

EB-2016-0152

**Ontario Power Generation Inc.
Application for payment amounts for the period
from January 1, 2017 and December 31, 2021**

VULNERABLE ENERGY CONSUMERS COALITION

**(“VECC”)
CROSS-EXAMINATION COMPENDIUM
PANEL 1D Schiff Hardin/K. Roberts**

March 9, 2017

TAB 1

Darlington Refurbishment
Project Report
to
Ontario Energy Board
November 21, 2016



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Section IV of the Pegasus Report contains detailed findings and conclusions based on Pegasus-Global's assessment of the DRP. The Pegasus-Global team had the opportunity to interview key personnel at OPG, which is a material difference from Schiff's analysis.⁵⁷ The ability to interview key personnel not only supplements the understanding of written project documentation, but also provides an opportunity to assess the skills of the OPG staff and gain insight from which to evaluate OPG's ability to manage the work during the Execution Phase. Generally, Schiff agrees with Pegasus-Global that OPG's actions during the Definition Phase of the DRP are within industry standards but notes that Pegasus-Global does not address the fact that the vast majority of mega-projects (including mega-programs) are over budget and over schedule. While OPG's detailed planning during the Definition Phase of the DRP mitigates some risk that may arise during the execution of the DRP, no amount of planning is a guarantee of successful completion. All mega-projects (including mega-programs) experience some form of cost and/or schedule issues. It is not a question of whether these type events occur, it is a matter of how OPG handles and responds to these issues when they arise.

IV. CONTRACTING STRATEGY, CONTRACTING TERMS, AND CONTRACTUAL RISK ALLOCATION BETWEEN OPG AND THE PRIME CONTRACTORS

Q: What is the contracting strategy deployed by OPG for the DRP project?

A: OPG has chosen to develop, design, construct, and start-up the DRP using a multi-prime approach. A multi-prime approach involves the owner entering into separate contracts with multiple contractors to perform select scopes of work on the applicable project. Under this contracting model, no single prime contracting party is responsible for the entire

⁵⁷ See Exhibit D2-2-11 at p. 8.

reasonable and meet the regulatory standard of prudence. Schiff does not disagree with this conclusion.

Q: Does OPG's contracting strategy for the DRP meet industry standards?

A: Yes. In Schiff's experience, on a major multi-project nuclear refurbishment program, OPG's multi-prime contracting strategy using mini-EPC contracts meets industry standards. However, a multi-prime contracting strategy is not without risks that need to be considered and mitigated. For an owner-led multi-prime strategy to be successful on a mega-project, the owner must employ a strong, capable, and experienced project management team or construction manager that is able to coordinate and track the work of such a complex project. Otherwise, the multi-prime approach is likely to miss important schedule milestones and cost objectives, thereby preventing OPG from realizing the advantages of a multi-prime methodology as discussed in this testimony.

There are several conventional reasons for a nuclear owner to deploy a multi-prime approach, including the following:

- a. It is difficult for an owner of a nuclear facility to shift all of the risk on the project to a single contractor.
- b. It allows the owner to maintain control over the design of the project.
- c. It allows the owner to provide project and schedule oversight and control.
- d. It reduces contractor costs because the contractors are not responsible for coordination costs across the entire project.
- e. It allows OPG to monitor the contractors' work and confirm that the work meets the design intent.

**TESTIMONY OF
DR. PATRICIA D. GALLOWAY
PRESIDENT AND CHIEF EXECUTIVE OFFICER,
PEGASUS GLOBAL HOLDINGS, INC.
ON BEHALF OF
ONTARIO POWER GENERATION INC.
RE: EB-2016-0152 – 2017-2021 PAYMENT AMOUNTS APPLICATION
BEFORE THE
ONTARIO ENERGY BOARD**

JULY 2016

Enterprise Leadership Team; Management Systems Oversight (MSO); the Program Assurance Group; and, steering committees for each major vendor. MSO acts as the Program Owner for oversight, which entails monitoring compliance with project and program standards to ensure Program objectives are achieved and facilitating and coordinating internal and external audit and oversight functions.³¹

Q. In your opinion does OPG possess the required experience and expertise to design and construct a megaprogram the size and complexity of the Darlington Refurbishment Program?

A. Yes. I found that OPG has a long history of managing nuclear construction projects and was intimately involved with the engineering and management of those projects. We interviewed 15 individuals involved in the DRP at different levels and functions. The group represented a vast amount and a breadth of nuclear experience. For example, some individuals had actually been involved in the original construction of Darlington. Others had come to the DRP after years of experience in multiple nuclear programs. My conclusion was that OPG sought to find the most qualified individuals in the industry to manage the Program and the individuals that were assigned to manage the Program are qualified and competent.

Q. What were your findings and conclusions pertaining to the OPG oversight of the Darlington Refurbishment Program?

A. I conclude that OPG senior management, executive management, and the Board of Directors: (i) have efficient oversight processes in place; (ii) are focused on important process/progress issues; (iii) are participating fully in strategic decisions; and, (iv) are active in issue resolution and are informed and engaged in the planning and pre-execution phases. I also conclude that OPG's oversight process is thorough, complete and consistent with what I would expect from a reasonable and prudent utility company embarking on this type of megaprogram.

VECC Interrogatory #5

Issue Number: 4.3

Issue: Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

Interrogatory:

Reference: Exhibit M1 Management Staff Capability

- a) The author makes a number of comments with respect to the number and capability of project managers and executive oversight for megaprojects. It is noted that there is no evidence regarding the training, experience, and qualification of the people directly involved in developing the DRP schedule (page 24). What evidence does the author believe should be provided in order to make an assessment as to capability of OPG in this regard?
- b) How has the author determined if OPG's planned staffing (page 26) are, in the first instance, sufficient, insufficient or too large, to meet the project's requirements?

Response:

The following response was provided by Schiff Hardin:

- a) An explanation of who developed the schedule and those individuals' resumes including their training, experience, and qualifications including, but not limited to, prior experience scheduling nuclear projects, mega-projects, and multi-prime mega-projects similar to the DRP.
- b) Schiff's report does not include an opinion about whether OPG's planned staffing levels are sufficient, insufficient or too large.

TAB 2

VECC Interrogatory #6

Issue Number: 4.3

Issue: Are the proposed nuclear capital expenditures and/or financial commitments for the Darlington Refurbishment Program reasonable?

Interrogatory:

Reference: Exhibit M1 Contract Recovery Plan & Mediation

- a) At pages 42-43 the author outlines contract risk due to lack of a contractually-required recovery plan and the lack of mediated dispute resolution. In the author's view does the lack of these contract features increase the risk to the project? If so what steps could now be taken to mitigate that risk?

Response:

The following response was provided by Schiff Hardin:

- a) There are a variety of strategies to mitigate risk, each with pros and cons and associated financial implications. The lack of these contract features does not necessarily increase the risk to the project. These provisions, however, are often deployed to mitigate project risk.

- b) At pages 64 the following statement is made:

For a utility owner to be confident in the ultimate regulatory recovery of construction costs, the prudence standard requires the owner's active involvement in the project, ongoing documentation of the decision-making process for any issues with cost or schedule impacts, and constant work with the contractors to resolve commercial disputes involving cost and schedule at the project level as they arise over the life cycle of the project/program. **As necessary, disputes must be elevated in a timely manner to executive management for negotiation and resolution. If the owner waits until the end of the project to "enforce its contractual rights" in order to resolve a dispute, by that time the damage has already been done. It is critical for the owner to be proactive and resolve disputes as they arise to maintain the contractors' continued cooperation and commitment to the project/program.** (emphasis added)

- a) In light of the author's stated concerns as to whether OPG has sufficient dispute resolution and early recovery plan as part of its contracting what regulatory reporting

1 or instructions are recommended to reduce the risk of cost overruns due to these
2 deficiencies.

3
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8 a) See Schiff Hardin's Response to M1-4.3-VECC-3(b) Earned Value which lists the
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13 b) The author also states: "*many utility regulatory commissions require the utility to*
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23 b) One option is that OPG provide the OEB a written report on a quarterly basis
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25 OEB with the contractually-required monthly contractor reports. Regardless of the
26 source of the report, the recommended reporting should contain the relevant project
27 data, including data relating to the topics identified in Attachment 1. Much, if not all
28 of this data, is either accumulated by, or is available to, OPG and can be provided to
29 OEB on a routine basis. In addition to the written reports, in order to disseminate,
30 discuss, and evaluate the data, OEB should consider having a quarterly meeting
31 with OPG throughout the DRP.

One of the important risk mitigation provisions of the contractual ADR process allows OPG to include parties under other contracts in any arbitration proceeding. This “joinder” provision will potentially prevent OPG from litigating the same dispute several times with different contractors (with potentially different results) and will help mitigate some of OPG’s exposure and the costs of the dispute resolution process.

Mediation is a process which brings a third-party neutral into a situation where the parties have been unsuccessful in negotiations but have a desire to resolve a pending controversy prior to incurring the cost and risk of binding dispute resolution. Mediators have no power to resolve disputes; their power is in their ability to help change one or both parties’ perspectives and potentially their settlement positions. Unlike arbitration, there is no one set procedure for mediation. The structure of the process should depend on the nature of the impasse, the viewpoints of the respective decision makers, the history and current nature of the relationship between the parties and the nature of the issue(s) in dispute. How the mediation process is designed is often outcome determinative. Based on Schiff’s experience, mediations have a high rate of successfully resolving disputes on mega-programs, and, even if the mediation does not result in a settlement, there are significant benefits to the information exchanged and perspective gained during the mediation process. This is because a mediator can provide a neutral sounding board for a party’s senior management to gauge the strength and weaknesses of its own and the other party’s case before spending significant money in arbitration. One effective way to learn the strengths and weaknesses of parties’ claims is to use an evaluative mediator who can assist

potential claim arises, any of the parties to the DRB agreement can ask the DRB for an advisory non-binding opinion based on the facts. Under some protocols, the opinion of the DRB can be used in a subsequent binding proceeding.

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the parties by pointing out weaknesses and predicting what a judge or jury might do in a particular case. In conclusion, while the DRP's contractual step negotiation process is within industry standard on a mega-program, the lack of a mandatory mediation process as a condition precedent to arbitration has eliminated an opportunity to mitigate schedule and cost disputes before arbitration.

Q: Do the contracts have sufficient "off-ramps" to allow OPG to terminate an underperforming contractor or the Program if necessary or desirable?

A: Yes. For a mega-program the size, cost, and duration of the entire DRP, it is critical that the owner have the ability to suspend the work, terminate the contractor, and/or terminate a project or the program. In all of the contracts, OPG retains the ability to terminate the contractor or the program. The Steam Generator Contract has industry-standard suspension, termination for convenience, and termination for default provisions. The contract also contains certain provisions that allow OPG to mitigate some of the potential damages or transition costs in the event of a termination. For instance, the Steam Generator Contract allows for: (1) partial termination; (2) an assignment of the contractor's subcontracts in the event of a termination; (3) a duty to cooperate in the event of a termination; and (4) the ability to use the contractor's materials and equipment to complete the contractor's work. Provided OPG has a reasonable alternative to the poorly performing contractor, it can also "terminate" the contractor by simply not moving forward with that contractor on the subsequent units. Other contracts have provisions similar to the Steam Generator Contract.

V. OTHER REFERENCE PROJECTS

Q: How does the DRP compare to other nuclear refurbishment projects?

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contractors report their status and provide visibility to their earned and actual hours as required by the systems in place.

Q: How can OPG use earned value on the DRP to make decisions?

A: OPG's executives and Program Management's decision-making during the Execution Phase of the DRP will be impacted by the quality of the information it receives from the Project team, including the contractors, on a regular basis. With respect to earned value, in Schiff's experience, once corporate executives and Program Management are educated regarding how to look at a project from an earned value perspective, it becomes a very effective tool for them to understand and quickly gain access to data necessary for managing a project. Earned value allows the project management team and the contractors to reduce a very complex construction project into something that can be readily seen and easily understood. By effectively utilizing this tool during the Execution Phase, OPG has the opportunity to understand where problems are with the DRP's major contractors and will have the opportunity, with timely decision making, to develop appropriate problem-solving strategies utilizing that information. During the Execution Phase, it is critical that the key metrics are provided regularly to OPG's leadership including schedule progress by the contractors in meeting key milestones, quality and safety statistics, and changes in scope and budget to provide OPG's DRP program and project management with the information necessary to make timely, reasonable, and prudent decisions.

Q: Did your review conclude that OPG's schedule development process was within industry standards?

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A: Yes. OPG's explanation of the schedule development process for the DRP is within industry standards.³⁸ However, OPG's evidence did not include details regarding the training, experience, and qualification of the people directly involved in developing the schedule. Additionally, Schiff did not independently verify the appropriateness, sufficiency, or correctness of the scope of the DRP or the Unit 2 schedule. Further, Schiff did not perform a compliance audit to determine whether the Unit 2 schedule adheres to industry standard scheduling practices.

Currently, OPG has only completed the detailed schedule for Unit 2.³⁹ The detailed schedules for Units 1, 3, and 4 do not yet exist and OPG's evidence does not specify when these schedules are going to be created. Depending on the size of the project controls team for both OPG and the major contractors, it may be a challenge during the Execution Phase to monitor, update and track the Unit 2 schedule while simultaneously developing the subsequent units' detailed schedules. Additionally, OPG plans to incorporate lessons learned from the execution of the refurbishment of Unit 2 into the schedule planning for the subsequent units on an ongoing basis.⁴⁰ To successfully execute this plan, OPG will need to apply the prudent management steps described above including: (1) diligently capturing the Unit 2 lessons learned information; (2) distributing the data to the appropriate audience; (3) evaluating the options for corrective/preventative action and analyzing the relevant underlying data; and (4) making timely and reasonable decisions and incorporating the information into the schedule, processes and procedures, or other applicable project management documents.

³⁸ See Exhibit D2-2-6.

³⁹ See Exhibit L-Tab 4.3, Schedule 2, AMPCO-65.

⁴⁰ See Exhibit L-Tab 4.3, Schedule 1 Staff-60.

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Q: Are the OPG Project Management staffing plans within industry standards?

A: Yes. The staffing plan⁴¹ appears to be within industry standards; however, in Schiff's experience, for an owner-led multi-prime contracting strategy to be successful, the owner must employ a strong, capable, and experienced project management team that is able to coordinate and track the work of such a complex project/program. Otherwise, the multi-prime approach is at risk to miss schedule and cost objectives, thereby preventing the owner from securing the benefits of a multi-prime contracting strategy as discussed later in this testimony. Not only having a full and complete management staff in place, but the experience of the management level staff is important. Compared to typical large construction, mega-projects (including mega-programs) are a different type of project to manage. One expert's view is that "if managers of conventional projects need the equivalent of a driver's license, then managers of megaprojects need a pilot's jumbo jet license."⁴² OPG provided information about the corporate executives involved in the DRP, but the evidence does not include any details regarding the DRP management team's prior experience and credentials including whether or not they possess: nuclear refurbishment experience; prior mega-project (or mega-program) project management experience; or prior experience managing a multi-prime project.⁴³

⁴¹ See Exhibit D2-2-2, Attachment 2.

⁴² Bent Flyvbjerg, 2014, "What You Should Know about Megaprojects and Why: An Overview," *Project Management Journal*, vol. 45, no. 2, April-May, pp. 3.

⁴³ During the November 14, 2016 Technical Conference, the panel verbally stated that there are some members of the management team who have prior nuclear refurbishment experience.

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Additionally, OPG's planned staffing levels for the DRP require an aggressive ramp up in 2016.⁴⁴ While OPG did increase the total FTEs from 519 FTE in January 2016 to 691 FTE in August 2016 (a net increase of 172 FTEs), this increase falls short of OPG's planned FTE staffing levels (actual FTE = 691 vs. planned FTE = 791).⁴⁵ As of August 2016, OPG was 100 people behind in its planned FTE increase. The actual DRP FTE staffing levels during January through August 2016 is shown in the chart below.

DATA FROM L-4.3 SCHEDULE 2 AMPCO-087		
MONTH	NET FTE STAFFING CHANGE FROM PREVIOUS MONTH	TOTAL ACTUAL DRP FTE
JANUARY 2016	+37	519
FEBRUARY 2016	+122	641
MARCH 2016	-23	618
APRIL 2016	+104	722
MAY 2016	-53	669
JUNE 2016	+68	737
JULY 2016	-46	699
AUGUST 2016	-8	691

OPG's staffing plan to manage Unit 2 requires significant additional increases to the August 2016 FTE staffing levels. The planned increase from actual August 2016 FTE to achieve the planned FTE level in December 2016 requires a net increase of 308 people, which represents

⁴⁴ See D2-2-8, Attachment 2 Page 29; Exhibit L-4.3 Schedule 2 AMPCO-087.

⁴⁵ Id.

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an approximately 45% increase from the actual August 2016 FTE level.⁴⁶ The planned staffing levels for September 2016 through December 2016 are shown in the chart below.

DATA FROM L-4.3 SCHEDULE 2 AMPCO-087		
MONTH	NET FTE STAFFING CHANGE FROM PREVIOUS MONTH	PLANNED DRP FTE
SEPTEMBER 2016	+119 <i>17% increase from previous month</i>	809
OCTOBER 2016	+198 <i>24% increase from previous month</i>	1007
NOVEMBER 2016	+4	1012
DECEMBER 2016	-13	999

Not only must OPG successfully achieve the planned staffing levels, but, when achieved, these staffing levels must be maintained for the next three years. OPG's planned staffing levels for 2017 – 2019 are shown in the chart below.

YEAR	AVG FTE STAFFING PER MONTH
2017	1058
2018	1042
2019	1000

⁴⁶ (308 ÷ 691 = 0.4457). During the November 14, 2016 Technical Conference, OPG reported that the staffing increase since the report issued is 186 FTE, which is less than the planned increase during October 2016.

Based on the information provided by OPG, OPG is behind in achieving the planned staffing levels. If OPG fails to create and maintain staffing levels in accordance with the staffing plan, it could adversely impact OPG's ability to effectively manage the DRP. As discussed throughout this testimony, the owner's project team is critically important in managing a multi-prime program and in OPG's ability to execute the prudent management decision-making framework. Sufficient and qualified project management staff is required to gather accurate data during the Execution Phase. Additionally, the management team must be deep enough to generate and evaluate all appropriate options and capable of conducting robust analyses of the data. Adequate project staffing in accordance with the project management plan is an important factor in the project team's ability to execute prudent, reasonable, and timely decision-making.

Q: Is OPG's use of audit and oversight within industry standards?

A: Yes. OPG's project management plans including the use of audit and oversight is within industry standard practices. Audit programs periodically test compliance of the project team to the written processes and procedures. For multi-year projects, audit reports provide important feedback to the project team on deviations from the written processes and procedures and the resulting risks. Oversight groups provide independent reviews of the project status to support prudent decision making. OPG is planning to use oversight from internal audit, the Refurbishment Construction Review Board, the Board of Directors, and the Ministry of Energy.⁴⁷ If an owner is engaging in a multi-prime mega-project, executive management may recognize the need to adopt a structured approach to the management of the contractors to ensure heavy owner involvement. During the early project planning, if executive management

⁴⁷ See Exhibit D2-2-2 at p. 8.

TAB 3

VECC Interrogatory #6

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Reference: Exhibit M1 Contract Recovery Plan & Mediation

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Response:

The following response was provided by Schiff Hardin:

- a) There are a variety of strategies to mitigate risk, each with pros and cons and associated financial implications. The lack of these contract features does not necessarily increase the risk to the project. These provisions, however, are often deployed to mitigate project risk.

- b) At pages 64 the following statement is made:

For a utility owner to be confident in the ultimate regulatory recovery of construction costs, the prudence standard requires the owner's active involvement in the project, ongoing documentation of the decision-making process for any issues with cost or schedule impacts, and constant work with the contractors to resolve commercial disputes involving cost and schedule at the project level as they arise over the life cycle of the project/program. **As necessary, disputes must be elevated in a timely manner to executive management for negotiation and resolution. If the owner waits until the end of the project to "enforce its contractual rights" in order to resolve a dispute, by that time the damage has already been done. It is critical for the owner to be proactive and resolve disputes as they arise to maintain the contractors' continued cooperation and commitment to the project/program.** (emphasis added)

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be put in place at these early stages of the Plant Vogtle Units 3 and 4 construction project. To that end the Commission directs the Staff and the Company to meet in a collaborative effort to develop a mechanism crafted as such and report to the Commission not later than 180 days after the date of this Order with such a mechanism for the Commission consideration.⁷⁰

After years of negotiation, Georgia Power and the Staff continued to have fundamental differences with respect to the framework of a proposed incentive program for the Vogtle Project. In an Order filed on August 4, 2011, the Georgia Public Service Commission PIA Staff and Georgia Power Company agreed that the following was the best way to align the interests of ratepayers and investors regarding the risk of cost increases on the Vogtle Project:

The verification and approval of expenditures by the Commission . . . does not preclude the Commission from subsequently excluding those expenditures from rate base upon a finding of fraud, concealment, failure to disclose a material fact, imprudence, or criminal misconduct. The burden of proof shall be on the party moving to exclude the verified and approved costs to demonstrate that the Commission should make such a finding.⁷¹

Even though an aggressive risk shifting provision was not ultimately adopted for the regulatory treatment of the Vogtle Project costs, the Commission's preapproval of the Vogtle Project costs does not function as a blank check to Georgia Power. While Georgia Power maintains the presumption of prudence and Staff (or other challenging parties) has the burden of proof to demonstrate one of the justifications for disallowance, this provision gives the Commission the right to "claw-back" any portion of the approved Vogtle Project budget. The Stipulation included in the Order also required Georgia Power to do the following during the execution of the Vogtle Project:

⁷⁰ Id. at pp. 6-7.

⁷¹ Georgia Public Utility Commission, August 4, 2011 Order, 137604, Docket 29849 at pp. 2-3.

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- File semiannual monitoring reports with the Commission on the dates requested addressing the topics and areas identified in the Stipulation⁷²;
- Provide the Commission with monthly status reports regarding the construction work in progress⁷³;
- Enact a records retention program acceptable to the Commission for records relating to the Vogtle Project⁷⁴; and
- “[P]ay up to \$600,000 per year for each year of construction for an independent Construction Monitor (“CM”) to assist the Staff in monitoring the construction work in progress. . . .”⁷⁵

These reporting requirements promote transparency and provide the Staff with the tools to understand the status of the Vogtle Project and whether Georgia Power is in fact exercising reasonable and prudent management and cost management *during* the life cycle of the project. As a result, the reporting and claw-back provisions help protect the ratepayers from the risk of runaway costs on the Vogtle Project.

As of October 2016, Georgia Power and the Staff of the Georgia Public Service Commission are negotiating the regulatory treatment of the \$1.8 billion cost overruns to the Vogtle Project. As a result, the final prudence determination regarding the project’s costs is currently unknown.

⁷² See Georgia Public Utility Commission, March 30, 2009, Attachment 1 Stipulation to the Amended Order, 27849, 2010 Order on Remand, Docket 29800 at pp. 1-3.

⁷³ Id. at p. 1, ¶2.

⁷⁴ Id.

⁷⁵ Id. at p. 2, ¶2(b).

TAB 4

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- The DRP risks and OPG's risk assessment are consistent with industry standard practices used by utilities on large capital construction projects (including mega-programs) of similar size and complexity.

- OPG's planned project controls systems for the DRP to manage cost and schedule are consistent with industry standard practices used by utilities on large capital construction projects (including mega-programs) of similar size and complexity.

- OPG's program and project management staffing plans and the written management policies and procedures for the DRP are consistent with industry standards used by utilities on large capital construction projects (including mega-programs) of similar size and complexity.

- OPG's contracting strategy, contract terms, and contractual risk allocation between OPG and the contractors for the DRP is consistent with industry standard risk shifting for projects (including mega-programs) the size and complexity of the DRP.

- Historically, the vast majority of mega-projects/mega-programs² are over budget and over schedule. Due to the sweeping scope, lead times, complexity, and stakeholder involvement, mega-projects are an entirely different breed from other large capital construction projects. Due to a number of variables, it is not possible to create an apples-to-apples cost, schedule, or risk comparison of the DRP to other nuclear refurbishment or other mega-projects. While the majority of mega-projects are ultimately over budget and experience delays, OPG used industry standard methods to complete extensive project planning in an effort to maximize the chance of being successful in executing the DRP.

² For purposes of discussing industry standards in this report, the terms mega-project and mega-program are used interchangeably.

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to identify, manage, and mitigate risk as it occurs during the Execution Phase of the DRP. Based on Schiff's experience in the industry, the duration of the Definition Phase of the DRP, and the tasks completed during that time, OPG's actions are consistent with industry standards used by utilities on large capital construction projects (including mega-programs) of similar size and complexity. Additionally, OPG's evidence filed in this case demonstrates that during the Definition Phase, OPG applied the prudent management decision-making framework described above by: (1) gathering relevant and accurate data; (2) distributing the data to the appropriate audience; (3) evaluating all appropriate options and conducting robust analysis of the data; and (4) making timely and reasonable decisions.

Q: During the Execution Phase of the DRP, what are the construction industry standards that OPG should utilize to mitigate risks?

A: OPG is just beginning the Execution Phase which, if all four units are completed, is scheduled to last for 112 months (February 2026). While OPG's detailed planning during the Definition Phase of the DRP does prepare OPG to mitigate the risks that occur during the Execution Phase of the DRP, the true test will be whether OPG actually executes those plans and whether OPG continually and reliably follows the prudent management decision-making framework described above to make reasonable management decisions. **Based on Schiff's experience in the industry, an owner's compliance with industry standard risk mitigation planning does not guarantee the successful execution of the program or project.**

As noted in the Pegasus-Global Report prepared by Dr. Patricia Galloway, an expert hired by OPG, the Facilities and Infrastructure Projects and Safety Improvement Opportunities

One of the important risk mitigation provisions of the contractual ADR process allows OPG to include parties under other contracts in any arbitration proceeding. This “joinder” provision will potentially prevent OPG from litigating the same dispute several times with different contractors (with potentially different results) and will help mitigate some of OPG’s exposure and the costs of the dispute resolution process.

Mediation is a process which brings a third-party neutral into a situation where the parties have been unsuccessful in negotiations but have a desire to resolve a pending controversy prior to incurring the cost and risk of binding dispute resolution. Mediators have no power to resolve disputes; their power is in their ability to help change one or both parties’ perspectives and potentially their settlement positions. Unlike arbitration, there is no one set procedure for mediation. The structure of the process should depend on the nature of the impasse, the viewpoints of the respective decision makers, the history and current nature of the relationship between the parties and the nature of the issue(s) in dispute. How the mediation process is designed is often outcome determinative. Based on Schiff’s experience, mediations have a high rate of successfully resolving disputes on mega-programs, and, even if the mediation does not result in a settlement, there are significant benefits to the information exchanged and perspective gained during the mediation process. This is because a mediator can provide a neutral sounding board for a party’s senior management to gauge the strength and weaknesses of its own and the other party’s case before spending significant money in arbitration. One effective way to learn the strengths and weaknesses of parties’ claims is to use an evaluative mediator who can assist

potential claim arises, any of the parties to the DRB agreement can ask the DRB for an advisory non-binding opinion based on the facts. Under some protocols, the opinion of the DRB can be used in a subsequent binding proceeding.

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the parties by pointing out weaknesses and predicting what a judge or jury might do in a particular case. In conclusion, while the DRP's contractual step negotiation process is within industry standard on a mega-program, the lack of a mandatory mediation process as a condition precedent to arbitration has eliminated an opportunity to mitigate schedule and cost disputes before arbitration.

Q: Do the contracts have sufficient "off-ramps" to allow OPG to terminate an underperforming contractor or the Program if necessary or desirable?

A: Yes. For a mega-program the size, cost, and duration of the entire DRP, it is critical that the owner have the ability to suspend the work, terminate the contractor, and/or terminate a project or the program. In all of the contracts, OPG retains the ability to terminate the contractor or the program. The Steam Generator Contract has industry-standard suspension, termination for convenience, and termination for default provisions. The contract also contains certain provisions that allow OPG to mitigate some of the potential damages or transition costs in the event of a termination. For instance, the Steam Generator Contract allows for: (1) partial termination; (2) an assignment of the contractor's subcontracts in the event of a termination; (3) a duty to cooperate in the event of a termination; and (4) the ability to use the contractor's materials and equipment to complete the contractor's work. Provided OPG has a reasonable alternative to the poorly performing contractor, it can also "terminate" the contractor by simply not moving forward with that contractor on the subsequent units. Other contracts have provisions similar to the Steam Generator Contract.

V. OTHER REFERENCE PROJECTS

Q: How does the DRP compare to other nuclear refurbishment projects?

A: Universally across all segments of the construction industry, it is difficult to successfully complete a mega-project or mega-program. Because the vast majority of mega-projects are not completed on time and within budget, researchers have called the “iron law of mega-projects’: *over budget, over time, over and over again*”.⁶² Mega-projects and mega-programs are inherently risky due to the long duration and complex interfaces. Under-staffing, inexperienced project planners or managers, and manager turnover during the life cycle of the project weaken leadership and threaten the consistent application of processes and procedures. Project scope will typically change over time. The occurrence of low probability-high impact events is possible, and the budget and time contingencies included in the original planning frequently prove to be inadequate. Successes in delivering mega-projects and mega-programs are rare. For example, a non-exhaustive list of mega-projects that have experienced 50% or more cost overruns is provided in Appendix 2.⁶³

It is difficult to make comparisons of two or more nuclear projects. The two most important metrics for after-the-fact comparison are cost and schedule. Each construction project is unique and publicly available information will omit commercially sensitive and confidential details necessary for a full and complete understanding of the basis for the outcome of the project or program. Accordingly, publicly available information does not tell the complete story regarding the overall cost and schedule outcome. Even seemingly similar projects can vary regarding the following non-exhaustive list of factors: type of technology; size and scope; project

⁶² Bent Flyvbjerg, 2014, “What You Should Know about Megaprojects and Why: An Overview,” *Project Management Journal*, vol. 45, no. 2, April-May, pp. 11.

⁶³ Most of the information in the chart in Appendix 2 is from Table 2 from Bent Flyvbjerg, 2014, “What You Should Know about Megaprojects and Why: An Overview,” *Project Management Journal*, vol. 45, no. 2.

delivery method; contract terms; pricing mechanism; schedule duration; site conditions; and labor needs. Total project cost as a basis for comparison is misleading because the costs have not been “normalized” so that apples-to-apples comparisons can be made. Factors that can significantly impact the cost of a project include, by way of example: the scope of the project or program; the contracting strategy; the cost of the labor in the area where the project is going to be built (union versus non-union labor and other regional cost differences); market forces and commodity pricing at the time of construction. A high level summary of some other nuclear mega-projects/mega-programs is provided below.

1. Point Lepreau Nuclear Generating Station

Point Lepreau Nuclear Generating Station is a nuclear power station consisting of a single CANDU nuclear reactor located 2 km northeast of Point Lepreau, New Brunswick, Canada. Original construction of Point Lepreau Generating Station completed in 1981. In 2008, the station closed for a refurbishment until October 2012, when it was first re-connected to the grid. The refurbishment of the power station began on March 28, 2008 and was originally scheduled to last 18 months with AECL as the lead contractor on the project.

The project experienced delays of approximately 3 years and cost increases of approximately \$1 billion. The refurbishment effort ran into several unexpected delays resulting from multiple causes and events. For example, one delay resulted from the time consuming replacement of all 380 calandria tubes, which hold the bundles of nuclear fuel. Another delay occurred when turbines being towed to the plant from the harbor in St. John, New Brunswick, fell in the water and had to be replaced. Currently, there are two multi-million dollar lawsuits involving NB Power, Atomic Energy of Canada Ltd. and seven insurance companies over who should pay for mistakes and delays during the refurbishment at the Point Lepreau nuclear plant.

In the pending lawsuits, NB Power is seeking \$320 million plus interest and costs, while AECL is looking for \$204 million.

The primary similarity between the Point Lepreau refurbishment and the DRP is that the core scope included replacement of the fuel channels and all or most of the feeder pipes. Point Lepreau has a smaller reactor core (380 fuel channels compared to Darlington's 480). There are also some significant scope differences between Point Lepreau and the DRP. Because Point Lepreau is a single unit, islanding was not required and the scope did not include a lot of balance of plant work.

2. Bruce Nuclear Generating Station

Bruce Nuclear Generating Station is a nuclear power station located on the eastern shore of Lake Huron, about 155 miles northwest of Toronto. Original construction occurred between 1970 and 1987. The Bruce station is one of the largest operating nuclear facilities in the world comprising 8 CANDU nuclear reactors having a total output of 6,272 MW and 7,276 MW (net) when all units are online. The eight reactors are arranged into two plants (A and B) of four reactors. The Bruce refurbishment experienced both cost and schedule overruns. The planned budget was \$2.75B and the total actual cost of the refurbishment was approximately \$7B. The total original schedule duration was approximately five years and the actual time was approximately seven years (2005-2012).

Even though Units A1 and A2 were refurbished from a cold and defueled state, this refurbishment project is the most similar to DRP. The number of fuel channels at Bruce is the same as Darlington (480 fuel channels per reactor). Like the DRP, the core scope of the Bruce refurbishment includes replacement of the fuel channels and all or most of the feeder pipes, refurbishment of the turbine-generator sets and significant balance of plant work. That said,

there are also meaningful differences between the Bruce refurbishment and the DRP. There were no significant islanding challenges because both Bruce units were shut down and refurbished in parallel. The other Bruce Units (3 and 4) were operating at the time, but are not located immediately adjacent to the Units being refurbished. Additionally, other critical distinctions between the Bruce refurbishment and the DRP include that (1) the Bruce units had been cold and defueled for several years prior to the beginning of the refurbishment and (2) steam generators were replaced at Bruce Units 1 and 2.

3. Pickering Nuclear Generation Station

Pickering Nuclear Generating Station is a Canadian nuclear power station located on the north shore of Lake Ontario in Pickering, Ontario. The Pickering station is one of the largest nuclear facilities in the world, comprising six operating CANDU nuclear reactors with a total output of 3,100 MW when all units are on line. The units are divided between Pickering A and Pickering B and were operated separately. In 2011, the Pickering operation was combined for cost savings reasons.

The Pickering A Return to Service which was completed in 2005 differs from the DRP because it is not a refurbishment, but a restart. Ultimately, there were cost overruns on the Pickering A Return to Service. One of OPG's key lessons learned from the Pickering A Return to Service was the importance of completing the regulatory process and completing the detailed engineering prior to the start of the execution of the construction work.⁶⁴ For the DRP, OPG did execute these tasks for the DRP, which were not done for the Pickering A Return to Service.

⁶⁴ See Exhibit L Tab 4.3, Schedule 2 AMPCO-58 at p. 2.

TAB 5

identify issues, and then take appropriate action to mitigate problems as they arise on this Program.

Q: What are the most significant risks when using a multi-prime contracting strategy?

A: Along with the above benefits, the owner in a multi-prime model also assumes significant risk for the coordination and overall performance of the work. There is also greater uncertainty over a comprehensive locked-in price for the overall Program. Indeed, the use of multiple pricing models within the mini-EPCs on the DRP project has certain risks attached to it which are discussed below.

The following are the most significant risks to the multi-prime model:

- The owner accepts greater risk due to accepting coordination of construction work and responsibility for design. Conversely, comparatively less risk is typically transferred to the contractors than in a typical single EPC, fixed-price model.
- The owner must have a well-qualified and committed or dedicated project management team and construction managers to direct the work. As stated above, without a complete team working on the owner's behalf, there would likely be no advantage to a multi-prime, owner-led Program for OPG. As discussed above, OPG needs to achieve its staffing plan in a timely manner according to its plan.
- Engineering and planning of work must be robust and the scope of work must be well defined before the start of significant field work on discrete scopes of work in order to assure that design conflicts are minimized and project cost and schedule can be met. As discussed above, OPG completed the Unit 2 engineering during the Definition Phase.

There is no contracting model that can guarantee the DRP is delivered on time and on budget. The obligation to coordinate the various prime contractors is a distinct risk for an owner-led multi-prime project. However, although some risk can be contractually transferred to a contractor, the ability to effectively orchestrate the coordination of multiple contractors resides in the capability of the owner's team managing the program. Mere contractual transfer of risk

risk. One risk is that the SNC/AECON joint venture will monopolize the schedule at the expense of other contractors when it can. OPG project management may also have a difficult time tracking which craft worker is working under each of the respective SNC/AECON contracts which is relevant for managing work under contracts with multiple pricing models and responding to any delay and impact claims that may arise.

Q: Are there any provisions in the contracts that create risks of cost increases?

A: Yes. One of the cost risks to the DRP is the pricing structure for the Steam Generator, the Turbine, the ESES, and the Retube and Feeder Replacement contracts. Each of these EPC contract “islands” has multiple pricing models which may create coordination and oversight issues. As an example, in the Steam Generator Contract there is:

- a. Fixed Price Work which is not subject to adjustment without an approved Project Change Directive;
- b. Firm Price Work which is subject to adjustment in accordance with the indices identified in Schedule 5.7 or through an approved Project Change Directive;
- c. Reimbursable Work Target Cost with a Reimbursable Work Fixed Fee;
- d. Contingency Work;
- e. Optional Work requiring a Notice to Proceed if the option is exercised;
- f. SS&E or Support Services and Equipment Target Cost (not including any support services, tooling or equipment required for Fixed Price Work or Firm Price Work).

In addition to these multiple layers of cost and pricing components, the Steam Generator work is also divided into Unit Primary Side (the nuclear side of the steam generator) and Unit Secondary Side (the conventional, non-nuclear side of the steam generator). The Turbine Generator contract has a similar multi-model, pricing structure as do the ESES contract and the Retube and Feeder Replacement contract. The Extended Services Agreement (BOP) pricing is dictated by

the execution of Purchase Order releases for specific aspects of the Work, and each specific Purchase Order can be priced as determined by OPG – again multiple pricing structures are possible.

It adds cost and administrative risk to have multiple pricing models on the same project. It is simply more difficult for an owner to administer work that is subject to different pricing models. Moreover, it is more difficult to track craft and other project personnel when they may be working under different pricing models on any given day. The easiest pricing scenario to administer is when owners and contractors agree to one pricing model for a specific EPC contract. The pricing models used most frequently include the following: (1) fixed price; (2) cost plus pricing; (3) guaranteed maximum price; and (4) target price models. Given OPG's strategy of using mini-EPCs for islands of work to help mitigate project risks, the need to deploy workers in both nuclear and non-nuclear areas of the respective islands, and the need for "on call" internal support services for each island, the use of multiple pricing methodology is within industry standard for programs of the size and complexity of the DRP.

In sum, it would be unlikely or extremely expensive for a contractor to assume on a lump sum basis all pricing risks on a nuclear refurbishment project the size of DRP. Nevertheless, as discussed above, managing multiple pricing components will be a large administrative task for OPG. By having several pricing structures with discrete scopes, OPG must aggressively track and manage the field work as well as diligently process the invoicing to avoid errors. One of the significant risks on a mega-program is tracking craft labor and materials. For instance, OPG needs to deploy sufficient construction management to ensure proper craft time keeping. On a daily basis, OPG will need to know whether craft laborer crews are performing reimbursable work or fixed price work in order to validate the contractor invoicing and draw from the correct

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purchase order. OPG should not depend exclusively on reporting by the contractors. At any given point in the Program, the applicable contractor may have an “incentive” to commingle fixed price work with reimbursable work under certain circumstances (i.e., threatened with having to pay disincentives vs. desire to receive incentives). This type of situation can also occur under the SS&E scenario where the contractor could use Reimbursable SS&E personnel to perform fixed price work and vice-versa. OPG has attempted to mitigate the potential for cost overruns by providing fixed price work and target price work that attempt to provide a ceiling on the potential liability of OPG, and it is important to note that the contractors are not simply working under a straight time-and-material pricing model for all scopes of work with no cap or limitation on cost overruns.

Q: Based on the contracts, are there any schedule issues that may create risk for OPG?

A: Yes. OPG’s right to demand a Recovery Plan (See e.g., Steam Generator Contract, Section 8.6; Turbine Contract, Section 8.6) (the “Section 8.6 Recovery Plan”) is not contractually triggered until after the contractor actually accrues schedule disincentives which are tied to the guaranteed dates. In Schiff’s experience, the potential to exercise this right occurs too late to effectively manage or mitigate earlier project schedule risks and its value is diminished as a result. Generally, the best opportunity to correct the delay or potential delay generally occurs earlier in the project when an owner can review the applicable data and determine that a milestone or guaranteed date is either threatened or will be missed. While the contracts appropriately have identified milestone dates and “guaranteed” milestone dates for completion of major activities at the end of the Program, all of the contracts should have provisions mandating that the contractors are obligated to meet the agreed to interim milestones.

Any failure should result in OPG's ability to request a written Section 8 Recovery Plan along with contractual terms that allow OPG to terminate the contractor or take over the work and back charge the contractor. For instance, in the Steam Generator contract, failure to deliver or implement a Recovery Plan is an Event of Default entitling OPG to all of its default rights. A recovery plan is a written process and schedule where the contractor provides its corrective action plan, including devoting additional labor, shifts, equipment, or other resources to overcome or mitigate the delay and get back on schedule. A contractually-required recovery plan based on achieving contractual milestone and guaranteed dates is an important tool for managing project risks and allows the owner to get an early warning of potential completion delays to the project and require the contractor to take corrective action before it impacts the cost or schedule for the project/program. This is an important tool for an owner managing a multi-prime contract, not only because it helps mitigate delays related to a specific island of work but also because a delay caused by one prime contractor may impact the work of another prime contractor.

Q: Does OPG have a strategy and a timeline to work through disagreements with contractors that have disputes regarding cost and schedule impacts?

A: Yes. Construction is a dispute prone industry, and the risk of disputes on mega-programs is heightened. One common approach to avoid adverse economic consequences in the construction industry involves two steps. First, acknowledging this reality and planning to avoid or minimize the magnitude of the dispute. Second, implementing required steps prior to binding dispute resolution that fairly, promptly, and inexpensively resolve the dispute to the satisfaction of all stakeholders. Alternative dispute resolution or "ADR" is a catch word which generally encompasses all the resolution techniques other than court litigation. Lack of required conditions

TAB 6

The second important milestone to occur in the estimating process is the achievement of a sufficient level of accuracy to set the budget for the project. This can occur when the available information for the project allows the estimate to meet the definition of Class 3. A Class 3 estimate is typically used to monitor variations to the budget until it is replaced by more detailed estimates, although it is not uncommon for an owner to stop an estimate's developmental progression at a Class 3 estimate level.

Q: Did OPG follow the AACE Classification System's estimate progression in developing the DRP's RQE estimate?

A: Yes. OPG's evidence asserts the RQE is a Class 3 estimate.³⁵ OPG provided the following independent reports in support of the DRP cost estimate and/or contingency amount:

- KPMG review of risk management and contingency development process (Exhibit D2-2-7, Attachment 1);
- KPMG review of the governance processes to develop the RQE (Exhibit D2-2-8, Attachment 3);
- Modus Strategic Solutions Canada Company and Burns & McDonnell Canada Ltd. review of the RQE development process (Exhibit D2-2-8, Attachment 2); and
- Expert panel review of the cost estimate for retube and feeder replacement (Exhibit D2-2-8, Attachment 4).

Based on Schiff's experience, OPG followed the typical and expected progression of cost estimate development for the RQE as AACE describes it and as is generally applied throughout the industry.

³⁵ See Exhibit D2-2-8.