

R E P O R T
of the
PICKERING "A"
REVIEW
PANEL

December 2003

Pickering Review Panel

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November 30, 2003

The Honourable Dwight Duncan, MPP
Minister of Energy
4th Floor, Hearst Block
900 Bay Street
Toronto, Ontario

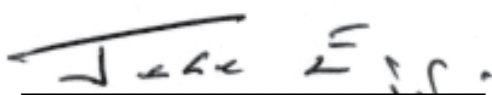
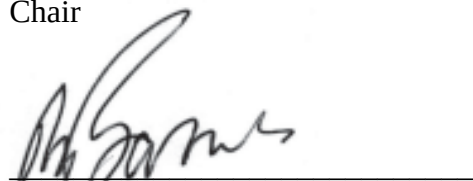
Dear Minister:

The Pickering "A" Review Panel has the honour of presenting our report to you in accordance with the terms of reference set out for the review in May 2003.

We would like to express appreciation to the participants who contributed to our understanding of the many, complex issues associated with the Pickering "A" return to service project. The Panel would also like to acknowledge the cooperation provided by officials from Ontario Power Generation.

Finally, we wish to thank the staff from the Ontario Financing Authority of the Ministry of Finance and Ministry of Energy for the assistance they provided to the Panel over the course of its review.

Respectfully submitted,


The Honourable Jake Epp
Chair
Peter Barnes
Dr. Robin Jeffrey

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Introduction

In late September 2003, the first of four Pickering A reactors (designated Unit 4) returned to service. Compared with the plan approved by the Board of Directors of Ontario Power Generation, Inc. (OPG) in August 1999, the cost for Unit 4 return to service had almost tripled, and the return to service date had slipped by more than two years.

These facts are alarming, but they are not the only price paid. The delay in the return to service of Pickering A has adversely affected Ontario's electricity sector and pushed up prices for residential and business consumers. The costs and delays of the project have also reduced OPG's revenues, capital resources and corporate value. But perhaps most seriously, faith has been compromised in the affordability and certainty of the supply of electricity vital to Ontario's citizens and businesses.

While the analysis of what went wrong provides a catalogue of problems, ultimate responsibility must lie with the OPG Board and senior management and how they exercised their oversight responsibilities.

The failings of the Unit 4 restart execution have been recognized by OPG, and over the past few months, more appropriate project management and oversight arrangements have been put in place.

The Panel considers it imperative that the decision on whether to continue with the restart of the remaining units be made as soon as possible. To make this decision, OPG must provide the Government and the Minister of Energy with a firm estimate of cost and timelines for completion.

This report sets out the findings and recommendations of the Review Panel's investigation.

Mandate and Scope

The Pickering “A” Review Panel was established at the end of May 2003 with the following terms of reference:

- Determine the reasons and reasonableness of the changes in the schedule and return to service dates.
- Determine the reasons and reasonableness of cost estimates and cost increases.
- Review the financial reporting for project costs.
- Make recommendations to the Minister on means of improving the management of the project to restore the Pickering A Generating Station to full operation, including measures to ensure the cost-effective and timely completion of the project.

The Panel began its work in June 2003 and has:

- Held more than 40 days of working sessions.
- Reviewed over 300 documents including key reports, management memoranda, submissions to the OPG Board, internal project reviews, and an external study on performance metrics.
- Met with members of the OPG Board of Directors.
- Interviewed senior OPG executives and a number of current and former Pickering A project managers.
- Met with the leadership of the Power Workers’ Union and the Society of Energy Professionals.
- Met with senior staff from two main contractors:
 - Atomic Energy of Canada Limited (AECL), the federal Crown corporation that acted as an independent consulting engineer to OPG; and
 - Canadian Nuclear Engineers and Constructors (CANEC), the joint venture that was initially involved as the general contractor and project director.¹
- Discussed the project and the regulatory process with officials from the Canadian Nuclear Safety Commission (CNSC).
- Received presentations from Schiff, Hardin & Waite, a U.S. firm with expertise in construction law.²
- Visited the Pickering A Generating Station to review and discuss the project.

¹ CANEC was formed for this project in June 1999 as a joint venture of Stone & Webster of Canada L.P., Comstock Canada Ltd., and Canatom NPM/BFC Industrial.

² OPG retained Schiff, Hardin & Waite in March 2003 to undertake an independent review and root-cause analysis audit to determine the reasons for the problems encountered with Unit 4 and identify key lessons learned from Unit 4 applicable to the return of the remaining units. Schiff, Hardin & Waite were assisted by J. Wilson & Associates and by Myer Construction Consulting.

Then and Now

In January 1997, Ontario Hydro, the predecessor to OPG, commissioned an Independent, Integrated Performance Assessment (IIPA) of Ontario's nuclear plants. The IIPA pointed out shortcomings in performance and concluded that the performance of Ontario's stations was well below that being achieved by the world's best nuclear stations.

Shortly after the release of the IIPA, Ontario Hydro endorsed a plan that included the temporary lay-up of the four units at Pickering A and the three operating units at Bruce A so that resources could be focussed on upgrades to the remaining operating units at Bruce B, Pickering B and Darlington. In addition to declining performance, the decision to lay up the Pickering A station also reflected the fact that the federal nuclear regulator, the Atomic Energy Control Board (AECB),³ had earlier established that the station could not operate after the end of 1997 without enhancements to its shutdown system.

The four units at Pickering A were laid up by the end of 1997 and the three at Bruce A by May 1998. A major difference between these two lay-ups was the decision to remove the fuel in the reactors at Bruce A, but leave the fuel in the Pickering A reactors, reflecting management's view that Pickering A would be returned to service sooner than Bruce A.

The Ontario Hydro Board of Directors approved work supporting the restart of all four units at Pickering A in August 1997, based on a budget of \$780 million and an expectation that the first unit would return to service in June 2000. This estimate was revised in May 1999 to \$840 million to reflect increased labour costs.⁴

The August 1999 approval to proceed by the Board of Directors of the newly created OPG was based on a total project cost of \$1.1 billion with the following breakdown by unit: \$457 million for Unit 4 and systems common to all four units, \$213 million for Unit 1, \$219 million for Unit 2, and \$211 million for Unit 3.

When Pickering A Unit 4 returned to commercial service at the end of September 2003, the costs had nearly tripled from the \$457 million estimate, and the return to service was more than two years behind the August 1999 schedule.

Three units remain out of service. OPG did not provide to the Panel an estimate for the cost of returning all four units to service. All that was made available was a range of estimates they had

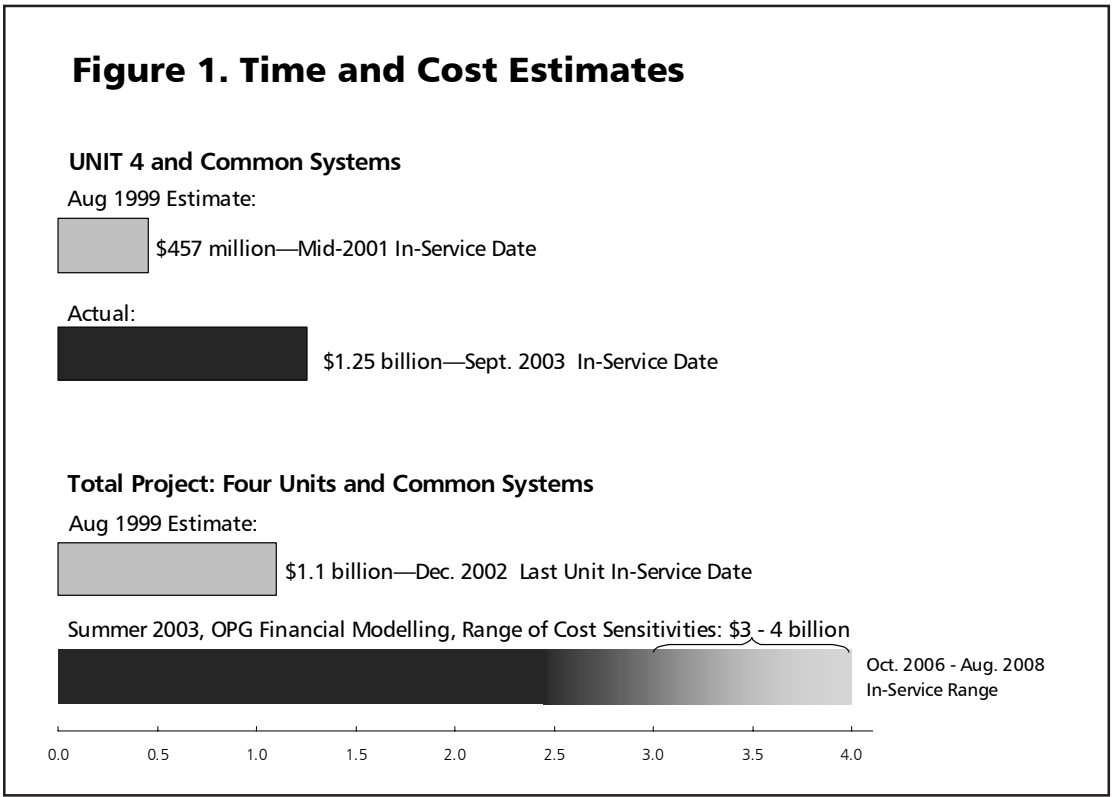
³ The Atomic Energy Control Board was the predecessor to the Canadian Nuclear Safety Commission, which came into being on May 31, 2000.

⁴ Neither of these early estimates included the costs of operations, maintenance and administration (OM&A) during the start-up phase. Starting from August 1999, estimates reported by OPG included an estimated cost for pre-start-up OM&A of \$200 million.

prepared for financial modelling purposes of \$3 to \$4 billion. Timelines for completion of the last unit range from October 2006 to August 2008.

OPG is currently undertaking some physical work on Unit 1, as well as completing design engineering, planning and assessing, and verifying detailed estimates by contractors. It is understood that in early 2004, OPG will present to its Board a detailed cost estimate for returning Unit 1 to service. Given that the current expenditure on the remaining three reactors is about \$25 million per month, it is critical that a decision on whether to continue with the return to service of additional units be made as soon as possible.

Figure 1 below highlights the degree to which costs have escalated and schedules have extended beyond the original plan.



What Went Wrong

From the outset, OPG failed to recognize the full scope and complexity of the project and was too slow to put in place the appropriate project management and accountability mechanisms.

Management of the project from initial planning to execution was seriously flawed. The Panel found that well-established industry practices and steps for carrying out a project of this size and complexity were not followed.

Furthermore, because adequate cost and progress reporting systems were not put in place, projections of project costs and completion dates were consistently unreliable and unrealistic.

Given the size of the investment and the importance of the project, the Government, as sole OPG shareholder, the Board, and senior management of OPG should have exercised greater oversight over the project's economics and execution and responded more quickly to emerging problems.

The Panel's detailed findings are set out below.

FLAWED PROJECT ASSUMPTIONS

Initial assumptions about the scope and complexity of the project, regulatory requirements, and when work would need to be undertaken were flawed.

Scope of the Project

From the outset, OPG failed to appreciate the full scope of the project. OPG nuclear management assumed that the restart project would be a relatively short-term outage, to be undertaken once the other operating plants began demonstrating improved performance. Based on the expected timing of this turnaround, the decision was made in 1997 not to remove the fuel from the reactor core once the four units at Pickering A were laid up.

The restart project was, in fact, a major design and construction project, with modifications required to virtually all systems in the plant, including the following:

- Replacing equipment, pipes and wires that did not meet current standards; for example, PVC-coated cables that had limited life in the reactor building.
- Reconfiguring equipment to optimize performance and safety; for example, moderator/ECI piping and valves in the moderator room.
- Adding new equipment; for example, a condenser ball-cleaning system.

- Improving the fire detection and suppression equipment; for example, a new sprinkler system in many areas of the plant.
- Increasing safety in the event of an earthquake; for example, new steel supports for numerous block walls around the plant.
- Refurbishing and reassembling equipment that was not replaced; for example, a major overhaul of the turbine/generator set.
- Clearing up a significant backlog of maintenance and minor modifications that had been identified in Ontario Hydro's 1997 assessment of its nuclear stations, including bringing all the engineering documentation up to date.

The Panel notes that the failure to appreciate the scope and complexity of the work required was observed and commented on by almost all of the individuals who participated in this Review.

Regulatory Requirements

OPG assumed that the regulatory approval process could be completed in three months and that it would not be necessary to prepare a formal environmental assessment (EA) under the *Canadian Environmental Assessment Act* (CEAA). These assumptions were made despite the age of the station, the backlog of outstanding regulatory commitments and concerns expressed by the community.

In a letter dated July 8, 1999,⁵ the AECB informed the company that the “resumption of operation of Pickering A after a prolonged shut-down period imposed by a condition of the current operating licence would constitute a ‘project’ for the purposes of CEAA.” The AECB continued: “As indicated at our meeting of June 28, we do not consider that the Exclusion List Regulations are applicable to this proposed project.” OPG was, therefore, formally instructed to carry out an EA under section 18 of CEAA on the return to service project.

The regulatory process ultimately took more than two years, including 19 months for an EA (from July 1999 to February 2001) and a subsequent nine months for the licensing process (from February 2001 to November 2001). The uncertainty about the outcome of the EA prompted OPG to institute a “minimum spend” policy, thus slowing the pace of work on the project. The Panel observes that OPG’s nuclear management did not use the window of opportunity provided during this period to ensure that critical activities such as design engineering were completed before construction began.

Timing of Essential Tasks

An assumption was made that some tasks could be undertaken following the restart of the first unit. This was evident in the initial documents prepared in 1999 for the AECB. These tasks

⁵ AECB letter to OPG, July 8, 1999.

included work programs associated with the completion of environmental qualification and fire protection systems.

In May 2000, the AECB informed OPG that all of the tasks related to the restart would have to be completed prior to restart.⁶ Despite the AECB's direction with respect to the scope of the work, at that time only minor adjustments were made to the schedule for restart, in large part because at this stage OPG nuclear management had not fully appreciated the extent of the engineering, planning and assessing required to meet the AECB's direction.

PROJECT MANAGEMENT FAILURES

Fundamental failures were evident in all of the areas related to project management, including the failure to sufficiently plan the restart project, as well as to put in place the necessary processes to monitor progress effectively. The Panel's findings with respect to the planning and execution of the project focus on OPG's role. There were, however, several contractors involved in the project.

Absence of a Project Execution Plan

It is industry practice to prepare a project execution plan (PEP) for a construction project of the magnitude of the Pickering A return to service. This is a critical document because it:

- Defines the roles and accountabilities for each of the major functional groups in the project;
- Establishes the work breakdown structure for the project;
- Establishes the cost breakdown structure for the project; and
- Defines the work to be completed, including preparatory and improvement milestones and associated metrics.

Nine months after construction started, an external consultant's report prepared for OPG project management noted the following: "At the time of the start of this project, it had become common practice in OPG to prepare a Project Execution Plan before approval and funding was granted. A management decision was made early in the project that a PEP was unnecessary."⁷

Given the then-current projection that the project was a two-year program of work costing \$1.1 billion, there was a compelling reason to develop a PEP from the start. The lack of a detailed project plan contributed to OPG's underestimation of the scope and cost of the project, as well as the lack of control and supervision over the project's progress.

⁶ AECB letter to OPG, May 8, 2000.

⁷ "OPG Incident Investigation Report: Delay in Engineering Deliverables for Unit 4 Outage," external consultant's report to OPG, August 24, 2001, p. 5.

In addition, given the lack of an integrated schedule, OPG's major contractors and suppliers had to organize their priorities and perform their respective work without knowing how it would contribute to the overall timing of the project.

In their public statements, OPG's management have frankly admitted that "we did not structure this project properly as a project with a project execution plan and scope and controls around that. And we did not structure it in such a way that we had an integrated approach to control of the engineering and the assessment."⁸

In summary, as the project unfolded, the lack of a fully developed plan led to significant problems in assessing, sequencing, coordinating and integrating the thousands of tasks that made up the project.

Lack of Integrated Project Management

The project suffered from the absence of a fully coordinated team with effective control over engineering, procurement and construction.

From the outset, OPG made a decision to undertake the Pickering A project by retaining contractors and contract management, including a senior project manager. OPG's overall role was to establish the scope of the project, manage the procurement function, obtain regulatory approvals, oversee the general contractor and operate the plant.

In late 1998, Atomic Energy of Canada Limited (AECL), the federal Crown corporation that designed and developed Canada's CANDU nuclear power technology, was engaged by OPG. From then until September 2002, AECL performed engineering design services, which focussed on the drafting, revision and issuance of numerous engineering design documents. Throughout this period, any engineering design changes to the facility had to be reviewed and approved by OPG's own engineering unit since OPG exercised "design authority" over the entire project.

In September 1999, OPG outsourced the project manager and general manager functions, and, after a competitive bidding process, began negotiations with Canadian Nuclear Engineers and Constructors (CANEC) to fill those roles. This culminated in a contract between OPG and CANEC signed January 2001. As general contractor, CANEC was responsible for about 60 per cent of the fieldwork and for coordinating the field activities of the other non-owner contractors. CANEC, however, had no direct contractual relationship with or full control over any of the other participants, whose contracts were with OPG. OPG also retained control over a number of important aspects of the project such as design authority and procurement.

⁸ Quoted in an article by John Spears: "Pickering a Failure of Planning: Official; Restart of four nuclear reactors behind schedule; Ontario Power underestimated scope of project," *Toronto Star*, June 12, 2003, p. D6.

In July 2001, OPG began gradually taking back functions assigned to CANEC with the objective of making the overall organization more effective. By March 2002, OPG had assumed the full role of project manager.

The Panel heard from many observers that the profusion of roles and responsibilities, especially in the early years of the project, led to confusion, poor communication, difficulty in resolving disputes, and lack of accountability, which ultimately contributed to both cost overruns and delays.

Delays in Engineering

Delays in engineering deliverables proved to be a significant issue.

In 2001, an external consultant retained by OPG project management to review the delay in engineering deliverables for Unit 4 made a number of observations on the underestimation of the time and resources needed for integrating the volume of engineering work. For example:

Initially it was believed that engineering work did not need to be included in the integrated schedule, because of an optimistic assumption by the project management team that all the engineering would be completed long before field execution occurred.⁹

There were extensive delays in reviewing engineering packages at OPG. The average time taken was ten weeks. The longest delay identified was 18 months. This was a result of awaiting a decision on whether to replace moderator pump motors or rewind them.¹⁰

Since the contract between OPG and AECL stated only an end date for the expected completion of all the engineering packages, AECL, in the absence of a prioritized list from OPG, was forced to develop its own priority list and time frame which were later found to be inconsistent with the actual project needs.

An internal OPG report noted that the final Unit 4 engineering design packages were delivered over 24 months later than the original scheduled date, introducing further delays into the assessment and execution phases. Material identified in the design was often not available when required. In addition, the quality of design products was less than adequate in terms of constructability, maintainability and operability.¹¹

⁹ "OPG Incident Investigation Report: Delay in Engineering Deliverables for Unit 4 Outage," external consultant's report to OPG, August 24, 2001, p. 9.

¹⁰ Ibid.

¹¹ Internal OPG Report on lessons learned, summer 2003.

Premature Mobilization of Construction and Scheduling

The construction workforce began to mobilize in December 2000—18 months before the final Unit 4 engineering design packages were completed.

Because many of the areas where people worked were highly congested, it was essential to complete the totality of the engineering work in order to plan and sequence effectively.

This was not done. Once execution began, poor coordination, inadequate resource estimates and lack of materials made it difficult to follow the schedule.

Work packages were released to the field piecemeal, corresponding to the extent to which engineering design packages were ready. As a result, there were often not enough tasks to keep workers fully occupied, and some work had to be redone based on subsequently completed engineering.

Further, some work that was identified on the basis of the early engineering packages was later found to be unnecessary. Of the 43,000 tasks generated for Unit 4, 15,000 were eventually cancelled during replanning. This overall lack of integration of work resulted in significant rework after the complete modification became known in the field.¹²

Materials Management

Lack of adequate materials available at the work site caused significant delays in execution. Delays in receiving material specifications cascaded to procurement and material receipt. Material storage and handling deficiencies and the reallocation of work to different work groups resulted in material loss and some material damage. The quantities of bulk materials, such as conduit and cable, delivered to the work site were often inadequate. In addition, work efficiency was reduced by stoppages due to lack of materials and work package revisions to incorporate design field changes.

Management of the Physical Site

For security reasons, OPG was required to monitor and control access to the facility. The Panel heard that there were numerous problems with OPG's management of the physical site, which impeded and delayed the completion of field and installation work. For example, there were often long lines in the morning to process workers for entry into the facility and on some days workers had to wait up to three hours. This was exacerbated by the enhanced security requirements after September 11, 2001.

UNRELIABLE COST AND SCHEDULE ESTIMATES

The August 1999 OPG Board approval was based on a total project cost of \$1.1 billion. The

¹² Internal OPG report on lessons learned, summer 2003.

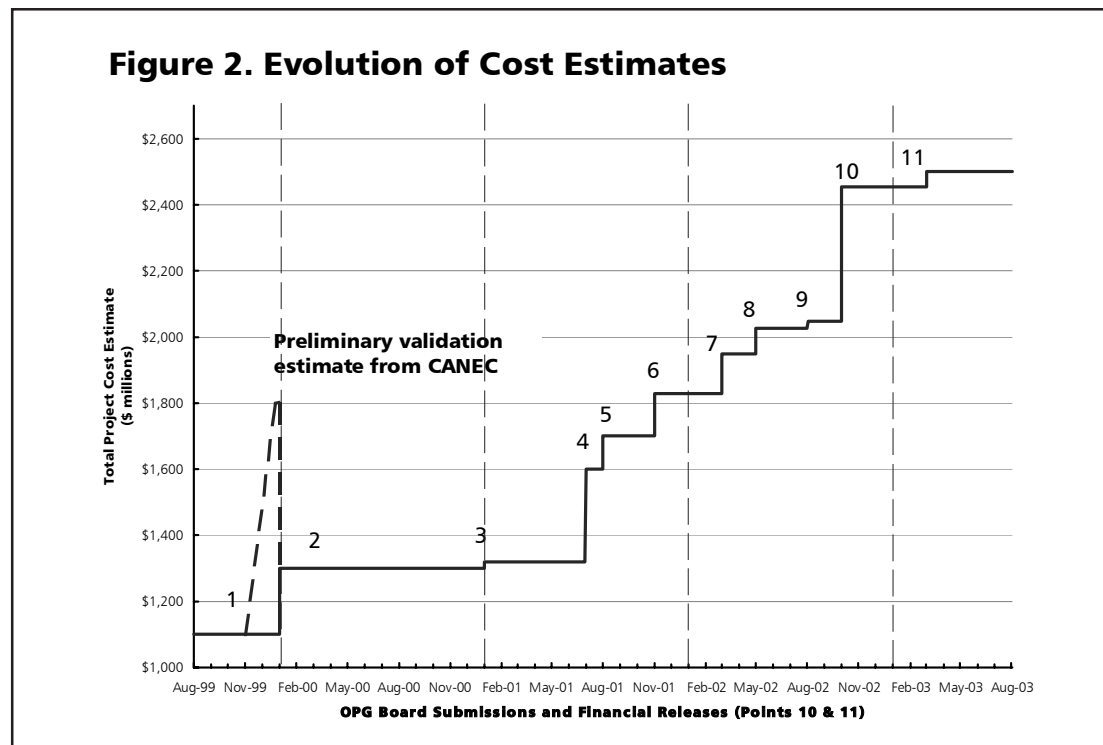
return to service date of Pickering A Unit 4 was forecast to be mid-2001, with subsequent units returning at six-month intervals thereafter. At the time, the engineering was too incomplete to use as basis for determining a realistic budget and schedule.

A validation of the August 1999 estimate was carried out by CANEC, the joint venture that was later engaged by OPG to act as the project manager and general contractor. During the validation, which began in late September 1999, CANEC found that the design documentation was at an early stage and that a number of work scope packages were evolving. Using the information available, a preliminary estimate was delivered to OPG on December 31, 1999 that projected the total cost of the project at about \$1.6 billion. Adding OPG's estimate of \$200 million of OM&A before start-up, this put the projected total estimated by CANEC at \$1.8 billion.

In the following three weeks, a team led by OPG, working with CANEC's estimate validation team, revised this estimate downwards by about 30 per cent.

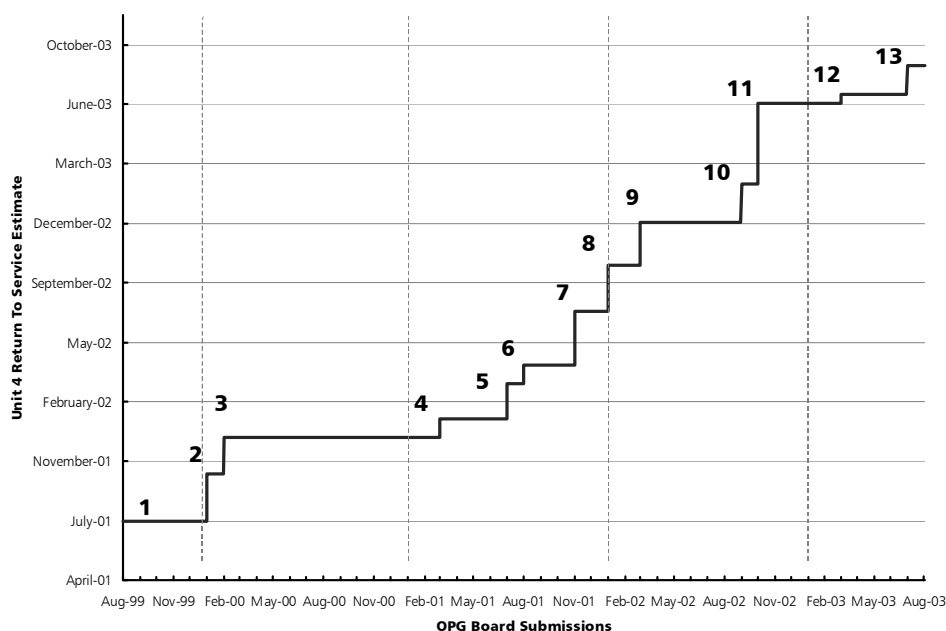
The revised estimate was presented to the Board of Directors on January 31, 2000. This estimate essentially remained in place until mid-2001, at which time the projected cost reached \$1.6 billion and the OPG Board had released \$815 million to the project.

In total, starting with the August 1999 meeting, the OPG Board was presented with 11 different cost estimates that took the estimated total project cost to approximately \$2.5 billion.



There were 13 different return-to-service dates for Unit 4 submitted to the Board between August 1999 and September 2003, following a pattern similar to that for costs.

Figure 3. Evolution of Scheduled Return To Service Dates



MANAGEMENT EFFECTIVENESS

The 1997 Independent Integrated Performance Assessment (IIPA) identified seven fundamental problems in the areas of managerial leadership, culture and standards, people and performance, processes and procedures, plant (hardware) and design, organization and resources, and labour relations.

As late as 2001, there were indications that OPG had still failed to implement an effective project management infrastructure. The concerns were summarized in a report by an external consultant:¹³

- Neither OPG nor AECL appreciated the rigour required to carry out a major project in the OPG operating environment.
- OPG managers did not demonstrate ownership and accountability for project execution.
- OPG management did not sufficiently plan the Unit 4 restart project.
- OPG management did not have the necessary processes in place to effectively monitor

¹³ "OPG Incident Investigation Report: Delay in Engineering Deliverables for Unit 4 Outage," external consultant's report to OPG, August 24, 2001, p. 9.

progress and when notified of potential schedule impacts, failed to take prompt corrective action.

- Concerns that arose during the course of the project were not effectively communicated at all levels of the organization.
- Senior OPG management did not hold responsible managers accountable for their respective jurisdictions.
- OPG management did not incorporate relevant lessons learned from past projects into the project.

Another external consultant's report prepared during the same period also identified continuing problems, as illustrated in the table below:¹⁴

MANAGEMENT ATTRIBUTE	1997 (IIPA REPORT)	2001 (EXTERNAL CONSULTANTS REPORT TO OPG)
Manager Accountability	■ Lack of accountability by managers ■ No awareness of site specific goals	■ Managers do not have ownership of their projects ■ No follow through on commitments
Lateral Working Relationships	■ Unclear lines of authority and of accountability ■ Lack of teamwork	■ Roles/responsibilities not clearly defined nor documented ■ Lack of teamwork
Managerial Practices	■ Ineffective lines of communication ■ Gap between perceived and actual performance ■ Timeliness and resource limitations	■ Ineffective management controls ■ No adherence for the achievement of milestones
Support of Subordinate Managers	■ Bad news does not flow up ■ Problems solved at too low a level	■ Workers are not encouraged to voice issues upward ■ No encouragement for innovation
Pickering A Culture	■ Little focus on cross-organizational cooperation ■ Employees lack accountability and commitment to quality	■ Ineffective sharing of information ■ No cultural support of safety standards

¹⁴ "Pickering A Return to Service Discussion Document," August 10, 2001, prepared for OPG by an external consulting firm, p. 4.

INADEQUATE COST AND PERFORMANCE REPORTING

There are three essential aspects of cost reporting typical to most construction projects:

- Cost management at the project level, in which actual costs are compared to estimates in a detailed work breakdown structure.
- Cost management at a project executive level, which rolls up the detailed work breakdown structure into major categories of work and provides a summary level management tool for senior project management.
- Cost reporting for senior corporate management and the Board of Directors, in which costs are tracked on a gross level and cost management is judged using tools such as projected versus actual cash flows and summary calculations of overall progress such as earned value – a measure comparing the dollars expended and time taken versus what is budgeted.

OPG's performance and financial reporting systems were below the norm with respect to each of the above. Detailed cost reporting was not done in a manner that allowed any meaningful and penetrating analysis of budget variances.

The Panel also found:

- Information was often not consistent from report to report, making it difficult to analyze trends, initiate corrective action and render accurate cost forecasts.
- Summary cost reports generated for project management did not include metrics that captured costs in discernable groups, making it difficult for the project management team to spot and analyze trends, initiate corrective action and make accurate projections for cost to completion.
- There was no reliable measure of earned value, in part because the project's scope was not frozen, which also skewed any cash flows reported to senior management.

While project audits were carried out, these focussed on procedural compliance instead of project progress. There was not sufficient independent identification of problems, verification of progress or challenge of project management. As well, no systematic external evaluations of Unit 4 cost and schedule performance were carried out.

Finally, the Panel was unable to attribute cost overruns to specific causes because of the inadequacies of the method that OPG used to track project costs.

Looking Forward

The Provincial Government, as OPG's sole shareholder, is accountable to the Ontario public for the performance of the company. As noted earlier, the failures in the Pickering A project to date have had a wide range of negative impacts. Making the right decisions about the remaining units is therefore crucial.

The Panel notes that, given all that it has learned in the course of its work, it is critical to apply the lessons learned from this project failure as we look forward.

It is vital to recognize that the failure was pervasive, at the Board, management and shareholder levels, and that each of these parties must be involved in ensuring it does not happen again.

The scope of the Panel's mandate included making recommendations to the Minister on means of improving the management of the project to restore the Pickering A generating station to full operation, including measures to ensure the cost-effective and timely completion of the project.

Therefore, the Panel makes the following observations.

COMPLEXITY OF THE PROJECT

It should be recognized that the return of the remaining units remains a large, complex project with a corresponding cost involving the reconditioning, rebuilding, replacing or adding of equipment at a 30-year-old station.

CONTRACTING STRATEGY

There are basically two alternatives: OPG could assume the role of general contractor and hire the sub-contractors needed for the project; alternatively, OPG could hire a general contractor for a turnkey solution (i.e., a fixed-price contract). OPG is proposing the first strategy, that of assuming the general contractor role itself. The Panel has concluded that in the present circumstances, the second option would likely be more costly and time-consuming.

The Panel has met on a number of occasions with the current project management team and has assessed that team's ability to fulfil the role of general contractor. In particular, the Panel reviewed the team's commitment to complete engineering and prepare integrated scheduling. The Panel also drilled down to a number of processes that will form the basis of the approach and, while some are not yet complete, have found them to be well-founded. The Panel has concluded that the current project management arrangements are appropriate for the completion of the project.

NEED FOR A ROBUST BUSINESS PLAN

The decision on whether to proceed with the restart of one or all three of the remaining units will require a thorough business plan covering both economic and project issues.

This business plan is, however, extremely sensitive to assumptions about the project costs, remaining years of life, electricity prices and the cost of capital. As a result, a carefully thought-out and rigorous analysis of all options will be critical.

GOVERNANCE

The Province reviews key business plan documents and approves major OPG investments.

The Panel would expect the Province to ensure that the oversight roles of the ministries involved are clearly defined and that it ensures clear lines of accountability for OPG.

CONSERVATION AND SUPPLY TASK FORCE

A provincially appointed Conservation and Supply Task Force will report by the end of 2003. The Panel recognizes that the Task Force's Report will provide a context for the Government's decision with respect to the restart of the remaining units.

Recommendations

With these observations in mind, the Panel makes the following recommendations. The Panel believes these will be relevant to OPG's long-term success regardless of which decision is made about the remaining Pickering units.

CORPORATE GOVERNANCE

Corporate governance "best practices" have evolved in recent years to make the responsibilities of corporate boards more explicit. Toronto Stock Exchange (TSX) guidelines on a board of director's stewardship function refer to five particularly important aspects:

- Adoption of a strategic planning process.
- The identification of the principal risks of the corporation's business and ensuring the implementation of appropriate systems to manage these risks.
- Succession planning, including appointing, training and monitoring senior management.
- A communication policy for the corporation.
- The integrity of the corporation's internal control and management information systems.¹⁵

Both the Shareholder and the Board must meet their responsibilities in order to ensure strong governance over any further work on the Pickering project.

Recommendation. That the Government, as shareholder, clearly define the roles and accountability within government for oversight of OPG.

Recommendation. That the Government, as shareholder, review the composition of the OPG Board of Directors and ensure that there is appropriate expertise to provide a greater focus on effective utility operations.

Recommendation. That the OPG Board of Directors ensure that the governance model for returning any of the remaining units to service include enhanced, independent oversight of project management decisions.

Recommendation. That OPG Management and its Board agree to a set of key standardized indicators of the progress of the project, and that, at all of its meetings, the Board receive a report that shows what it approved and where the indicators now stand, highlights any significant slippages against plan and explains what management is doing to bring the project back on track.

¹⁵ TSX Guidelines on board stewardship functions, guideline number one.

Recommendation. That the business case for restart be prepared in parallel with the current project development work and be independently verified in the context of the overall OPG business plan.

Recommendation. That a decision on whether to proceed be made as quickly as possible, noting that OPG is currently spending about \$25 million per month in work associated with the restart of Units 1, 2 and 3.

Recommendation. That OPG, as soon as possible, provide the Government with a firm estimate and timelines for completion. In parallel, that the Minister of Energy clarify the energy policy and business case criteria that a go-ahead decision should meet.

PROJECT MANAGEMENT

Should the project go ahead, OPG must ensure that effective project management is in place. The Panel notes that in the fall of 2002, a new senior project management team was appointed to the Pickering project.

The appointment of this team, although belated, has improved project discipline and effectiveness. The Panel believes that the team has learned lessons from the experience of restarting Unit 4 and that the team has the capacity to manage the return to service of the remaining units.

Recommendation. That, if approved, the project proceed with the current contracting strategy and project management structure.

Recommendation. That construction not begin until the following steps have been completed:

- Scope of the work is determined.
- Engineering design work and related work packages are completed.
- Project costs and construction plans are prepared.
- Work packages that outline material and other resource needs and set out timing are finalized and fully coordinated.
- Resources are procured on the basis of the work packages.

MANAGEMENT EFFECTIVENESS AND COMPANY CULTURE

Workforce effectiveness depends on building the skills of employees and working to retain them. This is especially true in industries that rely on a high level of technical expertise.

Ontario Hydro underwent internal restructuring that reduced its workforce in the early 1990s. In 1999, OPG emerged from a major corporate restructuring of Ontario Hydro that created two commercial entities.

These and other factors have had an impact on OPG's workforce. While carrying out its work, the Panel observed that over the last few years a number of senior posts have been filled by people recruited into OPG, many through short-term contracts. Many of these appointments have enhanced the management expertise of OPG. The future success of the company nonetheless hinges on internal staff development.

Recommendation. That going ahead, OPG place a priority on programs for staff development so that people of ability are available internally as strong candidates for senior positions.

Having the right culture, one in which coordinated and cooperative teamwork is an accepted way of working, is vital to the success of any large corporation. Instilling this culture is likely to take considerable time.

Recommendation. That improving management effectiveness and the corporate culture be made a major priority for the OPG Board and senior management, and that the Human Resources and Corporate Governance Committee of the OPG Board be made responsible for assessing and reporting on progress in this area.