Chapter 6
NB Power
Point Lepreau Generating Station Refurbishment – Phase I

Contents

NB Power Point Lepreau Generating Station Refurbishment – Phase I

Introduction

6.1 The Point Lepreau Generating Station refurbishment was one of the largest capital projects ever undertaken in the Province of New Brunswick. Its final estimated capital cost for NB Power was $1.4 billion. Another $1.0 billion in expenses relating to NB Power Nuclear operating costs and NB Power's incremental cost of providing replacement power during the refurbishment period were deferred in a special account. NB Power intends to recover the $2.4 billion refurbishment (less any recoveries from other sources) over the next 27 years through provincial electricity rates.

6.2 The refurbishment took 37 months longer and cost $1 billion more than anticipated. Given the magnitude of this capital project and the likelihood that NB Power will undertake future large capital projects, we believe this chapter should be of considerable interest to the Legislative Assembly as well as the New Brunswick public, most of whom are also NB Power rate payers.

Scope

Phase I

6.3 We decided to approach this examination in two phases. Our objectives for Phase I were as follows:

1. to describe key aspects of NB Power's planning and execution of the Point Lepreau refurbishment; and

2. to report summary-level financial information of amounts making up the $1.4 billion capital asset account and the $1.0 billion deferral account related to the refurbishment.

Phase II

6.4 In Phase II, we intend to continue with our examination of the refurbishment. In particular, we will complete more detailed analyses and testing of key components of costs of the project and assess their reasonableness, using the information presented in this chapter as a base. We plan to report on Phase II of our work in our 2014 Report.

6.5 In researching the information presented in this chapter, we conducted interviews with various NB Power representatives and toured the Point Lepreau Generating Station. We also reviewed the minutes of the NB Power board and its Nuclear Oversight Committee, attended several sessions of Energy and Utilities Board (EUB) rate hearings for NB Power, and reviewed other documents. Finally, we reviewed and summarized expenditure information related to the refurbishment.

6.6 Certain financial, statistical and other information presented in this chapter was compiled from information provided by NB Power. It has not been audited or otherwise verified. Readers are cautioned that this financial, statistical and other information may not be appropriate for their purposes.

Results in brief

Decision – Making Process

6.7 Final government approval to refurbish the Point Lepreau Generating Station was announced by the Premier on 29 July 2005. The Boards of New Brunswick Power Nuclear Corporation (Nuclearco) and New Brunswick Power Holding Corporation (Holdco) had previously recommended proceeding with the refurbishment.

6.8 The initial decision to conditionally contract with Atomic Energy of Canada Limited (AECL) was made in 2001 and we saw no evidence that it was challenged until a consultant hired by the Province reported in 2004. His recommendations, although received three years after the start of the decision-making process, did result in:

- a vetting of the draft agreement between AECL and NB Power, especially focusing on the costs to be paid and the risks to be assumed by the two parties; and
- some consideration of other possible alternatives to refurbishing the nuclear facility using AECL.

Risks Not Adequately Addressed in Decision-Making

6.9 Some other risks were not adequately addressed through the decision-making process including:

- The risk to the Province of financing such a large undertaking on its own. The search for a partner did not begin until after the report from the provincial consultant was delivered in 2004, and was ultimately unsuccessful.
- The risk associated with the length of time needed to recover all costs of the refurbishment, estimated to be 27 years by NB Power. (i.e. will the PLGS continue to generate power, and therefore revenue, throughout the entire period). (Note – This estimate was subsequently accepted by NB Power's regulator, the EUB.) The cost of building or refurbishing a nuclear power facility may be higher than the construction or refurbishment costs of some other generating options. This introduces an element of higher risk in that more dollars invested need to be recovered over a long period. If the business environment is not stable, or favorable, then this increases the risk of obtaining full recovery over a long period. It appears that an assumption was made that the business environment in which NB Power would be operating over the life of a refurbished PLGS would remain relatively stable. However, during the period the refurbishment was being planned and executed NB Power was restructured, attempts were made to sell all or part of the Corporation, consideration was given to building a second nuclear reactor at Point Lepreau, and part of AECL, the primary contractor, was sold. Also, growth in provincial demand for electricity has been flat in recent years.
- The risk that significant PLGS refurbishment planning costs ($90.2 million or 6.4% of the original project cost of $1.4 billion) incurred before final approval would be of no benefit if another alternative was chosen. NB Power indicated a small percentage of total project costs are typically incurred on a progressive basis during the planning phase of a project of this magnitude, and such costs are necessary to ensure decision-makers have access to adequate information about options under consideration.

Recommendation for Future Major Capital Projects

6.10 Our recommendation regarding the decision-making process for future major capital projects is presented in Exhibit 6.1.

PLGS Refurbishment Completion and Oversight

Delay in Completion of PLGS Refurbishment

6.11 The PLGS refurbishment was substantially complete by May 2012. NB Power representatives indicated installation of the 380 calandria tubes was delayed by 15.5 months because of accidental physical damage to calandria tube sheet bore holes which resulted in the tubes having to be installed twice. NB Power declared the plant commercially viable in November 2012. That is the point when the 27 year extended life of the PLGS was deemed to have commenced.

6.12 The financial impact upon NB Power relating to the delay in completion of the refurbishment was, as of October 2013, still in dispute. Litigation against the project's insurance underwriters to recover a significant portion of losses associated with the delay was pending.

Oversight of PLGS Refurbishment Process

6.13 We found evidence of a rigorous oversight reporting structure operating throughout the life of the refurbishment project. This involved NB Power and Nuclearco board members, along with senior and operational management staff of NB Power and AECL.

Costs Associated with the PLGS Refurbishment

Total Cost of PLGS Refurbishment

6.14 Costs associated with the PLGS refurbishment as of November 2012, totaled $2.4 billion. This amount included $1.4 billion in direct capital costs of the refurbishment and an additional $1.0 billion of deferred costs also considered part of the overall cost of the refurbishment under regulatory rules. These amounts exceeded planned costs of $1.0 billion in capital and $0.4 billion in deferred costs by a total of $1.0 billion.

Capital costs of PLGS Refurbishment

6.15 Capital costs of the project included all direct costs associated with planning and completing the refurbishment of PLGS including work done by third-party contractors and NB Power staff, along with financing costs incurred during the construction period.

6.16 Key components of capital costs included $90.2 million for project planning and initiation, $780.3 million for contracted or professional services, $260.5 million in NB Power internal costs, and $292.9 million in capitalized interest.

Deferred Costs of PLGS Refurbishment

6.17 Deferred costs were expenses incurred by Nuclearco and a related company NB Power Generation Corporation (Genco) because the PLGS was offline, and therefore generating no power, during the refurbishment period. Such costs were not eligible for capitalization as part of capital asset accounting standards applicable to NB Power. However, they are subject to recovery from customers in future periods (i.e. those customers who use the power generated by the refurbished PLGS) through the EUB rate-setting process.

6.18 Deferred costs accumulated by November 2012 included Nuclearco operating costs of $839.8 million, Genco costs to buy replacement power of $1,032.9 million, interest costs allocated to the deferral of $112.0 million, less a credit of $957.1 million representing an allocation of revenues received from customers during the refurbishment period.

Exhibit 6.1 – Summary of recommendations

Recommendation	Department's response	Target date for implementation
6.31 Based upon our observations relating to the decision-making process for the Point Lepreau Generating Station refurbishment, we recommend for future major capital projects undertaken by NB Power: • the decision-making process be clearly documented, including identifying the roles and responsibilities of key players (i.e. NB Power, the Province, external contractors, regulators such as the Energy and Utilities Board, etc.) before significant amounts are expended; • a planned decision-making timeline be developed and agreed upon by key players; • all feasible options be identified and fully investigated as early in the process as possible; • pre-decision spending be limited to that needed to adequately evaluate and mitigate risks associated with options under consideration prior to selecting a preferred option; • an independent, third-party expert be contracted to guide the process of selecting the best option, identifying and developing mitigation strategies for all significant risks, identifying a preferred proponent, and ensuring that the corporation gets the best possible outcome for provincial ratepayers; and • the process be transparent and the public made aware of the criteria to be used for decision making, progress towards making a decision and key reasons for the selection of a preferred alternative.	*Effective project management is essential to achieving NB Power's strategic goals and objectives. The refurbishment of the Point Lepreau Generating Station was the largest capital project completed by NB Power in decades.* *NB Power is committed to learning from this valuable experience and building increased efficiencies and effectiveness in its project management processes. NB Power values and supports the recommendations made in this report and will be implementing them as part of the work initiated through the establishment of a new Corporate Project Management Office.* *The Corporate Project Management Office will ensure a systematic and consistent approach to management of major projects within NB Power. The Corporate Project Management Office will establish the requirements for formal project management and governance plans for each major project, including clarifying the roles and responsibilities of all key participants in the project.* *All major project approvals and spending will follow a gated or phased-in approach, which includes the required approvals from a variety of participants including the NB Power Board of Directors as well as regulators. The approach will also incorporate consultation processes to engage third-party consultants, the public and First Nations communities in the consideration of project options.* *The recommendations in report will be completed and incorporated into NB Power's Project Management Framework to be implemented as part of NB Power's next major Project.*	*12 – 18 months*

Background

New Brunswick Power Nuclear Corporation (Nuclearco)

6.19 New Brunswick Power Nuclear Corporation (Nuclearco) was responsible for the ongoing operation of the Point Lepreau Generating Station (PLGS), including during the period in which the refurbishment took place. Nuclearco has its own board of directors and the legal authority to enter into contracts. It was accountable to the Province through its parent organization, the New Brunswick Power Holding Corporation (Holdco). Nuclearco and Holdco have all common directors. Appendix 1 provides detailed information on the structure of the NB Power Group of companies at the time of the refurbishment.

6.20 Nuclearco assumed responsibility for the PLGS refurbishment once a decision was made to proceed. NB Power representatives indicated the refurbishment created as many as 2,000 jobs during the construction life of the project. PLGS employs approximately 800 workers on a permanent basis.

Provincial Demand for Electricity Trending Downward

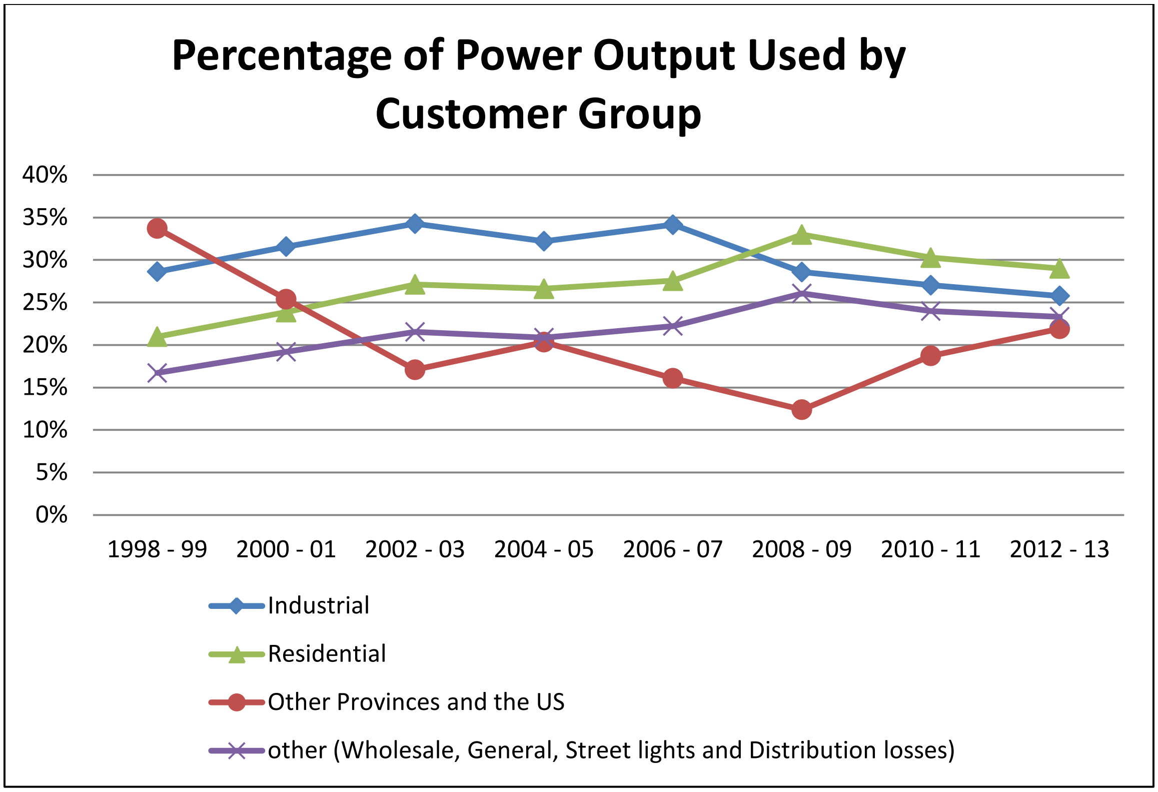
6.21 NB Power electricity sales (in kilowatt hours) by NB Power decreased 15% over the last 15 years, from a peak of over 20,000 million kilowatt hours (KWh) in 1998/99 to approximately 17,000 million KWh in 2012/13. However, this drop in demand has not been consistent among revenue categories.

Change in Relative Demand for Electricity Between Customer Groups

6.22 As shown in Exhibit 6.2, since 1998/99 the customer category, “other provinces and the US” has gone from the highest users of NB Power-provided power to the lowest. Overall usage by this customer group has dropped 47% over that period. Further, sales to industry have experienced a drop of 27% during that period.

6.23 However, during the same period residential users have moved up from third to first on the list, and are now consuming almost 30% of power provided by NB Power.

Exhibit 6.2 – Percentage of Power Output Used by Customer Group



Source: prepared by OAG from NB Power annual reports.

6.24 A review of the rates charged to all NB Power customers showed an average annual increase of 2.7% in the fiscal 1999 to 2013 periods, as indicated in NB Power annual reports. This is slightly higher than the average annual increase in the consumer price index (CPI) over the same period of approximately 2.0%.

Point Lepreau Generating Station (PLGS) Refurbishment

Decision-Making Process

6.25 In the late 1990s a consultant was engaged to *"determine the operational and economic life of PLGS and … to evaluate the optimal operational strategies for PLGS"*. In April 1998 the consultant reported that NB Power should plan on refurbishing the plant between 2005 and 2011 rather than a previously-identified target of 2014. A target date of 2006 for shut down and commencement of the refurbishment was established. NB Power indicated this target date was subsequently revised during the 2003/2004 fiscal year after it was determined the operation could continue to 2008 with acceptable risk. The consultant also advised:

- PLGS not be shut down in the near future;

- PLGS should be operated as long as possible before refurbishment;
- Given [high] natural gas price expectations, nuclear plant life extension appeared to be the more economical solution when compared with the option of developing a natural-gas fired generating plant; and
- Projecting costs for later years was complicated by the uncertainty of future natural gas prices and conversion efficiencies.

6.26 It appears that NB Power based its initial planning on the consultant's comments. Subsequent to the consultant's report, the following occurred:

Time Line:

2001 A preliminary contract was signed with AECL for re-tubing

1. In 2001 a preliminary contract was signed with Atomic Energy of Canada Ltd (AECL) for the re-tubing of the reactor. In March 2002 the Corporation entered into a refurbishment agreement with AECL. The agreements were divided into a Phase I and a Phase II list of deliverables. Phase I was essentially a planning stage and Phase II involved more detailed planning and construction. Phase II was contingent on a final decision being made by the Province to refurbish the PLGS. AECL commenced work on Phase I after the contracts were signed. This part of the refurbishment cost $90.2 million. It included costs incurred under the two contracts, along with NB Power internal costs up to the 2005 date of final project approval by the Province. Had a decision ultimately been made not to refurbish PLGS, these costs would have provided little benefit in terms of power generation.

2002 NB Power proposal to EUB for refurbishment of PLGS

2. In March 2001 NB Power appeared before the Board of Commissioners of Public Utilities (the Commission), the predecessor of the Energy and Utilities Board (EUB), preliminary to the main application to the Commission. In 2002, NB Power made an application to the Commission to refurbish the PLGS. After considering three options for future power generation including nuclear, natural gas, and orimulsion, the Commission concluded that there would be no significant advantage to the rate payers to proceed with the PLGS refurbishment project. The Commission consequently recommended to the NB Power Board

that they not proceed with the nuclear alternative. The Commission did, however, emphasize that there were other factors to be considered that were beyond the mandate of the Commission (e.g. environmental and economic development issues) and that government should consider these factors before making a final decision. They also indicated that although additional energy would be needed in future, the refurbished PLGS, when added to other existing provincial generating sources, could provide more than projected in-province requirements when completed. The Commission's recommendation to the NB Power Board was made under the *Public Utilities Act* and was therefore non-binding. It was up to the NB Power Board to accept or reject the recommendation.

2004- Spring
Consultant
Hired

3. In the spring of 2004, a consultant hired to work on behalf of the Province reported to the NB Power Board on the proposed PLGS project. He indicated that he agreed with the EUB that there was no purely economic reason for picking the nuclear option over others. Consequently, he did not recommend a preferred option but instead made a number of recommendations *"to facilitate a decision-making process that is open, auditable and fact based"* including:

   - NB Power should seek partners in this initiative;
   - AECL would be an acceptable contractor for the nuclear option, but that existing contracts should be renegotiated to provide for a fixed price for the refurbishment;
   - The cost overruns that plagued other nuclear projects could be avoided by proper oversight; and
   - Other factors to be considered in deciding on an option for generating needed power for the Province should include the volatility of natural gas prices (i.e. nuclear fuel is a fraction of the cost of natural gas and available within Canada), the CO_2 emissions associated with burning coal, the fact that nuclear power generation is much more labour intensive than other options, and the issue of less diversity of sources of fuel for power generation if the nuclear option was not selected.

2004-Winter 2005 AECL contract renegotiated

4. Through 2004 and the winter of 2005 the Province directed NB Power to renegotiate the AECL contract and considered their options based on the suggestions of the Province's consultant. Aside from a PLGS refurbishment by AECL, three other options under consideration included:

   - PLGS refurbishment by another third-party contractor;
   - coal-fired generation; and
   - natural gas-fired generation.

   In April 2005, the Premier stated that the final decision would be primarily based on economics.

2005 – May Nuclearco recommended refurbishment

5. In May 2005 the Nuclear Oversight Committee recommended the refurbishment of the PLGS by AECL. In July 2005, the Board of Holdco agreed on that option.

2005 – July Final board and government approval

6. Final government approval of the option was announced by the Premier on 29 July 2005. The Premier noted in his announcement that *"proceeding in partnership with AECL allows us to meet all our project objectives, including balancing our risk and cost, ensuring security and diversity of supply (of power), maximizing environmental benefits* (presumably reducing CO_2 emissions by not using fossil fuel alternatives) *and maintaining 700 highly skilled jobs."*

Our Observations on the Decision-Making Process

6.27 We make the following observations in relation to this decision-making process.

1. The decision-making process took four and a half years from 2001 to the summer of 2005. As late as the spring of 2005 there was still substantial uncertainty about what should be done to meet future provincial electricity needs. NB Power records from 2005 indicate that a decision on the refurbishment had to be made as soon as possible to allow PLGS to begin

preparations for its targeted 2008 shut down. Based on our examination, the major decision (i.e. to select between two supplier options for refurbishing PLGS (nuclear); building Belledune II (coal); or building a new facility (natural gas)) was made late in the process, in an environment where there was considerable time pressure.

2. The initial decision to conditionally contract with AECL was made very early in the process and we saw no evidence that it was challenged until the consultant hired by the Province reported in 2004. His recommendations, although received three years after the start of the decision-making process, did ensure:

    - There was a vetting of the draft agreement between AECL and NB Power, especially focusing on the costs to be paid and the risks to be assumed by the two parties; and
    - There was some consideration of other possible alternatives than to refurbish the nuclear facility using AECL.

Risks Not Adequately Addressed in Decision-Making

6.28 The Premier announced the refurbishment on 29 July 2005. In his announcement, he indicated the reasons for choosing refurbishment of the PLGS over other alternatives. Most of those reasons were examined as part of the vetting process and related risks were studied at that time. However, there were risks we believe should have been more fully addressed and mitigated, or addressed earlier in the decision making process:

- ***The risk of using new technology to refurbish a CANDU plant for the first time***, as illustrated by the calandria tube delay discussed in this chapter;

- ***The risk of New Brunswick essentially financing such a large undertaking on its own.*** The search for a partner only began after the report from the provincial consultant was delivered in 2004, and was ultimately unsuccessful. We did note however NB Power stated Maritime Electric Company Limited of Prince Edward Island does have a four to five percent stake in the venture ;

- ***Risks associated with the ability of NB Power to recover all costs of the refurbishment, over the planned 27 year period, from those customers who benefit from the power generated*** (i.e. will the PLGS continue to generate power, and therefore revenue, throughout the entire period.) The cost of building or refurbishing a nuclear power facility may be higher than the construction or refurbishment costs of some other generating options. This introduces an element of higher risk in that more dollars invested need to be recovered over a long period. The business environment needs to be stable, or favorable, over that period to ensure recovery. The business environment in which NB Power would be operating over the life of a refurbished PLGS would remain relatively stable to support the recapture of the cost of refurbishment over the 27 year period. We question that assumption given that during the period the refurbishment was being planned and executed NB Power was restructured, attempts were made to sell all or part of the Corporation, consideration was given to building a second nuclear reactor at Point Lepreau, and part of AECL was sold;

- ***The risk demand for power from the PLGS will not be high enough to require the refurbished PLGS to operate at expected production capacity over the planned 27 year recovery period.*** Reduced overall provincial demand for power in recent years is discussed in the background section of this Chapter;

- ***The risk associated with incurring significant PLGS refurbishment planning costs ($90.2 million*** or 6.4% of the original project cost of $1.4 billion) incurred before final approval would be of no benefit if another alternative was chosen. NB Power indicated a small percentage of total project costs are typically incurred on a progressive basis during the planning phase of a project of this magnitude, and such costs are necessary to ensure decision-makers have access to adequate information about options under consideration; and

- ***The risk of higher than expected overall project cost associated with a failure to complete the project by targeted completion dates.*** In particular, we noted that Nuclearco operational, maintenance, and other costs, which eventually ended up as part of the $1.0 billion deferral amount, were not considered.

Recommendations

6.29 Based upon our observations relating to the decision-making process for the Point Lepreau Generating Station refurbishment, we recommend for future major capital projects undertaken by NB Power:

- **the decision-making process be clearly documented, including identifying the roles and responsibilities of key players (i.e. NB Power, the Province, external contractors, regulators such as the Energy and Utilities Board, etc.) before significant amounts are expended;**
- **a planned decision-making timeline be developed and agreed upon by key players;**
- **all feasible options be identified and fully investigated as early in the process as possible;**
- **pre-decision spending be limited to that needed to adequately evaluate and mitigate risks associated with options under consideration prior to selecting a preferred option;**
- **an independent, third-party expert be contracted to guide the process of selecting the best option, identifying and developing mitigation strategies for all significant risks, identifying a preferred proponent, and ensuring that the corporation gets the best possible outcome for provincial ratepayers; and**
- **the process be transparent and the public made aware of the criteria to be used for decision making, progress towards making a decision and key reasons for the selection of a preferred alternative.**

The Refurbishment Process

Contracts with AECL

6.30 In 2001 a contract was signed with AECL for re-tubing the reactor. In 2002 a contract for the rest of the refurbishment was signed. Both agreements with AECL were contingent on a final decision being made by the Province to refurbish the PLGS.

6.31 The preliminary re-tube and refurbish contracts with AECL were set up in two parts:

- Phase 1 included all the work up to the decision point in 2005, including some detailed engineering; and
- Phase 2 involved completion of engineering work and all construction activities.

6.32 Phase I work was carried out by AECL under the re-tube and refurbish agreements between 2001 and 2005. During the same period, the Corporation carried out its own planning activities relating to the project including working through the regulatory process. These activities were capitalized as part of the project cost and amounted to $90.2 million.

6.33 On 29 July 2005, after final approval of the refurbishment by government, an amending omnibus agreement with AECL was signed. The omnibus agreement recognized the previous contracts and added additional work identified during the Phase I process. A specific fixed cost amount was set for both the re-tube and the refurbishment work under the omnibus agreement. Acceleration clauses in certain portions of the omnibus agreement were needed to reflect that, due to the delay in approval, the period between approval and outage start was shorter than contemplated by the agreements.

6.34 The fixed amount for the re-tube section of the omnibus agreement included the cost of the work AECL had completed to date under Phase I of the previous contracts, and a fixed amount for Phase II. The refurbishment portion of the omnibus agreement similarly set a Phase I amount and a fixed amount for Phase II. Phase II work outside the fixed portion of the refurbishment agreement was paid on a reimbursement basis and was subject to an escalation clause.

6.35 During the period from the signing of the omnibus agreement in 2005 to 2008 detailed engineering, site preparations, and material procurement and delivery occurred.

6.36 In 2008 an extended outage began to allow for refurbishment work to be carried out on the reactor. The outage and plant return to service was initially planned to be completed by September 2009, a period of 18 months.

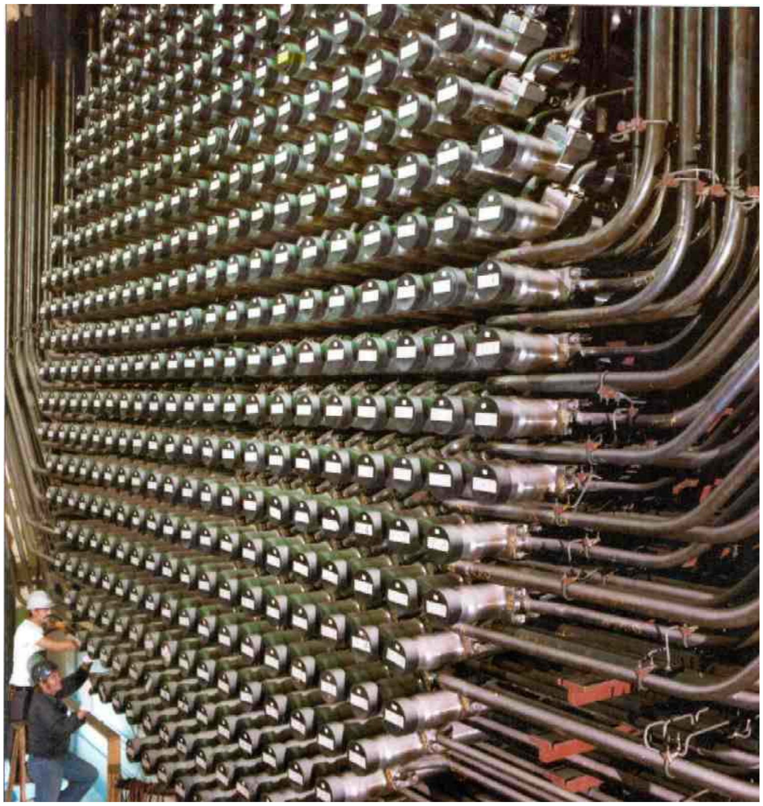
Calandria Tube Installation Delay

6.37 However, there were significant delays in completing the refurbishment relating in part to the installation of new calandria tubes at the facility. PLGS's reactor has 380 such calandria tubes that needed to be replaced as part of the refurbishment. Inserted into each calandria tube is a pressure tube that contains the fuel bundles used to power the reactor, so precision is critical to the proper functioning of the reactor.

6.38 NB Power representatives indicated the calandria tube sheet bore holes were accidentally damaged when preparing for installation of the new calandria tubes. As a result, the necessary seal between the calandria tubes and the tube sheet could not be achieved. It was only after all the calandria tubes had been installed that the consequences of this problem were understood.

6.39 Consequently, all 380 calandria tubes had to be removed, the damage to the bores repaired and a second set of new calandria tubes installed. To repair the damaged tubesheet bores effectively, a new tube sheet bore polishing technique was developed and implemented based on the problems previously encountered at PLGS, as well as similar installation issues experienced by a refurbishment team in Korea.

Exhibit 6.3 – Fuel Channel and Calandria Tubes



Source: (NB Power Website)

PLGS Declared Commercially Viable in November 2012

6.40 Ultimately, it was May 2012 before AECL completed its work on the refurbishment. PLGS was then able to move into the startup stage with NB Power declaring the plant commercially viable in November 2012.

6.41 Upon completion of the refurbishment, NB Power estimated the useful life of the PLGS to be 27 years. This estimate was accepted by the EUB for purposes of determining power rates for future years. The 27 year extended life of the PLGS was deemed to have commenced in November 2012. NB Power intends to recover costs associated with the $2.4 billion refurbishment (less any recoveries from other sources) over the next 27 years through provincial electricity rates.

Financial Impact of Refurbishment Delay

6.42 The financial impact to NB Power of the delay in completion of the refurbishment was, as of October 2013, still in dispute. Litigation against the project's insurance underwriters to recover a significant portion of losses associated with the delay was pending.

Oversight of Refurbishment by NB Power Boards and Management

6.43 In the fall of 2005 a project oversight structure was established. Although there were changes to oversight processes to adapt to the various stages of the refurbishment, the basic oversight structure remained relatively consistent over the life of the project. A full description of the oversight bodies, their composition and roles is provided in Appendix II.

Our Observations Relating to Project Oversight

6.44 During our review we examined documentation indicating the oversight structure at strategic levels (i.e. Board and senior NB Power management) operated throughout the life of the project. In our opinion, strategic oversight for the refurbishment project was rigorous, and planned Board reporting requirements appeared to be met. We were also provided with evidence that regular joint meetings were held involving representatives of NB Power and AECL. However, we did not review the activities of operational level oversight groups in detail.

Costs associated with the Refurbishment

6.45 Our second objective for this Chapter was to present summaries of amounts making up the $1.4 billion asset account and the $1.0 billion deferral account related to the refurbishment. Exhibit 6.4 provides further information on planned versus actual costs.

Exhibit 6.4 – Point Lepreau Generating Station Refurbishment Planned vs. Actual Costs (in $ billions)

Point Lepreau Generating Station Refurbishment Planned vs. Actual Costs (in $ billions)			
	Original Plan 2005	**Actual Costs 2013**	**Difference**
Capital Costs	$ 1.0	$ 1.4	$ 0.4
Deferral Account	0.4	1.0	0.6
Total	$ 1.4	$ 2.4	$ 1.0
Planned vs. Actual completion date			
	Original Plan	**Actual**	**Difference**
Completion date	September 2009	November 2012	37 months
Source: Created by the Office of the Auditor General with data obtained from NB Power Unaudited			

Capital Cost of the PLGS Refurbishment

6.46 Capital costs of the project were accumulated in the asset account. They included all direct costs associated with planning and completing the refurbishment of PLGS including work done by third-party contractors and NB Power staff, along with financing costs incurred during the construction period.

6.47 The initial capital budget for the PLGS refurbishment was $1 billion. The final cost estimate is in the range of $1.4 billion. This amount was incurred during two project Phases:

- Project planning and initiation (Phase I) - $90.2 million – Costs included in this amount relate to the re-tube and refurbishment planning work performed by AECL, along with other NB Power costs incurred, up to 29 July 2005 (i.e. the date the final agreement was signed between NB Power and AECL); and

- Engineering, procurement and construction phase of the project (Phase II) - $1,333.7 million - These costs relate to the performance of the refurbishment and include costs after Phase I, until the completion date. The three primary components of Phase II are shown in Exhibit 6.5. A further breakdown of these components is presented in Exhibits 6.6, 6.7, and 6.8.

Exhibit 6.5 – Components of Capitalized PLGS (in $ millions)

Components of Capitalized PLGS (in $ millions)	
Phase I Project Planning	$ 90.2
Phase II Engineering, Procurement, and Construction:	
Contracted or Professional Services	780.3
Capitalized Interest	292.9
NB Power internal costs	260.5
Total	**$ 1,423.9**
Source: Created by the Office of the Auditor General with data obtained from NB Power Unaudited	

Contracted or Professional Services

6.48 A total of 24 vendors were each paid in excess of $1.0 million in connection with the PLGS refurbishment, as detailed in Exhibit 6.6.

Exhibit 6.6- Contracted or Professional Services greater than $1.0 Million (in $ millions)

Contracted or Professional Services greater than $1.0 million (in $ millions)	
Atomic Energy Of Canada Limited	$ 579.5
Atlantic Nuclear Services Inc	34.6
Sunny Corner Enterprises Inc	30.8
Siemens Power Generation	28.6
Areva Np Canada Ltd	15.0
O'Brien Electric Co Ltd	9.8
Gardner Electric Ltd	8.0
Castle Rock Construction	7.2
Hatch Sargent & Lundy	6.2
Stantec Consulting Ltd	5.8
Exp Services Inc	5.2
Babcock And Wilcox Canada Ltd	4.6
Ian Martin Limited	3.9
Aluma Systems Canada Inc	3.6
Neill And Gunter Limited	2.7
NB Research & Productivity Council	2.4
Candu Energy Inc	2.0
WAG QA Services Canada Inc	2.0
Canadian Power Utility Services Ltd	1.8
Constable Power Group Ltd	1.4
Ernst & Young	1.3
John E Cole & Associates Ltd	1.3
Nma Lab & Ben	1.2
Maritime Rescue And Medical Inc	1.1
Other < $1.0 million	20.5
Total	**$ 780.3**

Source: Created by the Office of the Auditor General with data obtained from NB Power Unaudited

Capitalized Interest

6.49 Interest costs associated with borrowings required to finance the project have been capitalized as part of the project cost. As noted below in the deferral section, the capitalization of this interest in the capital account serves to reduce the normal period interest costs. Exhibit 6.7 shows year by year capitalization of interest for the PLGS refurbishment.

Exhibit 6.7 – Year by Year Capitalization of Interest Relating to the PLGS Refurbishment(in $ millions)

Year by Year Capitalization of Interest Relating to the PLGS Refurbishment (in $ millions)								
2006	2007	2008	2009	2010	2011	2012	2013	**Total**
7.2	17.6	21.7	33.6	48.7	56.4	63.5	44.2	**292.9**
Source: Created by the Office of the Auditor General with data obtained from NB Power Unaudited								

NB Power Internal Costs

6.50 NB Power internal costs represent a variety of costs deemed to be directly related to the refurbishment. Exhibit 6.8 summarizes NB Power internal costs that have been capitalized.

Exhibit 6.8 – Components of NB Power Internal Costs(in $ millions)

Components of NB Power Internal Costs (in $ millions)	
NB Power Labour	$ 149.6
Fees (Regulatory, Environmental, Training, Insurance etc.)	52.8
NB Power Materials	29.0
Properties (Heating, Lighting etc.)	18.6
Inter-Company Services	9.3
Operational – Various*	1.2
Total	**$ 260.5**
** Net of $3.7 million of revenue from commissioning energy generated during November 2012 return to service period. Source: Created by the Office of the Auditor General with data obtained from NB Power Unaudited*	

Deferral Costs Attributed to PLGS

6.51 Deferral account costs were indirect costs associated with the refurbishment of PLGS, which were not eligible for capitalization under capital asset accounting standards applicable to NB Power. These costs are expected to be recovered from customers in future periods (i.e. those customers who use the power generated by the refurbished PLGS), as directed by legislation, through the New Brunswick Energy and Utilities Board (EUB) rate-setting process. The *Electricity Act* was amended to provide guidance on the specific treatment of costs incurred for purposes of the regulatory deferral account. The deferral account approximates the incremental cost to NB Power of not operating the PLGS during refurbishment.

6.52 The regulatory deferred asset associated with the refurbishment of PLGS, as shown in Exhibit 6.9, includes:

- the normal period costs (net of any revenues) incurred by Nuclearco while the refurbishment was ongoing. These could not be recovered from sales to customers during construction because the PLGS was not generating power during that period;
- the cost for replacement power purchased by NB Power Generation Corporation (Genco), during the refurbishment period, to replace power normally available from the PLGS;
- interest on the regulatory deferral asset; and net of
- any costs built into by current rates for electricity sales charged to customers for PLGS power.

Exhibit 6.9 – Deferral Costs Accumulated by November 2012 (in $ millions)

Deferred Costs Accumulated to November 2012 (i.e. Date PLGS came back on line) (in $ millions)					
Fiscal Year	**Nuclearco Period Costs**	**Genco Replacement Power Costs**	**Costs Recovered Through Current Rates**	**Interest Assigned to Deferral**	**Total**
2008	$ 1.7	$ 0.3	$ (2.1)	$ -	$ (0.1)
2009	176.3	267.0	(209.4)	3.5	237.4
2010	176.4	224.7	(206.1)	16.3	211.3
2011	164.4	239.2	(206.7)	27.1	224.0
2012	188.9	198.4	(209.6)	36.6	214.3
2013	132.1	103.3	(123.2)	28.5	140.7
Total	**$ 839.8**	**$ 1,032.9**	**$ (957.1)**	**$ 112.0**	**$ 1,027.6**
Source: Created by the Office of the Auditor General with data obtained from NB Power. Unaudited					

Nuclearco Period Costs

6.53 Period costs are costs and expenses incurred by Nuclearco during the out-of-service period, other than those costs and expenses recorded as capital costs of the project. Given that Nuclearco's purpose is the operation of the Point Lepreau Generating Station, all operations of Nuclearco during the refurbishment period were capitalized and deferred either as part of capital projects like the PLGS refurbishment, as explained above, or as part of this deferral account.

6.54 Major components of period costs, as shown in Exhibit 6.10 are:

- ***Operations, maintenance and administration***:
    - Approximately 60 percent of PLGS systems were still in service during refurbishment,

while the balance of out-of-service systems still required routine preventative maintenance. These activities result in work load requirements similar to pre-refurbishment levels for work groups within the plant; and

- NB Power also took advantage of the reactor down time to perform a number of major maintenance projects;

- ***Transmission services***: this includes connection fees and tariffs. Long term transmission commitments are required to be paid regardless of whether they are used or not;
- ***Amortization and Decommissioning***:
  - Amortization of the capital costs of Nuclearco's fixed assets less the salvage value over their estimated service lives; and
  - Decommissioning costs provide for the estimated costs of permanently decommissioning the nuclear plant at the end of its service life;
- ***Taxes***: reflecting property taxes on the buildings and property, both at a municipal and provincial level;
- ***Finance charges***: Interest charged on long term and short term debt along with a debt portfolio management fee. This is reduced by interest charged to the various capital projects in Nuclearco including the refurbishment project. This is also net of interest earned from the nuclear trust funds and investments; and
- ***Revenue***: These revenues reflect the pre-existing participation agreement with a neighboring utility.

Exhibit 6.10 – Composition of Nuclearco Period Costs (in $ millions)

Composition of Nuclearco Period Costs (in $ millions)							
Expenses	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Labour & benefits	1.0	105.5	104.0	97.8	110.5	86.7	505.5
Material expense	0.1	11.7	12.9	8.7	10.8	8.2	52.4
Hired services	0.4	39.9	41.7	23.9	33.4	26.7	166.0
Other Operations, Maintenance and Administration Costs	0.3	31.4	37.5	34.8	36.7	27.7	168.4
Allocation to capital	(0.4)	(40.9)	(35.0)	(24.7)	(30.0)	(35.4)	(166.4)
Total Operations, Maintenance and Administration	1.4	147.6	161.1	140.5	161.4	113.9	725.9
Fuel & Transmission Expenses	-	1.9	1.9	1.9	1.9	1.5	9.1
Amortization & Decommissioning	0.3	32.4	31.9	36.8	41.1	28.5	171.0
Property Taxes	0.1	6.7	5.7	5.8	5.7	3.7	27.7
Finance Charges	-	(0.7)	(12.4)	(9.9)	(10.8)	(7.6)	(41.4)
Total Costs	1.8	187.9	188.2	175.1	199.3	140.0	892.3
Less: Revenues	0.1	11.6	11.8	10.6	10.5	7.9	52.5
Net Costs	1.7	176.3	176.4	164.5	188.8	132.1	839.8
Source: Created by the Office of the Auditor General with data obtained from NB Power Unaudited							

Genco Replacement Power Costs

6.55 The costs of replacement power purchased by the New Brunswick Power Generation Corporation (Genco) during the refurbishment is intended to reflect power supply costs that, if not for the refurbishment, would have been covered by Nuclearco from electricity generated at PLGS. Genco normally produces or procures power including that produced by Nuclearco. Therefore, the incremental cost Genco incurred because of PLGS being offline involves a complicated modeling process to isolate the additional costs attributable to time the PLGS spent offline during the refurbishment. These costs are shown in Exhibit 6.11.

Exhibit 6.11 - Composition of Genco Replacement Power Costs (in $ millions)

Composition of Genco Replacement Power Costs (in $ millions)							
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Power Costs attributed to PLGS shutdown:							
Firm*	$ 3.6	$ 255.8	$ 206.2	$ 224.0	$ 186.2	$ 90.6	$ 966.4
Interruptible**	0.0	9.5	1.2	3.9	3.8	5.0	23.4
Hedging Activities***	(3.3)	1.7	17.3	11.3	8.4	7.7	43.1
Total	**$ 0.3**	**$ 267.0**	**$ 224.7**	**$ 239.2**	**$ 198.4**	**$ 103.3**	**$ 1,032.9**

* Firm is power supplied to service the in-province load and other firm supply commitments.

** Interruptible is power supplied to large industrial customers when excess capacity is available and priced at NB Power's incremental cost.

*** Hedging amounts are based on existing NB Power hedging activity.

Source: Created by the Office of the Auditor General with data obtained from NB Power. Unaudited

Offsetting Credit

6.56 The offset amount is intended to avoid over recovery from customers. It was felt that simply deferring the two costs above would not have been appropriate since a portion of these costs are already included in current rates charged to customers. Including this offset amount has the effect of moving amounts out of the deferral account and back into current period expenses, thereby reducing the future rate recovery requirements.

6.57 The offset calculation is based on expected PLGS power output, multiplied by a purchase price agreement for Nuclearco power. Offset credits related to the PLGS refurbishment are shown in Exhibit 6.12.

Exhibit 6.12 - Calculation of Offset Credit

Calculation of Offset Credit							
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Power Attributed to PLGS (MWh)	0.0	3.9	3.8	3.8	3.8	2.2	
Year Ending Prices ($/MWh)	$53.19	$53.71	$54.18	$54.35	$54.92	$55.81	
Offset Credit ($ millions)	$ (2.1)	$ (209.4)	$ (206.1)	$ (206.7)	$ (209.6)	$ (123.2)	$ (957.1)

Source: Created by the Office of the Auditor General with data obtained from NB Power. Unaudited

Interest During Construction

6.58 The financing costs associated with funding this deferral account, as shown in Exhibit 6.13, are deferred rather than being expensed in the period during which they were incurred. Interest is charged on the deferral balance monthly at a rate that is intended to approximate NB Power's cost of borrowing.

Exhibit 6.13 - Composition of Interest in Deferral Account (in $ millions)

Composition of Interest in Deferral Account (in $ millions)						
	2009	**2010**	**2011**	**2012**	**2013**	**Total**
Interest Rate Applied*	3.0%	5.0%	4.9%	4.8%	4.6%	
Deferral Balance*	$ 111.0	$ 337.5	$ 560.5	$ 779.3	$ 966.2	
Interest Cost	$ 3.5	$ 16.3	$ 27.1	$ 36.6	$ 28.5	$ 112.0

* Interest applied per month, average interest rate and deferral month end balance reported.
Source: Created by the Office of the Auditor General with data obtained from NB Power
Unaudited

Future OAG Work Relating to PLGS Refurbishment

6.59 This chapter has presented information related to the decision-making process for the PLGS refurbishment, project oversight during the refurbishment, and summary-level financial information about the costs associated with the project. We hope the information presented will prove useful to Legislators and the public in better understanding this complex and costly project that will have significant financial and service impacts on all New Brunswick residents.

6.60 During the next year, we plan to continue with our examination of the refurbishment. In particular, we will be completing more detailed analyses and testing of key components of costs of the project and assess their reasonableness, using the information presented in this chapter as a base. We plan to report on this work in our 2014 Report.

Appendix I – NB Power Organizational Structure during refurbishment of Point Lepreau

NB Power Organizational Structure

6.61 During 2004 NB Power was re-organized into five main business units (known collectively as the NB Power Group) with several smaller business units reporting to them. Therefore, this new structure was in place through the latter stages of planning for the Point Lepreau Generating Station refurbishment and throughout the completion of the project.

6.62 The 2005-06 NB Power annual report included the following description of the NB Power Group:

The NB Power Group provides reliable, safe and reasonably-priced electricity with respect for the environment, while providing a commercial return to the Shareholder. The electricity is generated at 15 facilities and delivered via power lines, substations and terminals to more than 360,000 direct and indirect customers within New Brunswick and surrounding areas. The NB Power Group consists of a holding company and four operating companies:

• ***New Brunswick Power Holding Corporation (Holdco)****, which provides strategic direction, governance and support to the subsidiaries for communications, finance, human resources, legal and governance. It also provides shared services on a cost recovery basis*

• ***New Brunswick Power Generation Corporation (Genco),*** *which is responsible for the operation and maintenance of the oil, hydro, coal, Orimulsion® and diesel-powered generating stations*

• ***New Brunswick Power Nuclear Corporation (Nuclearco)****, which is responsible for the operation of Point Lepreau Generating Station*

• ***New Brunswick Power Transmission Corporation (Transco)****, which is responsible for operating and maintaining the transmission system*

• ***New Brunswick Power Distribution and***

Customer Service Corporation (Disco)*, which is responsible for operating and maintaining the distribution system. Disco is designated as the standard service supplier for the Province of New Brunswick and is obligated to provide standard services to residential, commercial, wholesale and industrial customers located throughout the province*

Appendix II – Oversight of Refurbishment by NB Power Boards and Management

Board Level Oversight

6.63 The Board of Nuclearco established a three to five member *refurbishment project sub-committee* for the duration of the project. Further, *the NB Power board (before restructuring in 2004) established a nuclear oversight committee which periodically held joint meetings with the NB Power audit committee* (a subcommittee of Holdco's Board).

6.64 Both board oversight bodies were regularly provided with information on project progress by senior management. Also, board committees were provided with quarterly reports addressing financial and risk management issues by NB Power's internal auditors, a public accounting firm. Further, quarterly technical progress reports were provided by an independent consultant.

6.65 Board meetings relating to the refurbishment were well documented and planned Board reporting requirements were met.

Senior Management Level Oversight

6.66 At the senior management level a group known as the *Executive Refurbishment Committee* was established for the duration of the project. It was made up of the CEO of NB Power and a number of other corporation executives. Information flowed regularly through this Committee to the Boards of Directors of Nuclearco and Holdco. Meetings of this Committee were well documented.

Project Management Level Oversight

6.67 A number of regular meetings were held to oversee project management during the refurbishment. These included:

- *Joint AECL /NB Power executive meetings* – This meeting group included the CEOs of NB Power and AECL together with vice presidents of the respective organizational units involved and the senior on-site NB Power managers. The group primarily discussed project progress and resolved significant issues around the refurbishment.

- *Strategic meetings* – This meeting group included the vice presidents of the Nuclearco and AECL units involved in the refurbishment. They met monthly for strategic updates, discussion of upcoming work, and to address issues not resolved at a lower management level.

- *Formal project review committee meetings* – This committee consisted of the project directors and construction teams of AECL and NB Power. They initially met monthly, and later weekly, to review progress, to identify opportunities to gain time in completing the refurbishment, to discuss issues, to review the risk register, and to address other matters.

- *Daily communication meetings* – Meeting participants included the project directors of AECL and NB Power. These meetings became part of the oversight regime for the project midway through project completion. They were intended as a means of expediting project progress by looking at recovery plans, turnover issues, training, tooling, and other factors on a daily basis.

- *Construction meetings* – Meeting participants were originally NB Power and AECL project directors and their project management teams, but later changed to primarily the project management teams and the AECL project director, and then to specific task managers and their construction teams. Meetings were initially held monthly, then weekly, and finally daily. The group was tasked with co-ordination of daily activities and action plans.

6.68 Oversight groups generally reported to the next level up to ensure accurate and timely communication of information about key issues and actions to higher levels of management.