unbundle the fuel handling work package into two bundles by the scope of work: (1) defueling of the four reactors; and (2) refurbishment of the fuel handling system;
2. The decision to proceed with negotiations and execute a contract with GEH-C on a single source basis for the defueling scope of work; and
3. The decision to further unbundle the refurbishment scope of work into five sub-bundles, and to competitively bid the majority of that work.

1. WORK PACKAGE BUNDLING

Ontario Power Generation made a decision in 2012 to bundle the Fuel Handling work package into two scopes of work: (1) defueling of the reactors; and (2) refurbishment of the fuel handling facilities. Per the Company, unbundling of the work by scope allowed the Project to: (a) source and move forward with critical path defueling work while preparing the detailed scope of work and commercial arrangement for the refurbishment; (b) mitigate risks associated with a non-integrated approach to the defueling work; and (c) maximize competitive sourcing for the overall fuel handling project. In addition, Ontario Power Generation unbundled the work by scope with the recognition that the defueling and refurbishment work scopes are independent of one another and that different vendors may be able to perform different portions of the scope work, increasing competition.

¹⁰ Station Improvement Opportunities included items such as the purchase of additional fuelling machines, replacing the powertrack with new technology, and installing a new fuel inspection facility.



2. NEGOTIATIONS WITH GEH-C FOR DEFUELING

For the defueling scope of work, Ontario Power Generation's contracting strategy was to single source the engineering, supply of hardware, and technical support to GEH-C. The Company began negotiations with GEH-C in the fourth quarter of 2012, agreeing to terms and conditions in December 2012, receiving a proposal from GEH-C in January 2013, signing a final contract on May 17, 2013, and issuing a purchase order to GEH-C on May 17, 2013.¹¹ GEH-C is also performing pre-engineering work for Ontario Power Generation under a separate contract. The engineering and supply portions of the contract will be performed under fixed pricing, while the technical support and commissioning work portions of the contract are planned to be performed under reimbursable cost pricing.

Contract incentives and disincentives include payments to GEH-C if each unit's defueling is completed on-time or better, warranty of procured equipment and liquidated damages for late delivery of equipment.

The main alternative to the preferred contracting strategy was to competitively bid the contract. Ontario Power Generation believes this was an inferior option, for reasons including:

- GEH-C is the designer of record for the Darlington fuel handling equipment.
- GEH-C has been retained by Ontario Power Generation to act as Darlington's sole fuel handling Design Agent for over 30 years. Ontario Power Generation currently contracts with GEH-C on an annual basis to maintain configuration management of Darlington's fuel handling documentation. In addition, GEH-C performs all current engineering work on Darlington's fuel handling facilities.
- GEH-C is the only potential supplier with trolley mounted fuel handling system design and engineering experience.
- GEH-C is the designer of the Darlington fuel bundles.
- Engagement of a supplier other than the OEM could introduce nuclear safety and integration compatibility risks.
- GEH-C completed the defueling work at Bruce Power LP, the only other CANDU plant with a trolley mounted fuel handling system (a similar method of defueling – *i.e.*, flow defuel – was also used at Bruce Power LP).¹²
- Ontario Power Generation prefers a single point of accountability to ensure proper oversight coordination, integration and flexibility of implementation.
- A Kepner-Tregoe analysis, in which the optimal solution is determined based on a weighting of each potential solution's match with the Company's "must haves" for a project, was performed for defueling. That analysis demonstrated that Ontario Power Generation's preferred approach was the highest scoring alternative.
- Due to its place on the critical path, there is a major risk to the overall Project if defueling is not completed according to schedule.

¹¹ Due to the delay between signing the contract and issuing the purchase order, all time-related performance clauses in the contract are based on a May 17, 2013 execution date.

¹² Concentric was advised of GEH-C's involvement in the Bruce refurbishment work by Ontario Power Generation.



3. SUB-BUNDLING OF FUEL HANDLING REFURBISHMENT

For the refurbishment scope of work, Ontario Power Generation plans to competitively bid the main fuel handling refurbishment and two other sub-bundles, and identified seven potential candidates to bid on the work. The Company plans to single source a fourth sub-bundle, the fuel machine head overhaul, to GEH-C in order to eliminate modification and integration risks.¹³ The reactor area bridges and carriages refurbishment work (*i.e.*, a fifth bundle) will be completed under the Retube & Feeder Replacement contract with SLN/Aecon Industrial through an addition to the scope of work under that contract due to overlapping work and work areas.

Ontario Power Generation believes that the scope is sufficiently developed for much of the refurbishment, with the exception of reactor area bridges and carriages refurbishment and that the most appropriate contracting model is fixed/firm or target pricing.

As discussed above, up until it performed its detailed scope optimization study, Ontario Power Generation planned on single sourcing the entire Fuel Handling work package to GEH-C. The scope optimization study, however, resulted in many findings by the Company that indicated a different commercial strategy was appropriate, including:

- There are distinctions between the sub-bundles that require different expertise. For example, the Main FH Refurbishment sub-bundle is a heavy-construction related scope of work, whereas the fuel handling control system refurbishment relates to information technology and is mechanical in nature.
- The scope optimization resulted in the majority of the work being heavy construction work that is not fuel handling specialty work. Other vendors are equally or more capable than GEH-C of doing that type of work, without the required involvement of the OEM. Specifically, per the Company, the main fuel handling refurbishment and control system work is not unique to fuel handling and requires little specialty knowledge. The irradiated fuel bay inspection tool and irradiated fuel bay heat exchanger sub-bundles are also non-fuel handling specialty work that the ESMSA vendors are capable of performing. If GEH-C was to perform this work, it would likely need to partner with a construction firm to do so.
- In total, the estimated cost for the refurbishment scope of work was reduced from approximately \$515 million, including \$450 million in contingency scope and Station Improvement Opportunities, to approximately \$170 million, including \$20 million of contingency scope. This significant reduction in scope resulted in a fundamental change in the nature of the fuel handling refurbishment project from one that required large amounts of specialty work by the OEM to one comprised largely of heavy construction. Whereas a single source approach with the OEM may have been appropriate for the larger, less defined scope, that approach became less appropriate as the refurbishment work was transformed into a heavy construction project.
- The timing and location of the sub-bundles allows Ontario Power Generation to execute contracts with multiple vendors without increasing vendor-interface and project

¹³ The fuel machine head overhaul involves procurement of an “off-the-shelf” parts kit that will be installed by a third party under a competitively-bid agreement.



management risks materially. In fact, due to the significant time gap between certain of the sub-bundles, and differences in the nature of work to be performed, having the entire refurbishment bundle scope of work performed under one contract might increase the contract management burden on the Company.

- Two bundles (*i.e.*, irradiated fuel bay inspection tooling and the irradiated fuel bay heat exchanger replacement) are required prior to defueling in order to allow the irradiated fuel bays to accommodate the increased amount of irradiated fuel that is defueled from the reactors. Thus, these two sub-bundles, which are planned to be performed by ESMSA vendors, will be implemented well in advance of the other four sub-bundles, which will occur during the refurbishment outages.
- For the reactor area bridges and carriages refurbishment sub-bundle, it was determined that the most appropriate action was to replace the bridges (which support the fuel machines and move vertically) and ball screws (upon which the bridges move up and down to and from the reactor) rather than re-install the existing equipment and replace them in a future year.¹⁴ Since the Retube & Feeder Replacement vendor is going to remove the bridges and ball screws as part of its scope of work, Ontario Power Generation determined that the most efficient strategy was to have that same vendor install the new equipment under an addition to the execution phase scope of work under the Retube & Feeder Replacement contract.
- Lastly, in terms of the fuel machine head, the design changes and modifications that are required for that piece of specialty equipment are unique to the fuel machine head and GEH-C is the original designer and manufacturer of the system.

On March 12, 2013, Ontario Power Generation solicited expressions of interest (“EOIs”) for the fuel handling refurbishment work that will be competitively bid. The Company received positive responses from eight potential vendors, four of whom propose to form joint ventures or sub-contract with one another.¹⁵ Ontario Power Generation issued a RFPs in July 2013.

VII. CONCENTRIC’S FINDINGS AND RECOMMENDATIONS

A. WORK PACKAGE BUNDLING

FINDINGS

Concentric finds that the decision to unbundle the fuel handling work package into two bundles by the scope of work: (1) defueling of the four reactors; and (2) refurbishment of the fuel handling system, is reasonable and appropriate. The strategy has evolved significantly since its initial development. The decision to

¹⁴ Ontario Power Generation operating experience review indicated that the Bruce and Point LePreau stations did not replace the ball screws during refurbishment and needed to replace them soon thereafter.

¹⁵ Areva and B&M expressed interest in forming a joint venture, with Areva performing engineering work and B&M performing procurement and construction work. In addition, GEH-C expressed interest in performing the work as the sole proponent, sub-contracting procurement of commodities and construction to AECON, while AECON also expressed interest in performing the work as the sole proponent with an unidentified party subcontracting for engineering work.



unbundle the defueling and refurbishment scopes of work allows Ontario Power Generation to focus on the critical path defueling project while increasing competition for the larger, refurbishment project.

B. DECISION TO CONTRACT WITH GEH-C

FINDINGS

Concentric finds that the decision to proceed with negotiations and execute a contract with GEH-C for the defueling contract is appropriate and prudent. The defueling scope of work is critical to the overall success of the Darlington Refurbishment Project, both in terms of its place on the critical path and the fact that it needs to be completed before the other major work packages can proceed. Ontario Power Generation performed the aforementioned Kepner-Tregoe analysis regarding the alternatives for contracting the defueling work (*i.e.*, bundled single source to OEM, bundled competitive bid, and unbundled with a mix of OEM and competitive bid). That analysis supported the decision to bundle the defueling work and contract through a single source strategy with the OEM. In addition, Concentric finds that senior management appears to be engaged and well apprised of project activity. Regular meetings have been held with the Program Contracting Steering Committee during the commercial strategy development and negotiations with GEH-C regarding defueling. Specifically, meetings were held November 2, 2012, December 11, 2012, February 27, 2013, and April 26, 2013. The Cross Functional Sourcing Team was briefed on the fuel handling project as well (January 28, 2013 and February 22, 2013).

As the Company identified, Ontario Power Generation can use negotiations with GEH-C for the defueling work to potentially gain negotiating leverage with and/or concessions from GEH-C for the refurbishment work (as discussed above, GEH-C has been identified as a potential respondent to Ontario Power Generation's RFPs for refurbishment work). Already, according to the Company, Ontario Power Generation has been able to improve upon its terms and conditions with GEH-C, and negotiated increased transparency on pricing.

The factors supporting a single source contract are significant. Those factors include that GEH-C is the Design Agent and OEM, prepared the Component Condition Assessments for the fuel handling system as the Fuel Handling work package scope of work was being developed, has performed preliminary engineering work, and has previous knowledge of trolley-based fuel handling systems and Darlington-specific experience. Candu Energy Inc. ("Candu Energy") appears to be the only other qualified alternative vendor. Per the Kepner-Tregoe analysis performed by the Company, however, there are risks that: (1) another vendor will not understand the Project scope; (2) another vendor will increase the number of interfaces and hand-offs; and (3) there may be integration misalignments if multiple vendors are involved with this portion of the work. Given the placement of defueling on the critical path of the Darlington Refurbishment Project and the relatively small budget for defueling as compared to the overall Darlington Refurbishment Project budget, the risks to cost and schedule of involving multiple vendors in this work may outweigh the benefits, if any.

RECOMMENDATIONS

Concentric notes that Ontario Power Generation recognized that a lack of transparency on the part of GEH-C presented a challenge in developing an acceptable contract with GEH-C, and the Company has taken steps to address that problem. Nonetheless, industry experience suggests management of a contract and



controlling costs with a vendor can also be difficult later in the life of a contract due to a lack of pricing transparency, and we suggest that the Company maintain vigilance in that area.

Concentric also notes that there is a lack of disincentives for GEH-C after a certain number of days' delay in the schedule for each unit, once the incentive runs out. Concentric recognizes overall schedule disincentives may be unachievable in a contract with GEH-C because Ontario Power Generation is doing the field work, but the Company should track and evaluate the risk that GEH-C will be unmotivated economically if the overall schedule slips by more than five days.

Lastly, we note that an Ontario Power Generation Internal Audit report from May 2012 made the recommendation that the Fuel Handling and Turbine Generators work package project teams clearly establish when justifications for single-source processes would be created and approved for significant portions of the two scopes of work. We agree with the audit's findings that there is a potential gap in the sequencing of supply-chain approvals, but stress that our concern is limited to the process for SSJ development and approval, not the basis for the SSJs themselves. Nothing Concentric observed in this regard has indicated imprudence on the part of Ontario Power Generation, nor did the process as implemented affect the outcome of the supply chain activities.

We believe that it is in the Project's best interest to achieve internal alignment on a single-source approach at the outset of the development of plans to negotiate with single-source vendors. This is particularly true for agreements that will develop over the course of several months or for contractual arrangements that will exceed \$10 million. This will ensure that the team is aligned on the strategic direction of the Project, and will mitigate the risk of committing significant resources to a procurement strategy that may not ultimately be approved by established Supply Chain procedures. It will also prevent unnecessary schedule extensions related to pursuing contracting strategies that are not ultimately approved. Recognizing that a structural solution may be too formal for what is an exceptionally dynamic process, we recommend that, at a minimum, clear lines of communication be established when new members of the Supply Chain organization are introduced to the Project, which will happen during a project of this scale and duration.

C. SUB-BUNDLING OF FUEL HANDLING REFURBISHMENT

FINDINGS

Concentric finds that the decision to sub-bundle the fuel handling refurbishment scope of work is reasonable. As discussed above, the Company's scope optimization study indicated that there are significant distinctions between each sub-bundle in terms of timing, location within the plant, and type of work. Such distinctions require different types of expertise that is not necessarily housed within one single vendor. In addition, the significant timing differences between the sub-bundles indicate that attempting to perform all of the fuel handling refurbishment work under one contract could be administratively burdensome and lead to project management challenges.

RECOMMENDATIONS

Concentric recommends that Ontario Power Generation revise its commercial strategy document to expand on the business case for the sub-bundling and competitive bidding approaches. Through interviews and data requests, Concentric was able to increase our understanding of the fuel handling commercial strategy



significantly, and many of the materials provided to Concentric as part of this process could be used to increase the robustness of the Company's commercial strategy documents.

Such expanded documentation should include an evaluation of how the risks that might typically be increased from a strategy that involves multiple vendors and contracts (*e.g.*, coordination challenges, technical integration of components, increased administrative burdens) are mitigated due to the timing, location, and work type of each sub-bundle.

VIII. CONCLUSION

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 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 the Company in mitigating these risks, no commercial strategy can fully eliminate them.

To conduct our review of the Project's commercial strategies, Concentric undertook a detailed process to determine whether the strategies selected for the Fuel Handling work package are reasonable and meet the regulatory prudence standard. Our opinion of these strategies relied on information provided by the Company in response to our data requests, interviews with key personnel, our independent research and Concentric's experience advising other megaproject sponsors. Our review confirms the reasonableness and prudence of Ontario Power Generation's selected procurement strategies, and also includes observations and recommendations.