Ontario Energy Board

P.O. Box 2319
2300 Yonge Street
27th Floor
Toronto ON M4P 1E4
Telephone: 416- 481-1967
Facsimile: 416- 440-7656
Toll free: 1-888-632-6273

Commission de l'énergie de l'Ontario

C.P. 2319
2300, rue Yonge
27e étage
Toronto ON M4P 1E4
Téléphone: 416- 481-1967
Télécopieur: 416- 440-7656
Numéro sans frais: 1-888-632-6273

Ontario

BY E-MAIL

November 21, 2016

Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319
2300 Yonge Street, 27th Floor
Toronto ON M4P 1E4

Dear Ms. Walli:

Re: Ontario Power Generation Inc.
2017-2021 Payment Amounts
Ontario Energy Board File Number EB-2016-0152

In accordance with Procedural Order No. 1, issued on August 12, 2016, please find attached the report prepared by Kenneth M. Roberts of Schiff Hardin, LLP regarding the Darlington Refurbishment Program.

The report was prepared at the request of OEB staff and is being filed for the purpose of assisting the OEB in the current proceeding. The report is marked as Exhibit M1.

OPG and all intervenors have been copied on this filing.

Yours truly,

Original signed by

Violet Binette
Project Advisor, Applications

Attach

Darlington Refurbishment Project Report

to

Ontario Energy Board

November 21, 2016

Kenneth M. Roberts
Construction Law Group
6600 Willis Tower
Chicago, IL 60606
312.258.5704
kroberts@schiffhardin.com

TABLE OF CONTENTS

I. INTRODUCTION AND BACKGROUND

Q: Please state your name and business address.

A: My name is Kenneth M. Roberts. My business address is 233 South Wacker Drive, Suite 6600, Chicago, Illinois 60606.

Q: By whom and in what capacity are you employed?

A: I am an equity partner, chair of the Construction Law Group, and a member of the executive committee of the law firm Schiff Hardin, LLP ("Schiff").

Q: Please describe your education, experience, and employment history.

A: I received my undergraduate degree, a Bachelor of General Studies, with honors, concentrations in Business, Political Science, and Rhetorical Studies, in 1982 and my juris doctor with distinction in 1985 from the University of Iowa. I have also attended the Kellogg Management Institute, Kellogg Graduate School of Management of Northwestern University (1999-2000), and The University of Chicago's Graduate School of Business Management Institute (2007). I am admitted to practice law in Illinois and Missouri, as well as before the United States District Courts for the Northern and Central Districts of Illinois and the Western District of Missouri. Since 2012, I have taught a course on Construction Law & Risk Management at Northwestern University's Department of Civil Engineering Graduate Program. In addition, I have been a guest lecturer at Northwestern University's Department of Civil Engineering lecturing on "Introduction to Risk/Finance for Engineers" and a guest lecturer at Loyola University Chicago Law School lecturing on "Mediation Advocacy." A copy of my resume and an executed Acknowledgment of Expert's Duty (Form A) is attached as Appendix 1.

My legal practice is concentrated in the field of construction law, procurement, project controls, and corporate governance in which I provide independent "eyes and ears" to corporate

boards and senior management, particularly on behalf of owners in the energy/utility industry, as to the status of large capital improvement projects. I have handled matters in Brazil, Canada, Great Britain, Italy, Alaska, California, Florida, Illinois, Indiana, Iowa, Kansas, Maryland, Massachusetts, Minnesota, Missouri, Nevada, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Texas, and Wisconsin. I engage in a range of services from preparation and negotiation of contracts, project controls monitoring and advice during on-going projects, negotiation of change orders and contract additions, alternative dispute resolution through mediation and arbitration, and when necessary, litigation. I also consult on a daily and ongoing basis with energy companies' procurement and risk management departments concerning every aspect of planned or ongoing construction projects and outages. The work I have performed for energy companies involves all elements of power plant construction and technology, including construction of nuclear, coal, natural gas, hydroelectric, solar, and wind power.

I also have an extensive background of representing owners, contractors, subcontractors, and architect/engineers in multi-faceted, complex disputes involving: delays, disruptions and losses of efficiency; breaches of contracts for performance, scope of work, and payment; and complex multi-party insurance coverage issues. I work with and manage a team that has extensive experience providing project controls (for tracking budget and schedule) for owners and architect/engineers on a national basis and work daily with the owner's project managers at the construction site.

Q: Have you previously testified in a regulatory proceeding?

A: Yes. I previously filed testimony before the Missouri Public Service Commission in the following Case Nos. ER-2009-0089, ER-2009-0090, ER-2010-0355 and before the Kansas Corporation Commission in Docket Nos. 09-KCPE-246-RTS and 10-KCPE-415-RTS.

Additionally, I prepared independent oversight reports on behalf of OPG regarding the Pickering Unit A return to service project, including Schiff Hardin's Report on Findings – Root Cause Analysis of Pickering A Unit 4 Return to Service (December 12, 2003) and Schiff Hardin's Pickering A Unit 1 Return to Service Readiness Assessment (March 15, 2004).

II. PURPOSE AND SUMMARY OF TESTIMONY

Q: What is the purpose of your testimony?

A: In late August 2016, Schiff was engaged by the Ontario Energy Board ("OEB") to provide an independent and objective assessment of the Darlington Refurbishment Program ("DRP" or the "Program") including analyzing the following:

- DRP risks and Ontario Power Generation ("OPG")'s risk assessment with respect to industry best practices for projects the size and complexity of DRP;
- Contract strategy, contract terms, and contractual risk allocation between OPG and contractors with respect to industry best practices for projects the size and complexity of the DRP; and
- The DRP as compared to other mega-programs including, but not limited to, previous nuclear refurbishments.

Q: Please summarize how you conducted your review.

A: Schiff performed a high-level review of the written evidence filed by OPG regarding the DRP as Exhibit D2-2 in case number EB-2016-0152 and the OPG interrogatory responses related to the planning and execution of the DRP. Schiff's review is limited to OPG's actions documented in the written material provided.[1] A high-level review is an appropriate

[1] Schiff signed the Declaration & Undertaking regarding confidential information.

scope of review because Schiff is not able to independently verify the appropriateness, sufficiency, or correctness of the scope of the DRP, the DRP cost estimate, or the DRP schedule. Additionally, Schiff did not perform a compliance audit to determine whether OPG has adhered to their internal policies, procedures, guidelines or any applicable legal regulations. Schiff's review is focused on the current status of the DRP – just beginning the Execution Phase – and does not include any predictions or assessments of the DRP's likelihood of success in terms of OPG's ability to manage the Program within the established budget or complete the DRP on schedule.

Q: How is your testimony organized?

A: **Section I** of my testimony begins with an introduction of my background, qualifications and experience, contains the purpose of my testimony, scope of Schiff's assessment and an executive summary of my findings. **Section II** addresses DRP risks and risk management including a discussion of industry standards for project controls, cost estimating, schedule development, earned value tracking, project management staffing, use of audit and oversight, and management processes and procedures. **Section III** addresses the DRP contract strategy, contract terms, and risk allocation between OPG and the major contractors. **Section IV** discusses other mega-projects and the terms other regulatory agencies have included as a condition of pre-approving large project (including mega-project) costs.

Q: Please provide an executive summary of the findings of your review.

A: Based on the review of written evidence filed by OPG in regarding the DRP in case number EB-2016-0152, I found that OPG has reasonably and prudently completed the Definition Phase of the DRP. An executive summary of my specific findings is provided below:

- 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-programs[2] 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.

- 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. To stay within the budget for the Unit 2 refurbishment and the overall DRP, OPG must demonstrate it is capable of implementing the risk management plans to effectively execute the major work bundles and comply with the prudent management decision-making framework described in this testimony.

- All mega-projects experience some form of cost and/or schedule issues which may include, but are not limited to, the following: commercial challenges, changes, unexpected and high-impact events, and/or delays. 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. During the Execution Phase of the DRP, OPG's successful risk management will depend on (a) sufficient management staff to adhere to the DRP processes and procedures and the execution of construction industry best practices and (b) the continuous and deliberate execution of the prudence decision making framework with respect to project controls and commercial contract management.

III. DRP RISKS AND RISK MANAGEMENT

Q: What is the current status of the DRP?

A: The DRP is a multi-year, multi-phase, mega-project intended to sequentially refurbish all four DRP units and to extend the duration of the safe and reliable generation of electricity.[3] The DRP includes the rehabilitation of certain components, replacement of life-

[3] See Exhibit D2-2-2 at p. 1.

limiting components, and the installation of upgrades to meet regulatory requirements.[4] OPG organized the DRP into phases: Initiation, Definition, Execution, Commissioning, and Project Closeout.[5] The Initiation Phase ended at the end of 2009 when OPG's Board of Directors granted approval to proceed with the DRP.[6] The Definition Phase commenced in 2010 and was completed at the end of 2015 when the Board of Directors approved the Release Quality Estimate ("RQE").[7] During the five-year Definition Phase, OPG completed major activities including, but not limited to, the following:[8]

- Defined the scope of the work to be included in the DRP;[9]
- Completed the detailed engineering for Unit 2;[10]
- After selecting the contracting strategy, awarded all major contracts;[11]
- Completed the budgeting process resulting in the Release Quality Estimate ("RQE");[12]
- Completed the Unit 2 schedule;[13]

[4] Id.

[5] See Exhibit D2-2-4 at p. 1 and Exhibit D2-2-2 Attachment 1 at p. 1.

[6] Id.

[7] Id.

[8] See Exhibits D2-2-1 and D2-2-4.

[9] See Exhibit D2-2-5.

[10] See Exhibit D2-2-4.

[11] See Exhibit D2-2-2, Attachment 1 and Exhibit D2-2-3.

[12] See Exhibits D2-2-7 and D2-2-8.

[13] See Exhibit D2-2-6.

- Constructed a full-scale mock-up and other training facilities to test tooling;[14]
- Evaluated and incorporated lessons learned and risk assessment findings;[15] and
- Revised the business case for the DRP.[16]

The Execution Phase is now underway and OPG took Unit 2 off-line in October 2016.[17] OPG organized the work for the DRP into five major work bundles: (1) retube and feeder replacement; (2) turbine generator; (3) balance of plant; (4) fuel handling and defueling; and (5) steam generator.[18] The duration for the Unit 2 Outage is 40 months and the overall duration of the DRP is 112 months.[19] The DRP schedule provides the sequential execution of the refurbishment of each unit according to the schedule below:[20]

UNIT	START	FINISH	MONTHS
Unit 2	15-OCT-16	15-FEB-20	40
Unit 3	15-DEC-19	15-APR-23	40
Unit 1	15-APR-21	15-JUN-24	38

[14] See Exhibit D2-2-4.

[15] See Exhibit D2-2-4 at pp. 3-4; see also OPG Responses to the following interrogatories: Exhibit L-Tab 4.3, Schedule 1, Staff-52; Staff-53; Exhibit L-Tab 4.3, Schedule 2 AMPCO-52; AMPCO-58; SEC-20.

[16] See Exhibit D2-2-8, Attachment 1, Exhibit D2-2-10, Attachment 1, OPG Interrogatory Response in Exhibit L-Tab 4.3, Schedule 2 AMPCO-51.

[17] See Exhibit D2-2-8, Attachment 1 at p. 7.

[18] See Exhibit D2-2-3 at pp. 1-3.

[19] See Exhibit D2-2-1 at p. 2.

[20] Information in the chart taken from Exhibit D2-2-8, Attachment 1 at p. 7.

UNIT	START	FINISH	MONTHS
Unit 4	15-JAN-23	15-FEB-26	37
TOTAL DRP	**15-OCT-16**	**15-FEB-26**	**112**

In the current proceeding, OPG is requesting, among other things, that the OEB approve the projected costs of the DRP from 2017 to 2021.[21]

Q: What are the general industry standards to evaluate whether a utility appropriately managed the risks of a project, including a mega-program?

A: Conceptually, industry standard risk management is related to the regulatory prudence standard. The key to a risk/prudence evaluation of all management decisions throughout the course of a construction project is whether the decision-making process over the execution of the project was sound and reasonable. The following aspects are those which are critical in evaluating the prudence of the decisions of a utility company's senior management and project management throughout the project:

- Data development – What information was reasonably available; were management systems and procedures organized and implemented to produce information to enable analysis; was the data reliable; what was the timeliness of the data to the decision?
- Information Flow – To whom and when was data transmitted; what data was communicated; in what format was the information made available?

[21] See Exhibit D-2-2-1 at p. 6.

- Analysis – What does the information mean; was the information gathered and possibilities considered reasonable; what alternatives were identified or, where possible, what benefits and impacts are projected; how does the decision mesh with project and corporate needs?
- Decision – What decision was made; was the decision reasonable; when was the decision made; how was the decision made; was the decision reviewed as assumptions and circumstances changed?

Effectively implementing the sequence of management actions described in the prudence standard above does mitigate risk, but does not guarantee an optimal end result of the construction (on time and on budget). On large, complex construction projects, not all management decisions, including those that were made prudently, appear to be perfect in hindsight. The standard for demonstrating prudent construction risk management is focused on the reasonableness of the management decision-making process that the owner used during both the definition phase and the execution phase of construction.

Q: Did OPG comply with industry standards in preparing a risk register?

A: Yes. In Schiff's opinion, the process OPG used to develop and evaluate the risk register is consistent with industry standards. This conclusion is limited to the process OPG used and the fact that OPG engaged in a formal process to identify and evaluate risks associated with the Program. Schiff does not have an opinion regarding the content or completeness of the risk registry or whether OPG's assessment of the likelihood or magnitude of all risks or any particular risk will prove to be accurate during the execution phase of the Program.

Q: During the Definition Phase, did OPG comply with industry standards to assess and mitigate the risks of the DRP?

A: Yes. As a part of the DRP planning activities, OPG engaged in a detailed risk assessment process including benchmarking, identifying lessons learned, and identifying risks in a risk register.[22] OPG incorporated the information from these risk assessment activities into its project planning activities including, but not limited to, the following:

- Refining the scope of the DRP[23];
- Completing the Unit 2 engineering[24];
- Developing the schedule[25];
- Developing the cost estimate[26];
- Putting together its project management staffing plans and developing the organization[27]; and
- Preparing program and project specific policies and procedures[28].

OPG spent five years planning to execute the DRP. OPG's work during the Definition Phase was for the purpose of establishing an industry standard framework for OPG to be in a position

[22] See Exhibit D2-2-4 at pp. 3-4; see also OPG Responses to the following interrogatories: Exhibit L-Tab 4.3, Schedule 1, Staff-52; Staff-53; Exhibit L-Tab 4.3, Schedule 2 AMPCO-52; AMPCO-58; SEC-20.

[23] See Exhibit D2-2-5.

[24] See Exhibit D2-2-6.

[25] See Exhibit D2-2-6.

[26] See Exhibits D2-2-7 and D2-2-8.

[27] See Exhibit D2-2-2.

[28] See OPG Response to Exhibit L-Tab 4.3, Schedule 1 Staff-48.

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

"were not necessarily completed per the initial planned schedule and estimate."[29] The original budget for the Heavy Water Facility was $110M but the OPG's current budget update is $381.1M, which is a variance of 247%.[30] OPG stated these cost increases resulted from inadequate design, inaccuracy in the original cost estimate, increased risk of a first of a kind design, costs/damages arising from the contactor's termination, disputed commercial claims, and poor workmanship.[31] Additionally, OPG asserts the risk profile of the new construction of the Heavy Water Facility is different than refurbishment of existing components.

The OPG evidence does not contain enough information to determine whether OPG followed the prudent management decision-making framework described above regarding the cost increase to the Heavy Water Facility. However, to stay within the budget for the Unit 2 refurbishment and the overall DRP, OPG must demonstrate that it is capable of implementing the risk management plans to effectively complete the major work bundles and comply with the prudent management decision-making framework described above. During the Execution Phase of the DRP, OPG's successful risk management will depend on (a) sufficient staff to adhere to the DRP processes and procedures and the execution of construction industry best practices and (b) the continuous and deliberate execution of the prudence decision making framework to make reasonable decisions with respect to project controls (including both cost and schedule management) and commercial contract management.

---

[29] See Exhibit D2-2-11, Attachment 3 at p. 5, Exhibit L-Tab 4.3, Schedule 1 Staff-74, Exhibit L-Tab 4.5, Schedule 1 Staff-78

[30] See Exhibit L-Tab 4.5, Schedule 1 Staff-78.

[31] Id.

Q: Are OPG's project controls systems within industry standard practices to manage risks during the Execution Phase of the DRP?

A: Yes. Project controls include the systems developed by construction owners to monitor, control, and report the schedule, cost, and other relevant information for a construction project. The DRP will be managed against the RQE budget and baseline schedule.[32] The project controls used on the DRP include: (i) development of a detailed Unit 2 schedule; (ii) earned value tracking of contractors; (iii) development of a RQE that would be reforecast as necessary to track trends and contingency; and (iv) development of management plans including staffing and written processes and procedures. Based upon Schiff's experience, OPG's use of these project controls tools to manage the DRP cost and schedule is consistent with industry standards. Each of these project controls tools are discussed in more detail below.

Q: What are the standards in the construction industry regarding accepted classifications for various types of cost estimates for construction projects?

A: There are several ways to classify an estimate. The actual terms themselves can vary from project to project, but there is an accepted progression of the level of accuracy of a cost estimate as a project's scope becomes better defined. The Association for the Advancement of Cost Engineers, also known as AACE International ("AACE"), which is an organization that acts as a clearinghouse for information related to cost issues in the construction industry, has developed a classification system that is widely referenced. AACE's Classification System is based upon the level of project definition. As defined by the AACE, "The level of project definition defines maturity, or the extent and types of input information available to the

[32] See Exhibits D2-2-6, D2-2-8, and D2-2-9.

estimating process. Such inputs include project scope definition, requirements documents, specifications, project plans, drawings, calculations, lessons learned from past projects, reconnaissance data, and other information that must be developed to (fully) define the project."[33] AACE's Classification System comprises five different "classes" of estimates (Class 1 through Class 5).[34] A Class 1 estimate is based upon a fully-developed project definition, while at the other end of the spectrum, a Class 5 estimate is often developed quickly and based on very preliminary and limited information. As a result, an estimate that fits the definition of a Class 5 estimate is not generally regarded within the industry as being very accurate.

Although AACE's Classification System defined above describes the development cycle of a cost estimate for a project from a conceptual stage to a very detailed stage, it is commonplace and acceptable for an estimate to mature based on available information and other project particulars. For an owner, the two most important milestones to consider in the development cycle of a project occur at the conceptual phase and then at the budgetary phase. A cost estimate during the conceptual phase allows corporate management to evaluate the overall feasibility of the project and to begin to evaluate how to strategically allocate resources. Under the AACE's Classification System, this estimate could typically either be a Class 5 or a Class 4 estimate. Conceptual phase estimates are not expected to be highly accurate; rather, they are regarded as merely providing a cost order of magnitude for a project.

---

[33] AACE International Recommended Practice No. 17R-97, Cost Estimate Classification System by Peter Christensen and Larry R. Dysert et al (August 12, 1997), at p. 3 and AACE International Recommended Practice No. 10S-90, Cost Engineering Terminology (April 13, 2004), at p. 17.

[34] AACE Recommended Practice 10S-90, at pp. 16-18 and generally AACE Recommended Practice No. 17R-97.

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.

Q: Did your review conclude that the cost estimate development process used by OPG to determine the RQE was within industry standards?

A: Yes. OPG's use of industry-standard cost estimating methodology and multiple independent experts in the cost estimate development process is consistent with industry standard practices used by utilities on large capital construction projects (including mega-programs) of similar size and complexity. Schiff's opinion is limited to the process used by OPG because Schiff did not independently verify the appropriateness, sufficiency, or correctness of the DRP RQE cost estimate. Additionally, in preparing this report, Schiff did not perform a compliance audit to determine whether OPG has adhered to general accounting principles, AACE or other construction industry standards, or their internal policies, procedures, or guidelines. It is important to note that within the industry, nuclear power plant construction cost estimates are generally accepted as very uncertain.[36] Costs have dramatically increased for several reasons including worldwide competition for resources, limited commodities and manufacturing capacity, limited engineer-procure-construct ("EPC") firms, and fewer suppliers of nuclear power plant components. While OPG has asserted a high confidence level in the RQE, nevertheless, the risk of project cost increases cannot be wholly eliminated. Every cost estimate contains allowances, assumptions, and/or subjective assessments that may ultimately prove to be inaccurate. The risk of cost increases may change over time but will exist throughout the Execution Phase of the DRP.

Q: What is the importance of a construction schedule?

[36] David Schlissel and Bruce Biewald, "Nuclear Power Plant Construction Costs", Synapse Energy Economics, Inc., July 2008.

A: An accurate and realistic schedule is important for planning and executing construction projects. Various professional entities (Government Accountability Office, Project Management Institute and AACE International) have established accepted practices for schedule development to assist project participants. The purpose of schedule management is for the owner to understand the contractor's overall plan and approach to the work, what activities are critical, and how the construction activities relate to each other. This knowledge puts the owner in a position to understand the critical path of the project. The critical path is the longest sequence of activities that must be finished for the project to achieve completion. An activity on the critical path cannot be started until its predecessor activity is complete; if it is delayed for a day, the entire project will be delayed for a day unless the activity following the delayed activity is completed a day earlier. The critical path is very useful in helping to manage any project. When the critical path has been identified, the owner can clearly determine where contractor effort cannot be compromised because if any of the activities on the critical path are delayed, the end date of the project will be affected. The critical path method (CPM) is a step-by-step project schedule management technique for process planning that defines critical and non-critical tasks and is ideally suited to projects consisting of numerous activities that interact in a complex manner. During the execution phase, an owner's ability to validate the work in the field, respond to commercial claims, and make effective business decisions is directly related to the understanding of the schedule and the quality and frequency of construction schedule updates.

Q: How is a construction schedule used?

A: OPG is using a multi-level scheduling approach from Level 0 to Level 3 which is an industry standard scheduling approach on construction projects, including mega-programs.[37] The different levels contain varying levels of detail from the Level 0 which contains milestones and major deliverables to Level 3 which has the greatest level of detail showing individual components of the work at the task level. A Level 1 schedule provides a high-level overview of the Project's major work in a critical path format and functions as a high-level management summary of the Program used on an ongoing basis by project managers.

The Level 3 schedule is more detailed than the Level 0, 1, or 2 schedules. The Level 3 Schedule is one of the essential construction management tools for the contractor executing the work. It encompasses all of the activities for the work performed by all of the contractors on site, who contributed their planned schedules at the outset of their work. The Level 3 Schedule reflects the proper sequence and duration for all of the work. The Level 3 Schedule is frequently used in commercial discussions between the owner and the contractors on a project.

Q: How is earned value utilized in the construction industry?

A: Earned value is an extremely valuable tool for tracking large volumes of work and establishing forecasts for contractor performance. It is essential that the management team also monitor the project's schedule to ensure that the work is being performed in the correct sequence. In Schiff's experience, earned value has been heavily utilized by sophisticated owners, contractors and engineering firms for more than 25 years. Ultimately, earned value is a tool that allows those who use it to gauge schedule compliance, progress, and productivity.

[37] See Exhibit D2-2-6 at pp. 2-4.

Depending on how it is used and the level of detail inherent to the particular application, earned value is used to examine progress on a project at both a macro and a micro level.

Contractors use earned value both to track the work necessary to meet their schedule commitments and to identify productivity issues. Earned value is a tool that assists contractors in understanding where they are either efficient or inefficient in their work. Engineering firms also use earned value to track scheduled work in ways that are often similar to how contractors use it. From an owner's standpoint, earned value has become a popular and effective way for owners to understand and control both schedule and budget for large, complex projects (including mega-programs) like DRP. It is a method that allows one to summarize many hundreds or even thousands of detailed schedule activities into simple time and cost indices. Additionally, owners use earned value to implement any contractual rights they may have to direct the contractor to submit a "recovery plan," accelerate the contractor's work, or to ensure that the contractor pays for its own productivity losses.

Q: How does earned value help control costs on a project?

A: One way earned value helps to control costs is to allow the owner to track the contractors' productivity in their performance of the work. The data generated by an earned value system allows the project team to drill down to find the root cause to mitigate adverse trends. In addition, using earned value to track schedule performance allows the project team to forecast the work's completion.

Q: What information is needed in order to track earned value on a project?

A: Earned value relies on all contractors having a resource or man-loaded baseline schedule, which identifies all of the project's activities and associated discrete work units or man-hours needed to complete those activities. Tracking earned value also requires that the

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?

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.

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

A: Yes. The staffing plan[41] 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.

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.

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 *17% increase from previous month*	809
OCTOBER 2016	+198 *24% increase from previous month*	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.

recognizes that the owner's project management team did not at that time have the internal resources experienced in construction management necessary to oversee projects of the size and complexity that were contemplated, it is industry standard to supplement the team with additional resources.

Q: Has OPG implemented industry standard processes and procedures to manage the DRP?

A: Yes. Based on Schiff's experience, OPG has implemented industry standard processes and procedures to manage the DRP. Schiff's conclusion is limited to the development of these documents and does not include an assessment of the contents. The project management organization was established by the DRP Charter[48] which defines the project scope and program and project management plans. OPG has put processes and procedures in place to identify, mitigate, and manage project risks. In addition to many administrative processes regarding project management functions and plans to manage each scope of work, OPG's processes and procedures include project controls processes including, but not limited to, processes regarding: tracking cost trends and contingency during the Execution Phase,[49] earned value,[50] schedule control,[51] commercial management,[52] and for reviewing and vetting changes and claims from the Project's contractors.[53]

---

[48] See Exhibit D2-2-2, Attachment 2.

[49] See attachments 23, 26 to OPG Interrogatory Response in Exhibit L-Tab 4.3, Schedule 1, Staff-48.

[50] See attachment 33, 45 to OPG Interrogatory Response in Exhibit L-Tab 4.3, Schedule 1, Staff-48.

[51] See attachments 25, 28, 54 to OPG's Interrogatory Response in Exhibit L-Tab 4.3, Schedule 1, Staff-48.

Q: What is your response to the report by Pegasus-Global (the "Pegasus Report")?[54]

A: I agree with the following findings in the Pegasus Report: (1) "OPG's approach for executing the Program is consistent with the approach typically used on other mega-programs;" and (2) that OPG completed extensive pre-execution planning utilizing industry standard cost estimating procedures to develop the Release Quality Estimate ("RQE"), policies and procedures, and cost control tools.[55]

As for the rest of the Pegasus Report, the executive summary contains a factual description of the Darlington Refurbishment Program.[56] Section III of the Pegasus Report contains definitional information explaining industry standard terms and practices regarding the following: definition and organization of mega-projects (pp. 10-13); policies and procedures (pp. 14-15); project controls (p. 16); cost estimating and management (including contingency development) (pp. 17-24); schedule development and management (pp. 25-26); risk management (pp. 27 – 28); reporting management (p. 29); pre-execution planning (pp. 30 – 32); and regulatory cost treatment of mega-programs (pp. 33-34). I do not have any material criticism, critique, or commentary regarding this definitional information.

---

[52] See attachments 1, 4, 5, 7, 17, 20 to OPG Interrogatory Response in Exhibit L-Tab 4.3, Schedule 1, Staff-48.

[53] See attachments 9, 11, 27 to OPG Interrogatory Response in Exhibit L-Tab 4.3, Schedule 1, Staff-48.

[54] See Exhibit D2-2-11.

[55] See Exhibit D2-2-11 at pp. 8-9.

[56] See Exhibit D2-2-11 at pp. 1-5.

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.

program. As a result, while each prime contractor is responsible for performing its own scope of work, the owner is ultimately responsible for coordination and project management of all of its prime contractors' work.

On a typical multi-prime project, the owner contracts with separate specialty contractors with each prime contractor being responsible for individual respective trades, such as a mechanical, electrical, and plumbing contract. However, it is not unusual, particularly on large complex mega-programs like DRP, for an owner to try to mitigate some of its risk by contracting with select contractors to manage "islands" of work that include all of the scope, including mechanical, electrical, and piping related to the particular island of work. These are sometimes known as "mini-EPCs." The owner remains responsible for the overall coordination of the design, procurement, and construction of the project; however, the mini-EPC contractors are responsible to the owner for the vertical and horizontal integration and construction of its identified island of work. On the DRP, OPG has opted to contract for the following major work bundles: the turbine generator work, the steam generator work, the retube and feeder replacement work, the balance of plant work, and the fuel handling and defueling work.[58] The contracts reviewed were executed between 2012 and 2014, so Schiff has focused its efforts on identifying significant risks that may create impediments to an on-time/on-budget completion. As a general rule, the contracts follow the same format and structure. This will be beneficial as OPG's project management personnel, such as contract administrator, cost, and schedule personnel, maneuver back and forth between documents - the consistency of many of the terms will create efficiencies.

[58] See Exhibit D2-2-3.

As part of its analysis, Schiff reviewed the following five contracts:

a. Engineering, Procurement and Construction Agreement for Turbine Generator Refurbishment Project, January 22, 2014 between Ontario Power Generation Inc. and AECON Construction Group Inc. and SNC Lavalin Nuclear Inc. (the "Turbine Contract") (Repairs and Retrofits on Turbine Generators);

b. Engineering, Procurement and Construction Agreement for Darlington Refurbishment Steam Generator Project between OPG and Babcock & Wilcox and CANDU Energy, December 30, 2013 (the "Steam Generator Contract") (Inspection and Maintenance);

c. Engineering, Procurement and Construction Agreement Darlington Refurbishment Retube and Feeder Replacement Project, March 1, 2012 between Ontario Power Generation and SNC-Lavalin Nuclear Inc. and AECON Construction Group Inc. (the "Retube and Feeder Replacement Contract");

d. Engineering Services and Equipment Supply Agreement for Turbine Generators Refurbishment Project Darlington Nuclear Generating Station Refurbishment Program, March 27, 2013 between Ontario Power Generation and ALSTOM Power and Transport Canada Inc. (the "ESES Contract") (Engineering Support and Equipment Supply); and

e. Extended Services Master Services Agreement between Ontario Power Generation Inc. and AECON Construction Group Inc. and SNC-Lavalin Nuclear Inc. made as of December 19, 2014 (the "Extended Services Contract") (Balance of Plant).

Q: What is your response to the Concentric Energy Advisors, Inc. Report (the "Concentric Report")?[59]

A: The July 2016 Concentric Report reviewed the contract for the Retube and Feeder Replacement ("RFR") work package. This Report supplemented previous conclusions from a report filed in EB-2013-0321 to address whether the final contract for the RFR, including the target price and the risk allocation, is reasonable and prudent. The Concentric Report concluded that the terms of the RFR contract, including the target price and the allocation of risk, are both

[59] Exhibit D2-2-11, Attachment 1.

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.

The use of the mini-EPCs allows OPG to contract for EPC-style risk as it is applied to the specific islands of work. The applicable EPC contractor will be responsible for its island of work. As to the particular island of work, OPG has appropriately attempted to shift the risk of island-specific performance to qualified contractors to perform the riskiest portions of the work. Because OPG does not routinely self-perform work on mega-projects the size of DRP, OPG, by hiring contractors with qualified personnel, is able to mitigate some of the risks related to hiring qualified staff for a multi-prime project with potentially hundreds of contractors.

The use of mini-EPCs also gives OPG the benefit of having single-point responsibility for performance of the applicable EPC work. Moreover, under OPG's mini-EPC contracts, OPG has tried, to the extent possible, to shift the financial risk for the applicable islands of work through various fixed, target, and cost-plus price structures and by using contract incentives and disincentives.

This is not to say that even with OPG deploying mini-EPC models for select scopes of work, OPG is devoid of responsibility. Effective management of multiple EPC prime contracts also requires a strong team capable of performing upfront work to establish key project requirements and carefully monitoring the EPC contractor's progress to the program's conclusion. This obligation is heightened in a nuclear environment where OPG has appropriately assumed responsibility for much of the nuclear risks related to safety, insurance, indemnity, and environmental issues. The key issue is whether OPG's project team can be mobilized to manage the day-to-day work during the Project. Given the current status of the Program (discussed above), OPG needs to meet its staffing plan to have all positions in both the construction and design management teams filled timely to be in a position to manage the execution of the work. The management and coordination risk related to the prime contractors,

lies squarely on OPG's shoulders, and, regardless of the contracting strategy, the owner's management of the project is crucial to its success. No contracting strategy will be successful unless it is properly managed throughout the life cycle of the project.

Q: What are some of the advantages of a multi-prime approach?

A: The advantages of the multi-prime contracting strategy include:

- Well run multi-prime projects are potentially less costly due to eliminating excess contractor profit, overhead and the excess contingency cost that a single EPC contractor would pass along in its initial price for risk of shifting and performing overall design and coordination work. Importantly, the owner also retains a greater ability to control costs when problems arise.
- The owner's project team has greater degree of control of schedule and progress and retains the ability to determine the scheduling priorities.
- Significantly greater transparency regarding the Program's progress, enhancing OPG's project team's ability to accurately report status to internal and external stakeholders.
- Increased involvement in specifying and designing critical Program elements to meet OPG's preferences and anticipated needs for the completed Program.
- By procuring the mini-EPC islands as design and erect contracts, OPG has attempted to shift the performance risk of these EPC contractors for the riskiest portions of the Program.
- Under the chosen multi-prime model, large portions of the engineering will be completed before construction commences. As such, scope would be well defined resulting in fewer surprises during construction.

Additionally, the core of the prudent management decision-making framework described above is the ability to (1) gather relevant and accurate data, (2) distribute the data to the appropriate audience, (3) evaluate all appropriate options and conduct robust analyses of the data, and (4) make timely and reasonable decisions. OPG's use of multi-prime model for the DRP should put the owner in a position to gather relevant and accurate data, use that data to

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

does not mean the projects within the DRP are effectively managed. The ability to identify problems or potential problems and the timely mitigation of those problems are the hallmark of successful projects and programs.

Q: What are industry best practices for contract terms for a project the size and complexity of DRP?

A: Industry practices related to contract terms vary from project to project (including mega-programs) depending on the type of project/program, economic conditions in the applicable industry, and the owner's ability and desire to assume risk. Due to the cost, size, scope and risk involved in mega-programs, the contract terms are heavily negotiated. The final contract terms, whatever they are, should place the risk of project performance on the party in the best position to bear or mitigate the risk. The determination of who should properly bear various forms of risk varies depending on the unique facts of each project/program. One of the important issues that is often overlooked in contracts, particularly on mega-programs such as DRP, is the contractor's obligation to be transparent with the owner in project controls reporting and on the project status. Virtually every project, particularly mega-projects, has cost and/or schedule issues that threaten or actually impact the project. It is critical that data flow to the right parties in a timely manner to make decisions. However, clarity, accuracy, and dissemination of the data are only the first step in mitigating issues on mega-programs. The telltale sign of good construction management is properly analyzing the potential paths forward and accurately weighing the likelihood and magnitude of potential consequences for the range of next steps – after the underlying factual cost and schedule data has been developed and analyzed.

Q: Do the DRP contract terms comply with industry standards?

A: Yes. Based on Schiff's experience, the risk shifting in the DRP contracts within the scope of our review is appropriate for a nuclear refurbishment mega-program, the contracts and OPG's processes and procedures have adequate project controls that will allow for appropriate transparency, the contract provisions meet industry standards, and the use of incentives and disincentives to encourage contractor performance are reasonable. However, there are certain provisions that still present risk to OPG's ability to mitigate project/program issues during the Execution Phase of the DRP. Those issues include the use of the SNC/AECON joint venture across three major prime contracts,[60] project controls, the pricing structure, and dispute resolution.

Q: Are there risk factors related to the DRP multi-prime contracting strategy?

A: Yes. There are risks related to the fact that the SNC/AECON joint venture is the contracting party performing work under three separate prime contracts. For instance, if either or both members of the SNC/AECON joint venture defaults, the risks to the program are unclear as the completion of three of the major scopes of work on the Project would be threatened or adversely impacted as would other aspects of the Program. Because the balance of plant ("BOP") work is subdivided into multiple scopes of work, in the event of joint venture default, there are other contracting parties (E.S. Fox and Black & McDonald) already involved in the Program that may be in a position to pick up additional components of the BOP work. Additionally, there is a potential for SNC/AECON to manipulate its personnel and the project schedule to its benefit. OPG will need to be vigilant during the Execution Phase to mitigate this

[60] OPG contracted with SNC/AECON to perform the following scopes of work: (1) retube feeder replacement; (2) field work required for the turbine generator installation, repairs and equipment replacement; and (3) a portion of the balance of plant work.

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

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

precedent to binding dispute resolution means disputes will end up in arbitration or court litigation, a process which may be necessary when faced with unrealistic opponents. However, litigation or arbitration, by its win-lose nature, cannot satisfy everyone and sometimes not even the "winners."

From a contractual perspective, the dispute resolution process used by OPG in the DRP contracts is not atypical in the industry. The process starts with project level negotiations, or step negotiations, and ends with binding arbitration. This is consistent across all of the contracts.

Under the Steam Generator Contract, disputes that are not resolved in the normal course of business will be referred to the project representatives of both the applicable contractor and OPG. Failure to refer a dispute within two years of the date the other party is aware of the dispute will constitute a waiver of that dispute. The project representatives have ten business days to resolve the dispute. If they are unable to resolve the dispute, then either project representative can refer the dispute to their senior management representatives with direct responsibility for the Program. Then the dispute gets elevated to the steering committee. The steering committee is composed of senior management representatives of each party and meets at least quarterly. The steering committee is tasked with resolving outstanding disputes, among other things. This is similar to a dispute review board, except that the composition of the committee is solely comprised of "interested" project participants rather than disinterested industry experts.[61] On the DRP, if the steering committee fails to resolve the dispute, either party may refer the dispute to arbitration.

[61] A Dispute Review Board or "DRB" is part of a process which assumes that the basis of many disputes is not personalities, but rather honest disagreement over facts. The DRB, usually consisting of three "disinterested" members, is appointed at the beginning of a project. Their job is to become and remain familiar with the construction activities on the job site. When a

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.

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.

4. Wolsong Generating Station

The Wolsong Nuclear Power Plant, or Wolsong, is a nuclear power plant located on the coast near Nae-ri, Yangnm-myeon, Gyeongju, North Gyeongsang province, South Korea. Wolsong Unit 1 went into service in 1983 and Wolsong Units 2 and 3 began operation in 1997 and 1998. In 2009, KHNP began an extended outage to retube and refurbish the Wolsong 1 reactor. During this process all 380 fuel channels and calandria tubes, along with the 760 feeder pipes were replaced, among other maintenance work. The reactor returned to full power on the Korean electrical grid in July 2011, marking the first CANDU 6 reactor to be retubed and restarted. The actual costs were approximately $520 million and the duration of the outage was 839 days. The original cost estimate and schedule are not known to Schiff. Like Darlington, the core scope included replacement of the fuel channels and all or most of the feeder pipes. However, Unit 1 has its own dedicated dueling machines, which eliminated any islanding challenges.

The primary similarity between the Wolsong refurbishment and the DRP is that the core scope included replacement of the fuel channels and all or most of the feeder pipes. Wolsong (similar to Point Lepreau) has a smaller reactor core (380 fuel channels compared to Darlington's 480). While Wolsong is a part of a multi-unit station, each unit has its own dedicated fuel machine, which eliminates the islanding challenges that the DRP faces.

5. Vogtle Electric Generating Plant

The Alvin W. Vogtle Electric Generating Plant, also known as Plant Vogtle, is a 2-unit nuclear power plant located in Burke County, near Waynesboro, Georgia, in the southeastern United States. The two units were designed and constructed by the Bechtel Power Corporation and Southern Company Services. Construction of the two-unit plant started in 1974. Unit 1

began commercial operation in May 1987. Unit 2 began commercial operation in May 1989. Each unit is capable of generating 1,215 megawatts for a total capacity of 2,430 MW. The plant is powered by pressurized water reactors manufactured by Westinghouse. Each unit has a General Electric steam turbine and electric generator. In 2009, the NRC renewed the licenses for both units for an additional 20 years.

Georgia Southern entered into an EPC (Engineering, Procurement, and Construction) contract with Chicago Bridge and Iron Co. and Westinghouse for the construction of two additional first-of-a-kind reactors (3 and 4). The construction is currently underway. The schedule has extended three years and the costs increased by US$3B. The first unit was originally scheduled to complete in 2016, but is now forecasted to complete in 2019 with the second unit completion one year later.

6. **Watts Bar Nuclear Generating Station**

The two units owned by the Tennessee Valley Authority, the Watts Bar Nuclear Generating Station is located on 1,700 acres on the northern end of the Chickamauga Reservoir near Spring City, in East Tennessee. The station is located in Rhea County, Tennessee between Knoxville and Chattanooga. The station uses Westinghouse pressurized water reactors. Unit 1 began commercial operation in May 1996 and is licensed for operation through 2035. Unit 2 began commercial operation in October 2016. Each unit can produce 1,150 megawatts of continuous electricity.

Unit 2 was 80% complete when construction on both units was stopped in the 1980s due in part to a projected decrease in power demand. In 2007, the Tennessee Valley Authority (TVA) Board approved completion of Unit 2 and construction resumed. The construction of

Unit 2 was expected to cost US$2.5 billion, but costs increased to $4.7 billion. NERC orders after the damage to the Fukishima-Daichi facility required design changes.

Q: How have regulatory bodies reviewed large capital construction project costs?

A: In a traditional rate making approach, a utility first constructs a facility, and then seeks rate recovery for the facility after completing the construction. For large capital projects (including mega-programs), the time between when the utility begins to incur costs for the project and the time when the utility can recover those costs in rates is often many years. In the traditional rate making approach, the governing public utility commission is able to compare the actual costs of the facility to the estimated costs of the facility and determine whether the costs or any variances in the costs were prudent. For large capital projects (including mega-projects and mega-programs), there is substantial financial risk to the utility as a result of this significant regulatory lag (the time between when the expenses were incurred and when those costs are included in the rate base). As a result, some jurisdictions have enacted statutes and/or regulations incentivizing utilities to engage in new construction or upgrades by minimizing regulatory uncertainty and regulatory lag otherwise associated with waiting until project completion to include the ultimate project costs in the rate base. Each regulatory body must comply with its individual governing rules, regulations and statutes, which may be unique with respect to the considerations, factors, or permissible rate recovery timing and mechanisms.

Whether required by the applicable statute/regulations or negotiated as a part of a voluntary stipulation and agreement, it is not uncommon for utility regulatory commissions to grant construction cost pre-approval. The pre-approval may be conditional and subject to the possibility of future prudence review and granted upon the further condition that the utility be

transparent with the commissions and others about the status of the project and comply with ongoing reporting requirements for the duration of the life cycle of the project. A summary of a few of the regulatory decisions pre-approving project costs is provided below.

The Georgia Public Utility Commission approved the approximately US$6.4 billion cost estimate for construction of the Vogtle Nuclear Units 3 and 4 (the "Vogtle Project").[65] In that proceeding, the Staff requested a novel risk-shifting term as a requirement of the commission's decision. The Staff wanted to incentivize Georgia Power to aggressively manage and control costs on the Vogtle Project and, therefore, suggested that the commission order establish a bandwidth of plus or minus $250 million above or below Georgia Power's cost estimate.[66] If the final Vogtle Project costs fell outside the bandwidth, there would be a corresponding positive or negative impact to the Georgia Power's return on common equity (ROE). The Staff's proposal was that, if the cost of the Vogtle Project was ultimately less than the lower threshold of the bandwidth, then Georgia Power could earn an incentive return of 10 basis points in the ROE for every $100 million that the total Vogtle Project cost was less than the lower threshold.[67] Alternatively, if the total Vogtle Project cost ultimately exceeded the upper threshold of the bandwidth, then the ROE would be reduced by 10 basis points for every $100 million the completed cost exceeded the upper threshold.[68] Georgia Power opposed this recommendation for multiple reasons including, but not limited to, the following: (1) the Staff's risk-shifting

[65] Georgia Public Utility Commission, March 30, 2009 Amended Order, 27849, 2010 Order on Remand, Docket 29800 and Attachment 1, Stipulation.

[66] Georgia Public Utility Commission, March 30, 2009 Amended Order, 27849, 2010 Order on Remand, Docket 29800 at p. 5.

[67] Id.

[68] Id.

proposal is contrary to Georgia law because it ignores the prudence standard and could operate as a penalty for Georgia Power's sound, reasonable and prudent project management of the Vogtle Project; (2) the risk-shifting proposal violates the U.S. Constitution and due process by depriving Georgia Power of the ability to recover all of the properly incurred costs of the Vogtle Project; (3) it creates perverse incentives "to build a less efficient or shoddy plant"; and (4) it ignores cost increases that may be required as a result of future government or regulatory requirements.[69]

Because the parties did not agree on the risk-shifting proposal, the Georgia Public Utility Commission did not adopt the Staff's recommendation. Instead, the Commission ordered the parties to continue to work collaboratively to reach mutual agreement on a provision that would incentivize cost control and protect the ratepayers without creating undue risk to Georgia Power. The Commission Order stated the following:

> There is justifiable concern that the in-service cost of Vogtle Units 3 and 4 will exceed the estimates presented in this case. It is the nature of such large construction projects and the history of nuclear construction programs bears that out. While the Commission believes that the Company should be, and will be, held accountable for the final construction costs, there certainly exists the potential that increases to the cost of construction might stem from events or causes over which the Company has no control. As the incentive mechanism proposed by the Staff would look simply at the in-service cost of the units and not differentiate as to the causes for cost increases over the certified cost the Commission finds that the proposed mechanism is flawed and will not be adopted. However, the question of accountability continues to exist and the Commission believes that a properly constructed incentive mechanism will align the risks of project overruns without sacrificing project efficiency and safety. Therefore, the Commission finds that it is in the best interest of the Company and its ratepayers that such properly constructed incentive mechanism

[69] Id. at pp. 5-6.

> 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.

- File semiannual monitoring reports with the Commission on the dates requested addressing the topics and areas identified in the Stipulation[72];
- Provide the Commission with monthly status reports regarding the construction work in progress[73];
- Enact a records retention program acceptable to the Commission for records relating to the Vogtle Project[74]; 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).

Pursuant to a Kansas statute permitting pre-approval of construction costs, the Kansas Corporation Commission preapproved Kansas City Power & Light Company (KCP&L)'s budget for the environmental retrofit of two coal-fired generating units at the LaCygne Generating Station ("LaCygne Project").[76] The estimated cost of the LaCygne Project was US$1.23 billion. In approving the cost estimate, the Commission found that:

> if the overall cost of the LaCygne Project goes over the 'definitive estimate' of $1.23 billion excluding Allowance for Funds Used During Construction (AFUDC) and property tax, and if KCP&L seeks to recover any excess over the defined estimate from ratepayers, then KCP&L bears the burden of proof to show the amount it seeks to recover from the ratepayers is just and reasonable.[77]

Practically speaking, the terms of the order could operate to avoid any subsequent prudence review of the LaCygne Project costs. If KCP&L completes the construction of the LaCygne Project within the $1.23 billion estimate and does not, in a subsequent proceeding, request recovery for any amount exceeding this estimate, then the Kansas Corporation Commission would not perform a prudence review of the LaCygne Project absent a showing of fraud or other intentional imprudence.[78] On the other hand, the terms of the order shift of the burden of proof that would otherwise exist under Kansas law because if the costs of the LaCygne Project exceed the approved $1.23 billion budget, then KCP&L bears the burden of proving such costs were prudently incurred and reasonable to recover from the ratepayers. K.S.A. 128(g)(b) provides that completed project costs will be presumed prudent unless they exceed 200% of the definitive

[76] August 19, 2011 Order, Kansas Corporation Commission, Docket No. 11-KCPE-581-PRE.

[77] Id. at p. 3, ¶3.

[78] Id. at p. 39, ¶71.

estimate. Accordingly, by pursuing predetermination of the LaCygne Project costs, there is a distinct tradeoff – KCP&L got the benefit of preapproval of the LaCygne Project costs, but a change to the applicable legal standard regarding the presumption of prudence for costs in excess of the approved budget.

The South Carolina Public Utility Commission approved the approximately US$4.5 billion cost estimate for two 1117 MW units at the SCANA Corporation's nuclear project prior to its execution.[79] In 2007, South Carolina enacted new legislation called the Base Load Review Act[80], which allows a utility to recover prudently incurred capital and operating costs associated with new nuclear or coal-fired, base-load electric generating facilities larger than 350 megawatts. In order to approve a project under the Base Load Review Act, the South Carolina Public Utility Commission is required to evaluate whether "the utility's decision to proceed with construction of the plant is prudent and reasonable given the information available to the utility at the time."[81] The South Carolina Base Load Review Act also requires related findings concerning the "choice of the specific type of unit or units and the major components of the plant" as well as "the qualification and selection of the principal contractors and suppliers for the plant."[82] An important component of the prudence analysis under the South Carolina Base Load Review Act is a review of the reasonableness and prudence of the contract under which the new units will be built. Additionally, after the project approval, the South Carolina Base Load Review Act requires

[79] March 29, 2009, South Carolina Public Utility Commission, Order 2009-104(A).

[80] S.C. Code Ann. §§ 58-33-210 *et seq.* (the "Base Load Review Act").

[81] S.C. Code Ann. 58-33-270(a)(1).

[82] S.C. Code Ann. 58-33-270(b)(4),(5).

regular and continuous review and oversight.[83] The utility is required to file reports with the South Carolina Public Utility Commission Office of Regulatory Staff quarterly until the plant begins commercial operation. These reports must contain the following information:

- A description of the progress of construction of the plant;
- Updated construction schedules;
- Schedules of the capital costs incurred, including updates;
- Updated schedules of the forecasted capital costs; and
- Other information as the Office of Regulatory Staff may require.[84]

The South Carolina Base Load Review Act requires the Office of Regulatory Staff to conduct on-going monitoring of the construction of the plant and expenditure of capital through review and audit of the quarterly reports.[85] Additionally, the Staff has the right to inspect the utility's project books and records regarding the plant and the physical progress of construction upon reasonable notice to the utility.[86]

The Mississippi Public Utility Commission approved the construction of the Kemper IGCC Generating Power Project ("Kemper Project") under a similar Base Load Act.[87] In 2008, Mississippi enacted a state law that allows utilities to charge customers for construction costs before a new power plant is completed and even if it is never completed. In approving the cost

---

[83] S C Code Ann 58-33- 277.

[84] Id.

[85] Id.

[86] Id.

[87] Miss. Code Ann. §§ 77-3-101 et seq.

estimate for the Kemper Project, the order included terms designed to appropriately balance the risk between the utility and its customers, including, but not limited to, the following:

- The Order imposed a construction cost cap of $2.88 billion, which represents a 20% cap above the approved Kemper Project estimate.[88] The purpose of the cost cap insulates customers from large construction cost overruns by shifting this risk to the utility at a certain total cost level beyond which customers are no longer responsible, even if the costs are found to be prudent.

- The utility must provide monthly reports regarding the project status.[89]

- The utility must adhere to the operational cost and performance parameters (assumptions concerning availability factor, heat rate, lignite heat content, and by-product revenues) from the cost estimates. The operational cost and performance parameters assure that ratepayers will not pay for an underperforming asset.[90]

- Maintenance of the provisions in the Baseload Act allowing for project cancellation.[91]

- The utility must periodically re-evaluate the economic viability of the Kemper Project to confirm that it remains in the overall best interest of customers.[92] This helps mitigate the risk that a better option becomes available because of subsequent changes in the technology, cost, energy markets and/or utility regulation.

In November 2007, the Indiana Utility Regulatory Commission approved Duke Energy Indiana, Inc. ("Duke")'s cost estimate of US$1.985 billion including allowance for funds used

[88] April 24, 2012, Mississippi Public Utility Commission Order, Docket No. 2009-UA-014, Case No. EC-120-0097-00, at p. 21, ¶36 and pp. 97-107.

[89] Id. at p. 28 ¶52.

[90] Id. at pp. 107-108.

[91] Id. at p. 110.

[92] Id. at pp. 29-30.

during construction ("AFUDC") for the Edwardsport Integrated Gasification Combined Cycle (IGCC) Generating Facility ("Edwardsport Project").[93] Duke subsequently requested, and the Indiana Utility Regulatory Commission granted, approval for an increase to the cost estimate of the IGCC Project from $1.985 billion to $2.350 billion.[94] Duke later requested approval for a further increase in the IGCC Project to approximately $3 billion.[95] Indiana Code precludes a utility from including in its rate base costs in excess of the estimate unless shown by the utility in construction of that facility to be "necessary and prudent."[96] Under Indiana law, Duke bears the burden of proving the cost estimate is reasonable and necessary.[97] However, Duke's conduct is presumed to be prudent unless the other parties in the regulatory proceeding present evidence that raises a question about Duke's actions. The Indiana Utility Regulatory Commission staff opposed the cost increase based on its position that cost increases were a result of Duke's imprudent management of the contractors on the Edwardsport Project. Although Duke did not believe there was any persuasive evidence of imprudence, gross mismanagement, concealment or fraud in the record, Duke's concern was that if the commission were to disallow Edwardsport Project Costs, the impact of any such disallowance would be significant.[98] To mitigate the risk

[93]December 27, 2012, Indiana Utility Regulatory Commission Order, Cause No. 43114 IGCC 4Sl.

[94] Id. at p. 7.

[95] Id. at p. 8.

[96] Id. at p. 110 and Indiana Code§§ 8-1-8.5-6.5 and 8-1-8.7-8.

[97] Id. at p. 111.

[98] Id. at pp. 96-97.

associated with leaving the decision to the Indiana Utility Regulatory Commission, Duke and the Indiana Utility Regulatory Commission staff ultimately reached a negotiated settlement.

Pursuant to the Settlement Agreement, Duke and the other interested parties agreed to increase the cost of the Edwardsport Project but that increase functions as a "Hard Cost Cap." The mutually agreed Hard Cost Cap was US$2.595 billion plus additional AFUDC. The parties also agreed that all costs incurred up to the Hard Cost Cap (plus additional AFUDC) are reasonable and are not affected by imprudence, gross mismanagement, concealment, or fraud.[99] Under the settlement, Duke would only be able to increase the Hard Cost Cap and recovery additional costs from ratepayers in the event of a force majeure situation.[100] The Hard Cost Cap allowed Duke only $94 million more in direct construction costs than the costs already approved and left Duke to absorb approximately $700 million.[101] Further, because of the Hard Cost Cap, Duke alone bears the risk of any further cost increases. Based on all the evidence presented, the Commission accepted the Settlement Agreement and held that it produces a fair, just, and reasonable result that balances the interests of the various stakeholders and the overall public interest, and results in just and reasonable rates.[102]

Q: How does the DRP compare to decisions in other jurisdictions regarding the incorporation of costs of other nuclear refurbishment projects into the rate base?

[99] Id. at p. 92.

[100] Id.

[101] Id. at pp. 96, 100. The approved $2.35 billion project budget included $2.225 billion in direct construction costs. The Hard Cap of $2.595 billion includes $2.319 billion in direct construction costs. The net increase in direct construction costs between the previously approved budget and the settlement is $94 million ($2.319 billion - $2.225 billion).

[102] Id. at p. 118.

A: When regulatory agencies undertake an evaluation of the costs of any large capital construction project (including mega-programs), their analysis is based on the prudence standard as articulated by the governing law of the applicable jurisdiction. Regardless of where the governing law allocates the burden of proof, it is common for the utility to provide testimony and supporting documentation demonstrating that the decision making process used was sound and the corresponding results were reasonable and in accordance with industry standards. In decisions that ultimately find a disallowance, the weight of the evidence demonstrated that the utility acted imprudently and that the imprudent actions were the cause of increased costs on the project/program. 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.

Construction disputes are messy, complicated and very rarely is there a clear-cut "winner" or "loser." For example, if an owner believes that a contractor is behind schedule due to no fault of the owner, and the owner simply waits until the completion date to address the issue, the project would already be late, and in almost every instance in my career, the owner is left with an incomplete remedy for the delay. Furthermore, the contractor would also raise

several defenses that would potentially absolve it from liability, which could leave the owner with no recovery whatsoever. In such situations, the owner is much better off attempting to work with the contractor to mitigate losses and ensure that commercial disputes do not impact the parties' ability to communicate or work together. It is also worth noting that compliance with the traditional regulatory timeline makes it challenging to review all of the project information regarding the tens of thousands of decisions that occurred during the life cycle of a mega-program. In recognition of this difficult task, many utility regulatory commissions require the utility to provide transparent and frequent reporting on the project status and the staff's active participation and ongoing review in the project. This trend is demonstrated by the discussion of other regulatory decisions earlier in this section, many of which required regular reporting of project status by the utility and prescribed the detailed content of those reports and the required the staff to perform an ongoing review.

In completing my review, I did not discover any evidence that raises a serious doubt as to the prudence of OPG's planning activities during the Definition Phase of the DRP. However, the DRP is only starting the Execution Phase – no one knows how it will turn out and whether OPG will manage the project within the budget and schedule. As a result, it is premature to compare the DRP to any completed nuclear refurbishment.

Kenneth M. Roberts

Partner, Executive Committee Member, Practice Group Leader, Construction
Chicago
kroberts@schiffhardin.com

D 312.258.5704

Overview

Ken concentrates his practice in the field of construction law, project controls, and procurement contracts. He is consulted on a daily and ongoing basis by procurement and risk management departments concerning every aspect of planned or ongoing construction projects. He engages in a range of services from preparation and negotiation of contracts, project controls monitoring, and advice during on-going projects, negotiation of change orders and contract additions, alternate dispute resolution through mediation, arbitration, dispute review boards, and when necessary, litigation.

Procurement/Contract Negotiation

By combining his skills as a litigator/advocate with his transactional experience, Ken provides clients with a set of unique services designed to suit their business needs. He has authored the standard forms for service and commercial contracts utilized by numerous companies and has also advised owners during contract negotiations and major procurements. He and his team have negotiated more than $15 billion in major procurement contracts over the past several years.

Alternative Dispute Resolution

U.S. News rated the Schiff Hardin Construction Law Group as the #1 Construction Litigation firm in 2011. Ken has an extensive background of representing owners, contractors, and architect/engineers in multi-faceted, complex disputes involving delays, disruption, and losses of efficiency; breaches of contracts for performance, scope of work and payment; and complex multi-party insurance coverage issues. He has sat on and chaired several dispute resolution boards involving projects ranging in size up to $1 billion.

Ken is widely recognized for his successful use of alternate dispute resolution, having successfully resolved virtually every type of construction dispute. He and his team typically mediate 15-20 times per year as part of their Project Controls practice—generally relating to issues that have not reached litigation.

Ken lectures on ADR issues at Loyola Law School and teaches a graduate level course at Northwestern University's Civil Engineering School that includes ADR for Engineers.

He and the Schiff Hardin Construction Law Group were recently selected in a nationwide selection process to represent the City of Kansas City in a multimillion dollar construction dispute.

Power Plant Construction

Ken has been involved in all elements of power plant construction and technology, including low N0x burners, heat recovery steam generators ("HRSG's"), selective catalyst reduction ("SCR"), precipitators, nuclear waste disposal and storage, coal handling systems, steam generators, gas and steam turbines, boilers, control systems, and other operational and environmental equipment. His range of services—from preparing contracts to the monitoring of more than 20 major power/industrial/commercial projects to the numerous mediations/arbitrations and negotiations over such projects—has given him a rare combination of technical and commercial insight that is useful in every aspect of his practice.

Project Controls

Ken has provided project controls advice and project monitoring on more than 20 major energy, industrial, and commercial projects, ranging from newly built projects to plant expansions during limited outages. His project controls engagements typically involve providing clients with realistic opinions of scheduling and cost issues, an objective appraisal of critical project issues, and resolution of disputes before they can impact ongoing work.

Ken has monitored construction-related and nuclear power plant litigation involving excess insurance and reinsurance issues.

He has participated in numerous construction claims and other construction related disputes on behalf of insurance carriers as well as represented carriers on policy coverage issues. He also has extensive experience in government contract litigation, including representing a contractor in a state debarment proceeding, and government contract litigation involving the Corps of Engineers, TVA, and various State Departments of Transportation.

Corporate Governance

Ken was on the board of T.D. Williamson Inc., a world leader in both onshore and offshore pipeline equipment and services from 2009 until 2014. He is also a standing committee member of the American Bar Association/Tort Trial & Insurance Practice Section Corporate Governance Task Force, and he has presented to numerous corporate boards on the issue of data fidelity and the status of major capital improvements.

Practices

- Construction
- Energy
- Energy Litigation
- Litigation
- Project Controls

Industries

- Construction
- Energy

Credentials

(a) Education

- University of Chicago Graduate School of Business Management Institute, post-graduate studies, 2007
- Northwestern University Kellogg School of Management, post-graduate studies, 1999-2000
- University of Iowa College of Law, J.D., 1985, *with distinction*
- University of Iowa, B.G.S., Business, Political Science, Rhetorical Studies, 1982, *with honors*

(b) Bar Admissions

- Illinois
- Missouri
- U.S. District Court for the Central District of Illinois
- U.S. District Court for the Northern District of Illinois
- U.S. District Court for the Western District of Missouri

(c) Professional Memberships

- American Bar Association, Forum on the Construction Industry, Section of Dispute Resolution, CLE Committee
- American Bar Association, Section of Environment Energy & Resources
- American Bar Association, Section of Litigation, Corporate Counsel Committee, Past Chair
- American Bar Association, Section of Public Contract Law, Construction Division, Vice Chair
- American Bar Association, Tort Trial & Insurance Practice Section, Committee on Excess, Surplus Lines and Reinsurance, Past Chair
- American Bar Association, Long-Range Planning Committee
- American Bar Association, Task Force on Corporate Governance
- Chicago Bar Association, Alternative Dispute Resolution Committee, Past Vice Chair
- Corporate Counsel Institute, Standing Member
- Dispute Review Board Foundation
- Illinois State Bar Association
- Missouri Bar Association
- New York Building Congress, Energy Committee Member
- Society of Illinois Construction Attorneys

(d) Teaching Appointments

- Chicago-Kent College of Law, Mediation Advocacy, Guest Lecturer (2015)
- Northwestern University, Department of Civil Engineering Graduate Program, Construction Law & Risk Management, Adjunct Professor (2012-2015)
- Northwestern University, Department of Civil Engineering, Introduction to Risk/Finance for Engineers, Guest Lecturer (2013)
- Loyola University Chicago Law School, Mediation Advocacy, Guest Lecturer (2005-2012)
- Northwestern University, Department of Civil Engineering, Project Finance, Guest Lecturer (2008-2010)
- Northwestern University School of Law, Mediation Advocacy, Guest Lecturer (2008, 2010, 2012)
- Northwestern University, Department of Civil Engineering, Construction Law and Dispute Resolution, Instructor (2010-2011)
- University of Iowa, College of Business, Introduction to Business Law, Instructor (1984-1985)

Publications

- "Arbitrators," (co-author) *Construction ADR*, Chapter 5 (2014)
- "Claims for Acceleration and Delay," (co-author) *Construction Dispute Litigation*, IICLE (2013)
- "Strategies to Mitigate Risk and Improve Investment Return in Large Capital Projects," *The Journal of Private Equity* (Summer 2011)
- "Mediating the Evaluative-Facilitative Debate: Why Both Parties are Wrong and a Proposal for Settlement," 39 *Loyola University Chicago Law Journal* 187 (2007)
- "Recent Developments in Corporate Counsel Law," *Tort Trial & Insurance Practice Law Journal* (Winter 2005)
- "Effective Use of Design-Build on State and Local Government Projects," *Design/Build for the Public Sector*, Chapter 5, Aspen Publishers (Jan. 2003)
- "Building Harmony into Partnering," *Constructech* (Apr. 2000)
- "Design-Build – The Single Entity Option," (co-author) *Independent Energy* (Jan./Feb. 1997)
- "Design-Build Contracts Under State and Local Procurement Laws," (co-author) *Public Contract Law Journal*, Vol. 25, No. 4 (1996)
- "Annual Survey of Excess, Surplus Lines and Reinsurance Law," (co-author) *Tort & Insurance Law Journal*, Vol. 31, No. 2 (Winter 1996)
- "Ask the Attorney Before Your Partner," *Professional Services Management Journal*, Vol. 20, No. 2 (Feb. 1993)

- "Use a Facilitator," *Professional Services Management Journal*, Vol. 20, No. 2 (Feb. 1993)
- "Partnering: Prescriptions for Success," *Construction Litigation Reporter,* Vol. 13, No. 11 (Nov. 1992)
- "The Davis-Bacon Act, Another Setback for Labor: *Building & Construction Trades Dept., AFL-CIO v. Donovan*," *Journal of Corporation Law*, Vol. 10:1 (1984). Reprinted by Westlaw: *Yearbook of Procurement Articles*, Vol. 22 (1985) and *Yearbook of Construction Articles*, Vol. 4 (1985)

Speeches & Presentations

- "Critical Issues in Construction Litigation," (co-presenter) IICLE, Chicago, Ill. (Oct. 8, 2013)
- "Construction Delay and Disruption Claims," (co-presenter) Critical Issues in Construction Litigation, IICLE, Chicago, Ill. (Oct. 8, 2013)
- "Seven Secrets to Successful B2B Mediations," (panelist) ALI CLE Telephone Seminar and Audio Webcast (Dec. 2012)
- "An Insider's View of Preparing for and Responding to Disasters Caused by Acts of Terrorism," (moderator) Disasters Caused by Acts of Terrorism, American Bar Association's Annual Meeting Program (Aug. 2012)
- "Integrated Project Delivery: An Introduction," (keynote speaker) Northwestern University Master of Project Management Breakfast Meeting, Chicago, Ill. (Aug. 2, 2011)
- "Seven Secret Benefits of Working with the Highly Skilled Mediator," (panelist) Council on Litigation Management, 2010 Annual Conference, New Orleans, LA (Mar. 2010)
- "U.S./Canadian Cross Border Issues in Construction Law," (panelist) Resolving Construction Law Issues Across the 49th Parallel, JAMS/Canadian College of Construction Attorneys, Chicago, Ill. (May 28, 2009)
- "IAM Plays Broadway," (panelist) International Academy of Mediators' 2009 Spring Conference (Apr. 2009)
- "Diversity in the Boardroom," (co-moderator) Beyond Legal: A Business Approach to Corporate Governance, American Bar Association (May 2008)
- "Mediation Advocacy: Advanced Techniques and New Developments," (panelist) American Bar Association Litigation Section Annual Conference (Apr. 2008)
- "Construction of a Wind Energy Project: Practical Problems and Solutions," (moderator) Innovations in Regulated Industries Conference, American Bar Association (Apr. 2008)
- "Corporate Governance in the Privately Held Company," (moderator) A Business Approach to Corporate Governance Program, American Bar Association (May 2007)
- "Gold Standard Commercial Mediation: Joining Ethical Practice With Practical Results," (presenter) American Bar Association's Section of Dispute Resolution 2007 Spring Conference (Apr. 2007)

- "Bad Data – Bad Decisions – The Adequacy and Accuracy of Information Flow to the Board," (moderator) Corporate Governance Institute Program, American Bar Association (May 2006)
- "A Risk Manager's Guide to Mediation," (panelist) International Risk Management Institute Inc. 2005 Annual Conference (Nov. 2005)
- "Mediating the Bet Your Company Case," (moderator) American Bar Association's Annual Meeting Program (August 2005)
- "The Cutting Edge of Mediation," (panelist – "Mediating the Intense Scheduling/Expert Case") Southern California Mediation Association's 2004 Annual Interactive Conference, Malibu, CA (Nov. 2004)
- "Mediating the Intense Scheduling/Expert Case," Southern California Mediation Association's 2004 Annual Interactive Conference, Malibu, Calif. (Nov. 2004)
- "Risk Shifting in Government Construction Contracts: Highway to the Future or a One-Way Street?," (chair) American Bar Association, Public Contract Law Section (Jul. 2000)

Awards & Honors

- Best Lawyers in America, *U.S. News & World Report* (2008-2009, 2012-2017)
- *Chambers USA*, Chambers & Partners (2006-2009, 2011-2016)
- *Illinois Super Lawyers*, Thomson Reuters (2006-2009, 2011-2016)
- Illinois Leading Lawyer, Law Bulletin's *Illinois Leading Lawyers Network* (2007-2010, 2012-2016)
- Top 10 Construction Lawyers, Law Bulletin's *Illinois Leading Lawyers Network* (2011-2012, 2015)
- Top 100 Real Estate-Related Lawyers, Law Bulletin's *Illinois Leading Lawyers Network* (2011-2012, 2015)
- PLC Which Lawyer? - Chicago – Construction Lawyer, *Practical Law Company* (2008-2013)
- Legal 500, *Legalease* (2011)
- Who's Who Legal Illinois, *Law Business Research Limited* (2007, 2008)
- Lawdragon 500 New Stars, *Lawdragon, Inc.* (2007)
- Leading Lawyer, Law Bulletin's *Illinois Leading Lawyers Network* (2006)
- The Legal 500 U.S. – Real Estate and Construction, *Legalease* (Since 2006)
- Peer Reviewed AV® Preeminent™, *Martindale-Hubbell* (Since 2005)
- Who's Who Legal – Construction, *Law Business Research* (2003-2016)

FORM A

Proceeding: EB-2016-0152

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is Kenneth M. Roberts. I live in Hinsdale, in the State of Illinois.

2. I have been engaged by or on behalf of the Staff of the Ontario Energy Board to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:

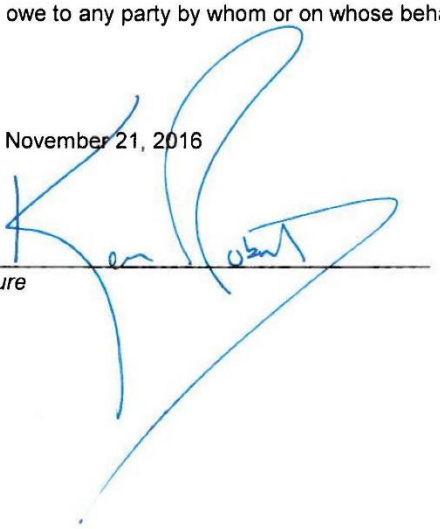
   (a) to provide opinion evidence that is fair, objective and non-partisan;

   (b) to provide opinion evidence that is related only to matters that are within my area of expertise; and

   (c) to provide such additional assistance as the Board may reasonably require, to determine a matter in issue.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date: November 21, 2016



Signature

APPENDIX 2
EXAMPLES OF MEGA-PROJECTS
WITH COST OVERRUNS

Project	**Approximate Cost Overrun (%)**
Suez Canal, Egypt	1,900
Scottish Parliament Building, Scotland	1,600
Sydney Opera House, Australia	1,400
Montreal Summer Olympics, Canada	1,300
Concorde supersonic aeroplane, UK, France	1,100
Troy and Greenfield railroad, USA	900
Excalibur Smart Projectile, USA, Sweden	650
Canadian Firearms Registry, Canada	590
Lake Placid Winter Olympics, USA	560
Medicare transaction system, USA	560
National Health Service IT system, UK	550
Bank of Norway headquarters, Norway	440
Furka base tunnel, Switzerland	300
Verrazano Narrow bridge, USA	280
Boston's Big Dig artery/tunnel project, USA	220
Denver international airport, USA	200
Panama canal, Panama	200
Minneapolis Hiawatha light rail line, USA	190
Humber bridge, UK	180
Dublin Port tunnel, Ireland	160
Montreal metro Laval extension, Canada	160

Project	**Approximate Cost Overrun (%)**
Copenhagen metro, Denmark	150
Boston-New York-Washington railway, USA	130
Great Belt rail tunnel, Denmark	120
London Limehouse road tunnel, UK	110
Brooklyn bridge, USA	100
Shinkansen Joetsu high-speed rail line, Japan	100
Channel tunnel, UK, France	80
Karlsruhe-Bretten light rail, Germany	80
London Jubilee Line extension, UK	80
Bangkok metro, Thailand	70
Mexico City metroline, Mexico	60
High-speed Rail Line South, The Netherlands	60
Great Belt east bridge, Denmark	50