DARLINGTON REFURBISHMENT

1.0 PURPOSE

1.1 Purpose of the Darlington Refurbishment Project

The Darlington Refurbishment Project (the "DRP" or the "Project") is a multi-year, multi-phase program for Ontario Power Generation's Darlington Nuclear Generating Station ("DNGS") to enable the replacement of life-limiting critical components, the completion of upgrades to meet current regulatory requirements and the rehabilitation of components. It is comprised of individual projects of various scales and sizes that will be executed during multi-year outages.

The DRP, when completed, will allow the nuclear generating station to continue safe and reliable operation for an additional 30 years. Without refurbishment DNGS would cease production in 2020.

1.2 Approvals and Findings

This Exhibit D2-2-1 sets out evidence in support of the following findings and approvals that are sought by OPG:

- A finding that OPG's commercial and contracting strategies for the DRP are reasonable;
- A finding that the proposed capital expenditures of $837.4M in 2014 and $631.8M in 2015 are reasonable;
- Approval of OM&A expenditures of $19.6M in 2014 and $18.2M in 2015 (Ex. F2-7-1) ;
- Approval of in-service additions to rate base of $5.0M in 2012, $104.2M in 2013, $18.7M in 2014, and $209.4M in 2015 for new facilities and related 2014 and 2015 depreciation expense; and

- Approval to recover the capital cost portion of the actual audited nuclear balance in the Capacity Refurbishment Variance Account as at December 31, 2013, currently projected at $3.7M.

2.0 OVERVIEW

This exhibit sets out:

- The background to and an update of the DRP since EB-2010-0008 as well as a look forward to the test years 2014 and 2015;
- A description of and justification for the DRP's overall commercial strategy and the contracting strategy for the major project work packages forming the DRP;
- A description of in-service rate base additions for the years 2012 through to 2015;
- A description of proposed capital expenditures in the test period; and
- A description of the DRP-related balance in the Capacity Refurbishment Variance Account ("CRVA").

3.0 BACKGROUND AND UPDATE

3.1 Support for the DRP

The DRP is needed to ensure continued safe and reliable operation of the station for an additional 30 years.

As noted by the OEB in the EB-2010-0008 Decision with Reasons, OPG's Board of Directors approved the decision to proceed with the DRP on November 19, 2009. In its decision, the OEB found that the forecast DRP expenditures of $105.2M for 2011 and $255.8M for 2012 were reasonable. OPG indicated at that time that it would bring forward an update to the DRP and the planned expenditures and work plans in the next application.

The Minister of Energy confirmed provincial support for the refurbishment project as indicated in his March 8, 2011 letter to the Chair of OPG (Attachment 1).

> *The government is committed to continuing to use nuclear power to supply about 50 per cent of Ontario's energy supply. Achieving this goal will require the refurbishment of all existing units at OPG's Darlington Nuclear Generating Station. This refurbishment is key to the government's plan for modernizing the existing nuclear fleet. To this end I encourage OPG to efficiently manage the refurbishment process in a transparent and cost-effective manner.*

In 2012, the OPA performed its own economic assessment on the DRP (Ex. F2-2-3 Att. 2). The OPA stated:

> *On balance, the preservation of approximately 3,500 MW and 28 TWh of nuclear supply on an existing site with access to services and transmission is seen to have merit in terms of shorter lead-time, community acceptance, impacts on the environment and cost. In consideration of the longer-term uncertainties, the OPA's probabilistic analysis suggests a high likelihood that refurbishing Darlington NGS would be less costly than other sources of supply, including new nuclear or new gas-fired facilities, for a wide range of potential future conditions.*
>
> *In addition to the above considerations, the OPA estimates that the option would not add significantly to carbon emissions in the province. In comparison, an equivalent natural gas-fired alternative would increase CO^2 emissions by an average of 10 megatonnes annually between 2024 and 2054. This would approximately triple the annual volume of CO2 emissions for Ontario that is otherwise projected for the long-term.*

Further, the OPA views Darlington refurbishment as supportive of the diversity and performance of Ontario's long-term electricity supply mix. The rationale for a diverse supply

mix relates to considerations of uncertainty, risk mitigation and security of supply. Recognition of nuclear energy in these and other regards is found in the OPA's Supply Mix Advice provided to the Ontario Government in December 2005, the Integrated Power System Plan submitted to the Ontario Energy Board in 2007 (EB-2007-0707), the Ontario Government's Long-Term Energy Plan issued in 2010 and, subsequently, in the 2011 Supply Mix Directive, and in the Making Choices document issued by the Ministry of Energy as part of the current review of Ontario's Long Term Energy Plan. Each of these identifies an important role for nuclear energy in Ontario's long-term supply mix. Refurbishment of Darlington, in addition to the merits outlined above, is consistent with this direction.

3.2 Project Description

The DRP is a multi-phase program comprised of individual projects of various scales and sizes. In particular, the DRP consists of the following five major project work packages: Re-tube and Feeder Replacement ("RFR"), Turbines and Generators, Fuel Handling, Steam Generators, and Balance of Plant

The RFR work package includes the removal and replacement of pressure tubes, calandria tubes and feeders in each reactor.

The Turbine Generator work package consists of inspections, repairs and replacements of specific components of the four turbine generator sets and their auxiliaries; and the replacement of analog control systems with digital systems.

The Fuel Handling work package involves the defueling of the reactor prior to re-tube and feeder replacement; as well as life cycle repair and replacement work to refurbish the fuel handling equipment.

The Steam Generators work package includes mechanical cleaning, water lancing, inspection and maintenance work.

The Balance of Plant work package consists of replacement of safety and control system components and repair and replacement of components for systems on the reactor side of

the unit (such as heavy water and cooling systems) and for systems on the conventional side of the unit (such as electrical system, piping and valve work).

3.3 Role of the CNSC

Nuclear power plants in Canada are subject to the ongoing regulatory oversight of the Canadian Nuclear Safety Commission ("CNSC"), including periodic licence renewal. Continued operation of the Nuclear Power Plant is largely dependent on the work that is required for long term safe operation of the plant as described in the CNSC's Regulatory Document RD-360: Life Extension of Nuclear Power Plants (Attachment 2).

OPG's operating licence for DNGS will be amended to introduce specific conditions for the regulatory control of life extension projects. OPG is expected to adhere to the requirements of the *Nuclear Safety and Control Act*, the *Canadian Environmental Assessment Act*, all associated regulations, and to all licence conditions.

Approval for return-to-service is contingent upon demonstration by the licencee that all licence conditions are met.

The CNSC expects the licencee to demonstrate that the following objectives are met for any life extension project:

1. The technical scope of the project is adequately determined through a Integrated Implementation Plan that takes into account the results of an Environmental Assessment ("EA") and an Integrated Safety Review ("ISR");

2. Programs and processes that take into account the special considerations of the project are established; and

3. The project is appropriately planned and executed.

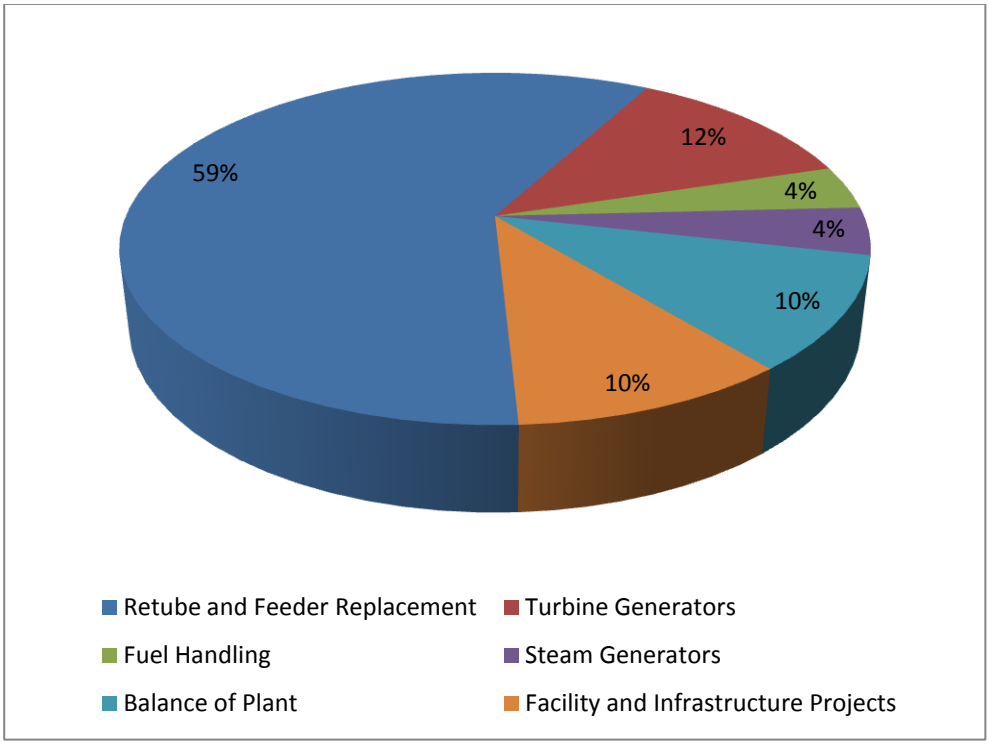
The EA Screening Report for the project was submitted to the CNSC on December 1, 2011. The CNSC released its decision on the EA on March 14, 2013. The overall finding of the CNSC is that the project will not result in any significant adverse environmental effects given the proposed mitigations.

The ISR, which assesses and documents key safety factors against modern codes and standards, was submitted to the CNSC on October 27, 2011. The CNSC issued their assessment of the ISR on July 5, 2013; the assessment concluded that the ISR meets applicable regulatory requirements.

OPG is currently in the process of preparing the Integrated Implementation Plan ("IIP") and Licensing Application for the DRP; both will be submitted to the CNSC in late 2013 and the new licence is expected by early 2015. The new licence will allow OPG to execute the refurbishment and continue to operate DNGS for an additional 30 years assuming all licence conditions and regulatory obligations are met.

Figure1 provides a breakdown, in terms of percent of total direct costs, of the major work packages described in section 3.2.

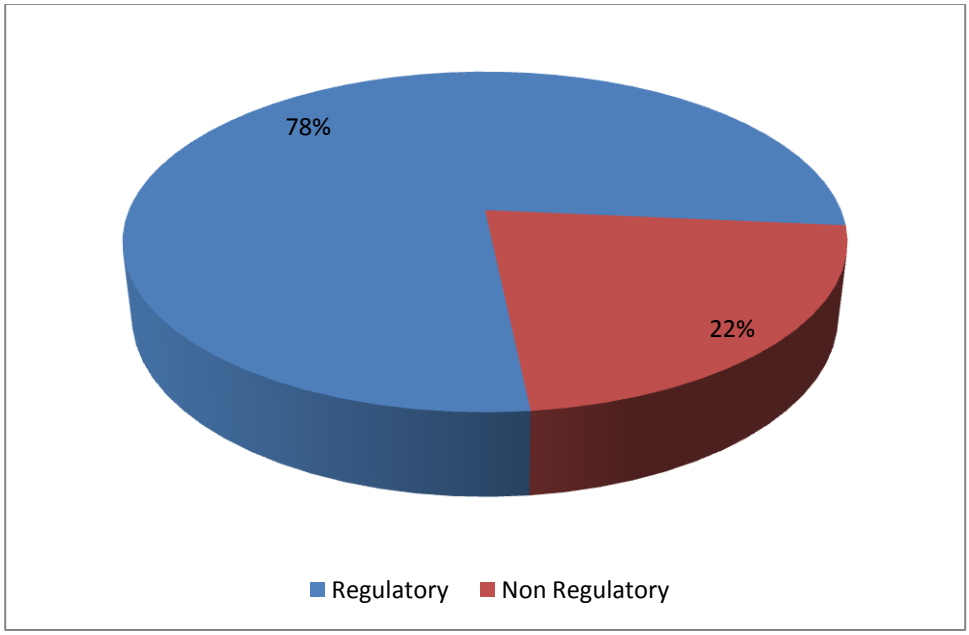
Figure 1: Major Work Packages, as a % of total Direct Costs



Regulatory requirements have a significant impact on scope and costs associated with the DRP. Regulatory scope includes all scope commitments made to the CNSC in the IIP including re-tube and feeder replacement, refurbishment or replacement of equipment to allow safe operation for an additional 30 years, practical upgrades to systems to meet modern codes, as well as scope required to be completed in order to execute the DRP; non-regulatory scope includes work that is best performed when the unit is in a drained and defueled state or during an extended refurbishment outage such as the Turbine Generator rehabilitation.

Figure 2 provides a breakdown of all work in terms of regulatory or non-regulatory scope.

Figure 2: Regulatory vs. Non-Regulatory Scope as a % of total Direct Costs



3.4 Project Management

3.4.1 Project Management Approach

OPG has adopted best project management practices and has given significant consideration to lessons learned from other major refurbishments and complex, large scale, construction projects of this nature. These have been incorporated into the DRP Project Management Standard (Attachment 3). Guides, manuals and instructions are in place to implement the principals found in the Project Management Standard.

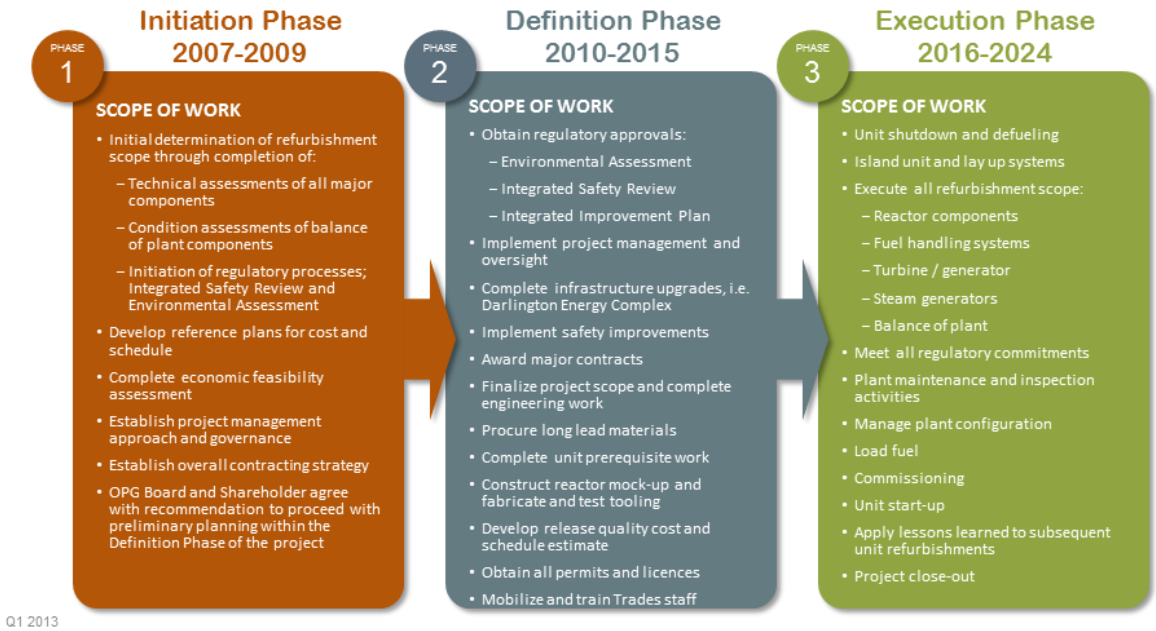
The Project Management Standard follows the Project Management Institute's ("PMI") Project Management Body of Knowledge; accordingly the project has been divided into phases. Project phases are distinct chronological project stages separated by decision gates.

Decision gates provide an effective tool for management oversight of each project phase. They allow management to control funding and the progression of approvals through the

project life cycle; and establish a consistent standard for project quality and performance. At each decision gate, the current phase deliverables and project performance are reviewed together with the plan and deliverables for the next phase(s).

OPG has organized DRP into three main phases, as shown in Figure 3, followed by a close-out phase.

Figure 3: Darlington Refurbishment Phased Approach



- Project Initiation (2007-2009) - Preliminary assessment and viability recommendation.

- Project Definition (2010-2015) - Front-end project planning including completion of all regulatory requirements, required Facility and Infrastructure upgrades, tooling, detailed engineering and the development of the project scope, cost, and schedule baseline.

- Execution (2016-2024) - Outage preparation and refurbishment outage execution, including project monitoring and control.

- Close-out (2024-2025) - Close-out of the major project.

The implementation of a phased approach together with decision gates facilitates OPG's ability to manage project risk. OPG assesses project feasibility on an ongoing basis, based on periodic project scope, cost and schedule reviews.

3.4.2 Program Management Plans

OPG has developed a set of Program Management Plans ("PMP") (Attachment 4) which have replaced the initial (2009) and updated (2011) Project Execution Plans ("PEP"). This is consistent with the PMI's methodology for managing programs.

The PMP's describe the high-level roles and processes that will deliver the program benefits; they conform to OPG's Project Management Standard. The PMP's are updated annually during the Definition Phase to incorporate improvements in project definition.

3.5 Progress through Phases and Gates

During the Initiation Phase, the following key activities were completed by OPG:

- Determined preliminary project scope through the completion of a Plant Condition Assessment ("PCA") with a special focus on the life-limiting components.
- Planned for the Integrated Safety Review, including a review of modern codes and standards, and the EA.
- Assessed the various execution options (e.g., contracting, project management, work management, governance) for the Definition and Execution Phases of the Refurbishment Project.
- Identified an initial project organization for the Definition and Execution Phases.

- Developed Project Management processes and methods including performance measures, scheduling, risk and contingency management, project metrics and reports.

- Developed a preliminary schedule and cost estimate for the refurbishment project, and a Refurbishment Outage Preparation Plan that included both key and supporting scope (organization, infrastructure, oversight, plant and programmatic work, risk contingencies and allowances).

The Initiation Phase concluded on December 31, 2009 with OPG Board approval of management's recommendation to proceed to refurbish the Darlington units.

The DRP is currently in the Definition phase. The Definition phase has two sub-phases (i) preliminary planning and (ii) detailed planning.

Preliminary Planning includes establishment of the Project Management organization, confirmation of contracting strategies, formation of contracting relationships with key vendors, development of project controls governance, and submission of the EA and ISR to the CNSC for review and acceptance. Additionally, some Facility and Infrastructure Projects were initiated as described in Section 7 below.

The following key activities in the Preliminary Planning sub-phase have been completed:

- Established the Project Management Organization for the Definition Phase

- Developed and approved an overall commercial strategy document.

- Issued contracts and commenced work for the Darlington Energy Complex and the Water and Sewer Project.

- Implemented project controls governance including cost management, scheduling, estimating, risk management, and change management.

- Established a Scope Review Board ("SRB") for approval of all scope executed by the DRP.

- Established a Gate Review Board ("GRB") to review project development and to control the release of funds for project work.

- Updated the project cost and schedule and reviewed post refurbishment operations costs.

- Updated the economic assessment which was presented to OPG's Board of Directors for approval to proceed to the Detailed Planning Phase.

On November 17, 2011, OPG's Board of Directors approved the revised overall project timeline, the updated Program Release Strategy incorporating an October 2015 Release Quality Estimate (revised from October 2014 in order to incorporate tool testing results from the Re-tube and Feeder Replacement project), and Management's recommendation to move to the Detailed Planning Phase.

On January 1, 2012, the Detailed Planning sub-phase of the project commenced. Detailed Planning includes implementation of all major contracts, completion of all planning, including engineering and tool development, finalization of all project scope, preparation of a release quality cost and schedule estimate ("RQE"), and preparation of an updated Business Case for the project. Required long lead materials will also be procured in this phase.

The Detailed Planning sub-phase is scheduled to conclude in 2015, upon completion of the RQE and an updated Business Case for the project. At that time, OPG will request approval from the Board of Directors to proceed to the execution phase of the project.

3.6 Releases

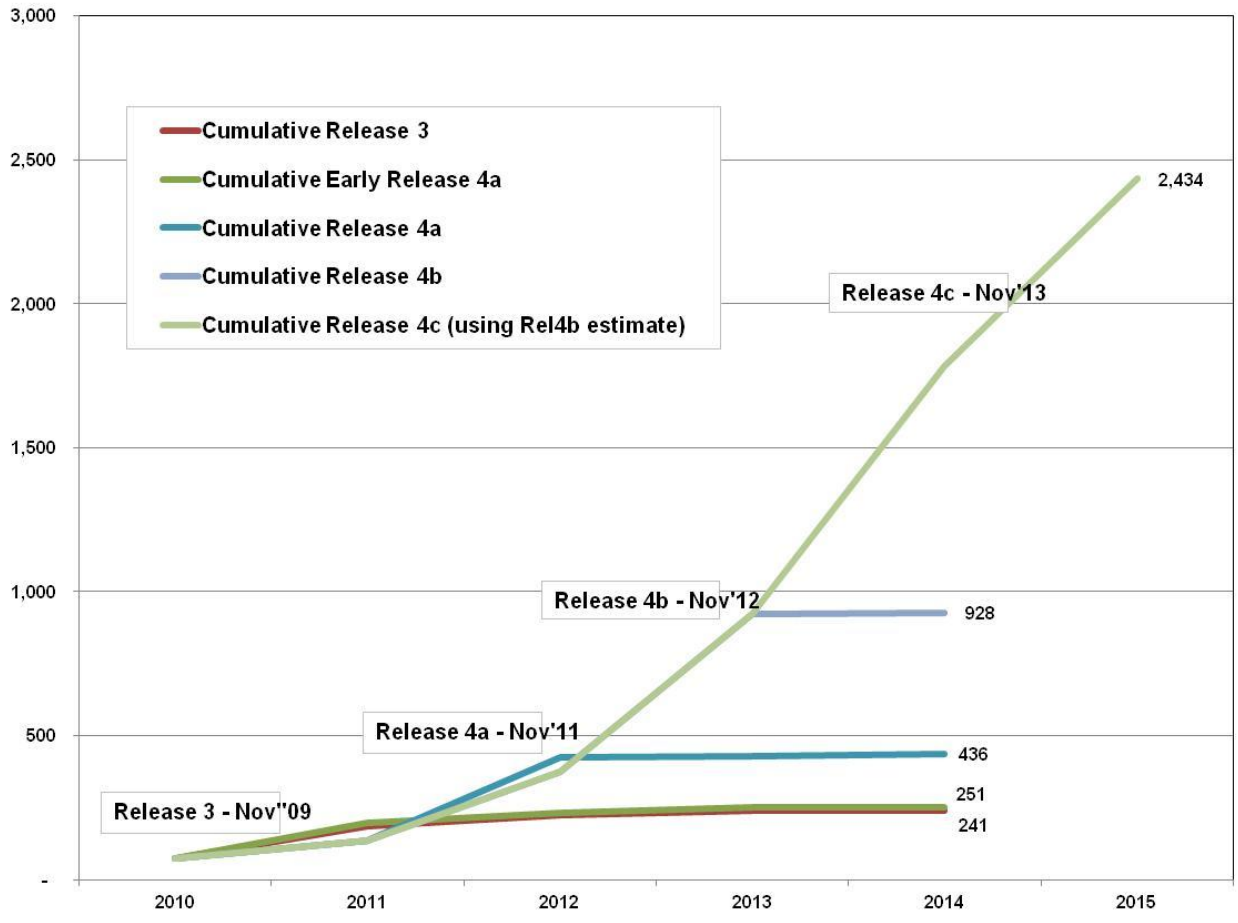
The November 2011 approval to progress to the Detailed Planning sub-phase of the project included a partial release of funds, for 2012 deliverables, in the amount of $196M, for a cumulative project release of $436M.

In November 2012, OPG updated the DRP economics (Attachment 5) including cost and schedule estimates, post-refurbishment operational assumptions, and resulting Levelized Unit Energy Costs ("LUEC"). OPG's Board of Directors approved a further partial release of

funds, for 2013 deliverables, in the amount of $492M for a cumulative project release of $928M.

In November 2013, Management will update the overall Business Case for the DRP and present it to OPG's Board of Directors for approval. Management will also request a release of funds to complete the Definition Phase, projected in the amount of $857M in 2014 and $650M in 2015. The total cumulative release amount including OM&A, to the end of 2015 and the conclusion of the Definition Phase is projected to be $2,434M. Figure 4 provides an overview of the cumulative project release amount.

Figure 4: Overview of the Darlington Refurbishment Release Amount (M$)

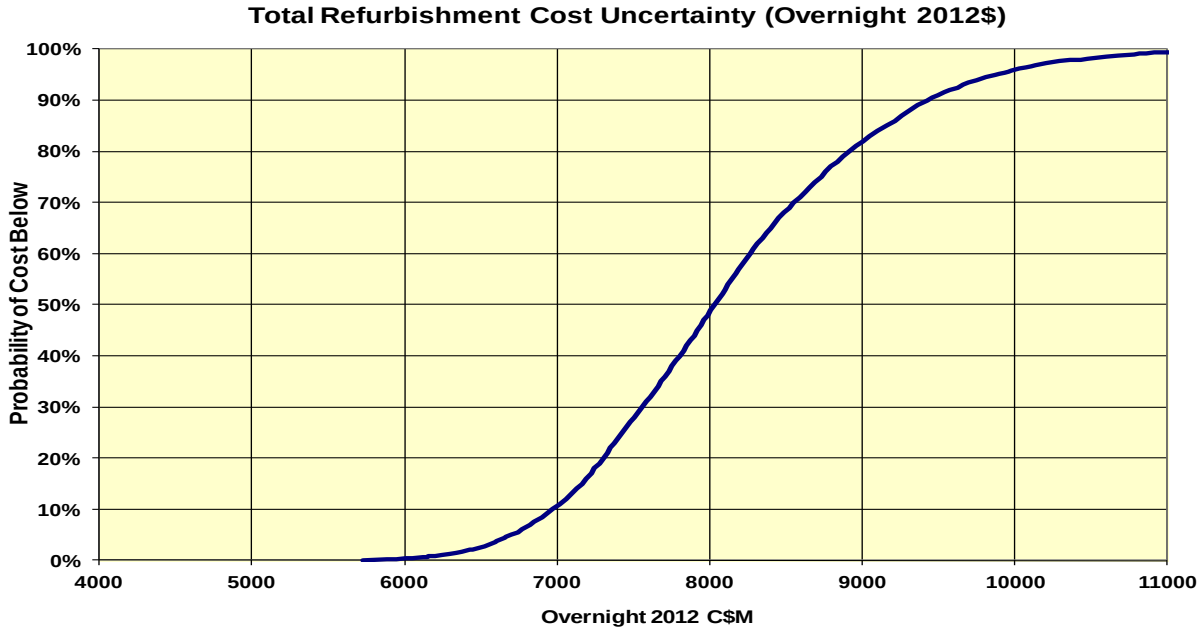


4.0 ECONOMIC UPDATE

The Preliminary Planning Business Case, filed in EB-2010-0008, established with a very high confidence that the refurbishment of Darlington will result in a LUEC of less than 8¢/kWh (2009$) with a project estimate of less than $10.0B (2009$).

As a result of continued planning, a detailed understanding of scope, and a better understanding of the timing of cash flows, OPG updated its economic assessment of the project and presented it to OPG's Board of Directors in November 2012 (Attachment 5). OPG continues to have high confidence that the LUEC of refurbishing and continuing to operate the Darlington units for a further 30 years is less than 8.6¢/kWh (2012$), which is equivalent to 8¢/kWh (2009$). As shown in Figure 5, OPG continues to have a high confidence that the project cost estimate will be less than $10.8B (2012$) which is also equivalent to $10.0B (2009$). These costs are presented as overnight dollars and exclude interest and future escalation.

Figure 5: Darlington Refurbishment Project Cost Estimate



5.0 SCHEDULE

In June 2013, to provide a higher confidence in the refurbishment outcome, a revised planning scenario was proposed which eliminates the execution overlap between the first and second units. This decision does pose a risk to idle time on later units, and OPG is working on programs to increase its confidence to operate the units beyond their normal design life.

This planning scenario will be used to update the base case in the Business Case Summary to be updated in late 2013. Upon approval by OPG's Board of Directors, the overall timeline and funding release strategy will be updated.

6.0 CONTRACTING

As noted, the DRP is a multi-phase project made up of individual projects of various sizes. As part of the Definition Phase, OPG developed an overall Commercial Strategy and separate Contracting Strategies for all major project work packages (Attachment 6). The "Commercial Strategy" sets out an overall commercial framework with guiding principles for establishing and maintaining commercial relationships with third parties to support the DRP.

A "Contracting Strategy" is the means for successful implementation of the project delivery approach for the major project work packages making up the DRP. Each Contracting Strategy is free standing and takes into account factors such as the nature and scope of the work, the vendor marketplace, and any potential long term commercial arrangements. Each Contracting Strategy results in a recommendation on the most suitable sourcing approach, contract structure and pricing mechanism for that specific work package.

6.1 Commercial Strategy

The Commercial Strategy selected by OPG is a multi-prime contractor model in which there is more than one prime contractor working on the project. The owner has a separate contract with each prime contractor. A prime contractor is responsible for the completion of the work under its particular contract, but not for the entire project. The owner is the integrator between the prime contractors and is responsible for the entire project.

Under this model OPG retains project management responsibility and design authority for the DRP. To execute the work OPG retains a number of contractors who are responsible for major project work packages. To guide OPG in project oversight and contracting activities, OPG has engaged external technical and project management experts to assist with the overall project management.

The benefits of this model are that OPG retains control over the entire DRP, including the deliverables, costs and schedule. Retaining control by OPG is important given the scale, technical complexity and integrated nature of the DRP. OPG will also be able to assign risks to the party best able to manage the risk. This will provide OPG with a better balance between the transfer of risk and the costs of the contractor services.

OPG considered a number of alternative commercial strategies, including multi-prime contractors, partnering, lump-sum turnkey agreement and a project management organization arrangement.

Partnering typically contemplates a single agreement with a number of service providers (organized in the forming of a joint venture). However, OPG found it not viable due to issues of alignment between service providers, a loss of control related to the service providers and service providers will typically not engage in this structure.

OPG found that although there was price certainty in a lump sum turnkey strategy, it came at a cost including loss of control of design, schedule and management of key aspects. Additionally the risk premium was out of proportion to the corresponding transfer of risk since various exclusions or force majeure provisions diminished the transfer of risk.

Under the project management model, one firm would be responsible for planning the project, negotiating requirements and managing the work packages. Although this provides the owner with project management experience, there can be lack of alignment between the project manager, owner and contractors, especially if the project manager was also participating in the completion of an aspect of the project. There would also be a risk premium factored into the arrangement.

In examining the alternatives, OPG took into consideration lessons learned from other nuclear refurbishment projects such as the consequences of schedule slippage and replacement power where a lump sum turnkey agreement was used; and in another instance, a mid-project commercial strategy change (i.e. the abandonment of the project management model and the adoption of the multi-prime model).

Under the Multi-prime Contractor model, individual standalone contracting strategies are developed for each of the major projects (e.g. RFR, Fuel Handling, Turbine-Generator, Steam Generators, and Balance of Plant). The strategies identify the breakdown of work packages to be assigned to each contractor. This flexibility allows OPG to tailor the strategy to the nature and scope of work, the marketplace and post refurbishment arrangements. In section 6.2 below, the Contracting Strategy for each major project work package is described.

6.1.1 Independent Review of Commercial and Contracting Strategy

In September 2011, Concentric Energy Advisors Inc. (Concentric) was retained to review whether the commercial and the contracting strategies for the DRP were reasonable and prudent. In a series of opinions (Attachment 7) Concentric considered OPG's overall Commercial Strategy and the contracting strategies for RFR, Turbine Generator, Fuel Handling, Steam Generator and Balance of Plant work packages. Concentric provided an assessment based on document review and interviews with OPG personnel, who concluded that OPG's Commercial Strategy is appropriate and reasonable and meets the regulatory standard of prudence given the current status of the Project. Concentric also found that OPG's approach in engaging contractors for each of the work packages were reasonable and prudent in the context of the DRP and current market conditions for these services. Concentric has made a number of specific recommendations that OPG will incorporate in future work on the Project.

6.2 Contracts for Major Work Packages

6.2.1 Re-tube and Feeder Replacements

The RFR work package determines the DRP's critical path. This work package includes the removal and replacement of each reactor's 480 pressure tubes and calandria tubes, and the removal and replacement of the 960 feeder pipes in each reactor.

The RFR contracting process was initiated in 2010. OPG initially issued a request for expressions of interest and received submissions from seven potential contractors. Based upon the responses received, pre-qualification of the potential contractors, and the subsequent partnering by potential contractors, OPG, in March 2011, issued a Request For Proposals ("RFP") to two proponents: 1) Babcock & Wilcox Canada Ltd., with GE-Hitachi Canada and Black & MacDonald as sub contractors, ("Babcock & Wilcox") and 2) a consortium of SNC-Lavalin Nuclear Inc. and AECON Industrial, a division of AECON Construction Group Inc., ("the SNC/AECON Consortium").

Responses to the RFP were received from both proponents on June 26, 2011. OPG began meeting with the proponents in July 2011 and agreed to "contract principles" with both parties in mid-August. OPG continued negotiations with both proponents in an effort to reach acceptable commercial terms with each proponent. OPG then required each proponent to submit their final proposals based on the negotiated terms. The SNC/AECON Consortium was selected and OPG executed a final agreement with the consortium on March 1, 2012.

The contracting strategy selected by OPG for the RFR work package is to use an Engineering, Procurement and Construction ("EPC") arrangement that combine fixed/firm pricing for known or highly definable tasks and a target price for the remaining scope of the RFR work package where work is less definable. The work is phased with a project schedule comprised of a definition phase, an execution phase and a commissioning phase. During the definition phase, OPG and its selected contractor will complete the detailed design of the project, procure long lead materials, fabricate long lead components and tools, construct the reactor mock-up, test the specialized tooling and complete final planning activities. At the conclusion of the definition phase, the "execution phase target price" will be determined to estimate the total cost to complete the execution phase work with upper and lower cost sharing bands. Within these cost sharing bands, OPG and the selected contractor will jointly share in cost over-runs or under-runs. Outside of these cost sharing bands, the

RFR agreement reverts to a cost reimbursable agreement, excluding vendor profit and overhead. Financial incentives also exist for early completion of each unit outage, and financial penalties exist for failure to complete unit outages within the agreed upon schedule.

6.2.2 Turbine Generator

The Turbine Generator Project consists of (i) inspections, repairs and replacement of specific components of the four Turbine Generator sets and their auxiliaries; and (ii) upgrades to the steam turbine control and generator excitation systems from analog to a digital platform. The turbine generator sets are highly specialized machines designed and manufactured to order specifically for Darlington by BBC Brown Boveri Canada Inc. A series of corporate mergers and acquisitions resulted in Alstom Power & Transport Canada Inc. ("Alstom") becoming the Original Equipment Manufacturer ("OEM").

This work package was divided into two contracts. The first contract for Engineering Services and Equipment Supply was awarded as a single source contract to Alstom on March 27, 2013. Since the original design was specifically for Darlington and given the technical complexity of the work, the single source strategy was selected to ensure that no technical or operational risks were introduced as a result of component replacements and converting from analog to digital turbine and excitation control systems. Operating experience across other major refurbishments has shown that the OEM is the only provider capable of ensuring the compatibility of the new systems to existing equipment. A complete steam path retrofit is not being undertaken since the Turbine Generator sets are in excellent condition and have performed extremely well over the years, and replacement is not required. As a result, the OEM provides the consistency needed to ensure compatibility.

The contract includes extended warranty periods to ensure the equipment performs as required and fixed/firm price for equipment and component delivery to ensure cost certainty. As set out in Attachment 7, Concentric reviewed the terms and conditions of the contract and concluded that they are reasonable and prudent. A summary of the analysis undertaken by OPG as part of the decision to pursue sole sourcing for this aspect of the Turbine Generation

work package is set out in Concentric's opinion. OPG has reviewed Concentric's opinion and confirms that the facts set out in that opinion are accurate.

The scope of the work for the second contract includes the field work required for installations, repairs and replacements of equipment and components, and engineering integration of the OEM equipment with the OPG Engineering Change Control process. The contract will follow the competitive procurement process and is expected to be awarded early in 2014. The two vendors will work together through assignment of the Engineering Services and Equipment Supply contract to the integration and field installation vendor or through the coordination of the two contracts by OPG.

6.2.3 Fuel Handling

The Fuel Handling Work Package has two distinct areas of work: (i) defueling of the reactor core; and (ii) refurbishment of the fuel handling equipment.

Defueling is a critical path element for each unit's refurbishment since it involves the removal of all irradiated fuel from each reactor prior to each refurbishment outage. No other refurbishment work can occur until the unit is defueled. The defueling work will include field and non-field work. All defueling field work will be done by OPG. Defueling non-field work involving engineering, manufacturing and technical support will be done by a third party.

The non-field related work will be performed under an Engineering Services and Equipment Supply contract issued to GE-Hitachi Nuclear Energy Canada Inc. ("GHNEC") on May 17, 2013. The contract is made up of firm/fixed price for components and equipment and a cost reimbursable element for technical support during the defueling operation.

The Darlington fuel handling system was designed and manufactured by GHNEC. GHNEC, as the OEM, has provided OPG with fuel handling related equipment, components and services including test facilities, systems engineering, and materials and troubleshooting support for over 30 years. Engaging a supplier other than the OEM would introduce integration, compatibility, operational and nuclear safety risks. The contract strategy selected to mitigate these risks was to single source the supply component and equipment

related to defueling, along with the technical experts required to support OPG during the defueling operations, to the OEM. The contract was reviewed by Concentric and found to be reasonable and prudent. Concentric's opinion is set out in Attachment 7 which includes Concentric's review of the process and analysis undertaken by OPG to sole source the defueling work. OPG has reviewed Concentric's summary of the analysis and agrees with the accuracy of the summary.

The second work area of Fuel Handling is refurbishment of the Fuel Handling systems. This includes more traditional life cycle repair and replacement work that will be executed in five sub-bundles and will be contracted through the normal procurement process in 2013 and 2014.

6.2.4 Steam Generators

The Steam Generator work package consists of major inspections and maintenance work to extend the life of the Steam Generators for an additional 30 years. There are a number of aspects including chemical cleaning of the inside of the Steam Generator tubes, augmented inspection and repairs, leakage measurements, and water lancing each steam generator.

After evaluating the work and other contracting considerations, OPG has decided to bundle all of the Steam Generator Work into one work package to be competitively bid. OPG considered various contracting models and determined that the Steam Generator work package fits well into a model where an EPC contract is negotiated. Details of this analysis are set out in Attachment 6.

6.2.5 Balance of Plant

Balance of Plant work represents the remaining work to be performed by the DRP that is not included in one of the above major packages. The Balance of Plant Project is divided into 6 work groups. The Reactor and Conventional Systems groups contain respectively, heavy water and high voltage equipment. The Common Systems group deals primarily with station structures. The Pre-Refurbishment group includes all work that must be complete prior to the start of the execution phase of the DRP. The Safety and Controls group contains reactor

safety and computer equipment. The final group, Special Programs, contains valves and components across all systems.

OPG concluded that the preferred contracting strategy was an EPC contract under existing Extended Services Master Service Agreements ("ESMSA"), and to separate out specialized work by exception for alternative sourcing strategies. The analysis leading to this approach is set out in the Contracting Strategy for Balance of Plant in Attachment 6.

7.0 CAPITAL EXPENDITURES AND IN-SERVICE ADDITIONS

7.1 Capital Expenditures

OPG's projected capital expenditures for the Definition Phase in the test period are $837.4M in 2014 and $631.8M in 2015 (Ex.D2-2-1 Table 1, Line 7). Facility and Infrastructure projects to support or extend Darlington station life have commenced in the Definition Phase (Exhibit D2-2-1, Table 3 and 4).

7.2 Capital In Service Additions

Some assets arising from pre-requisite work done in the Definition Phase, including Facility and Infrastructure projects, will be placed in service and included in rate base as soon as they are used or useful to OPG, and as such, will be depreciated over their useful lives. These projects are expected to remain useful to OPG's current or future nuclear operations independent of whether the DRP is completed. Depreciation will start being charged as an expense on the income statement when these assets are placed in service, to be recovered over the refurbishment period and during the continued safe and reliable operation of the station for an additional 30 years.

The following facility and infrastructure projects will be completed and placed in service in the test period (Ex.D2-2-1, Table 3 and 4):

- Darlington Energy Complex (DEC),
- Water and Sewer Project,
- Heavy Water Storage and Drum Handling Facility,
- Darlington Operations Support Building (OSB) Refurbishment,

- Auxiliary Heating System, and
- Electrical Power Distribution System.

Business Case Summaries for Facility and Infrastructure projects of $20M or greater are included in Attachment 8.

Additionally, three safety improvement projects, as committed in the DRP EA, will also be placed in service in the test period: the Powerhouse Steam Venting System project, the Third Emergency Power Generator project, and the Containment Filter Venting System project. These projects are in addition to a number of Fukushima-related projects (Ex. D2-1-2) such as portable diesel-driven pumps.

7.2.1 Darlington Energy Complex

Lessons learned in previous refurbishments and other nuclear projects have shown that the use of equipment mock-ups, replicas and models for training is effective for the successful execution of complex projects. Accordingly, a decision was made to design and build multiple mock-up models in preparation for the refurbishment of the Darlington reactors. The Darlington Energy Complex ("DEC") will house a full-scale reactor mock-up, other key mock-ups, and a training center. Workers will be trained on the mock-ups and tested on new tooling in the DEC prior to working on the reactor face. Additionally, the DEC includes a warehouse for the storage of tooling and materials to be used in the training center.

As part of a strategy to address other business needs, create efficiencies and maximize the occupancy of the facilities, the DEC will house other OPG programs and services including components of the Security Program for processing of new DRP staff and a new Information Centre to replace the current facility on-site. Upon completion of the DRP, the DEC will provide future warehouse, office space, and training for the Nuclear support functions, eliminating the need for existing leased facilities.

The project was placed in-service in June 2013. The Application reflects the total budgeted project cost for the DEC of $105.4M and the budgeted 2013 in-service capital amount of

$94.2M. The 2013 impacts of the project closing to rate base in 2013 are being recorded in the Capacity Refurbishment Variance Account, as noted in Section 9.0 below.

7.2.2 Water and Sewer

The Water and Sewer project will ensure adequate and reliable domestic and fire water supply and sanitary sewer system capacity in support of the new Refurbishment support facilities, as well as continued operation of the station for an additional 25 to 30 years. This project will eliminate employee concerns regarding the quality of the potable water and mitigate environmental concerns associated with the existing Sewage Treatment Plant. The existing water supply line was originally installed for the construction phase of the station. It has never been replaced and has deteriorated and represents a single point of vulnerability. The existing Sewage Treatment Plant requires extensive maintenance and care for its continued operation and compliance with applicable regulations. The capacity of the plant is not adequate to meet the demand of the station and the refurbishment project.

The total project cost for the Water and Sewer Project is $36.0M, with a total projected in service amounts of $27.2M over the period 2012-2014 reflecting various stages of completion of which $5M was placed in service in 2012. The impacts in 2012 and 2013 of portions of the project closing to rate base are recorded in the Capacity Refurbishment Variance Account, as noted in Section 9.0 below.

7.2.3 Heavy Water Storage and Drum Handling Facility

The Heavy Water ("D_2O") Storage and Drum Handling Facility project will provide heavy water storage capacity during refurbishment and support ongoing station operations.

This storage capacity is needed for the heavy water removed from the reactors being refurbished (approximately 1,500 $m^{3,}$ per unit) and to facilitate flushing and other support operations associated with the preparation of the Darlington units for refurbishment work.

The project will also implement improvements for heavy water management at the Tritium Removal Facility ("TRF") including increasing operational storage; adding D_2O drum handling, cleaning, testing, and storage capability; and consolidating offices for TRF staff.

The total project cost for the Heavy Water Storage and Drum Handling Facility is projected to be $108.1M with an in-service date of October 2015, one year before the planned start of the first-unit refurbishment and projected in-service amount of $83.5M[1].

7.2.4 Darlington Operations Support Building Refurbishment

The purpose of this project is to extend the life of the Operations Support Building ("OSB") to support the continued operations of the Darlington station. The OSB houses technical services that are essential to the operations of Darlington including security systems, site IT and telephone network hubs, quality assurance vault, station domestic water piping and safe access to the powerhouse via the bridge. This facility also provides office and conference room space for 375 station employees and various specialty groups inside the Darlington protected area.

An assessment performed by an external engineering firm found that many of the existing building systems are currently, or will be, at their end of life by 2015. Several systems need to be replaced such as the heating, ventilation, and air conditioning ("HVAC") equipment and ducting, elevator, plumbing, electrical distribution, cladding and windows, roof membrane, IT and telephone, cafeteria, furniture, interior furnishings including the carpet and ceiling tiles. Other safety systems need to be installed such as a sprinkler system and interior overhead lighting.

The total project cost for the Darlington OSB Refurbishment, including non-capital expenditures, is projected to be $46.8M. The projected capital in-service amount is $29.7M with an in-service date of September 2015.

7.2.5 Auxiliary Heating System

[1] As discussed in Ex. B1-1-1 and shown in Ex. B3-3-1 Table 2, note 3, because the in-service amount exceeds $50M, it is subject to a weighting of 3/12, rather than the half-year rule, in calculating the gross plant rate base amount for 2015.

This project will provide a source of reliable back-up steam to the Darlington main heating steam header. Back-up steam is needed to support irregular operating conditions such as an event where all four turbine units are shut down in the winter, to mitigate potential major equipment damage due to freezing.

This will be achieved by replacing the existing original Construction Boiler House with a new facility that can, in the event of a four unit shutdown, provide reliable back-up steam at a sufficient capacity to meet the station's needs. This back-up steam will contribute to maintaining the temperature inside the Powerhouse and Tritium Removal Facility/Heavy Water Management Building at levels needed to prevent impairment of essential systems due to freezing.

The total project cost for the Auxiliary Heating System, including non-capital expenditures, is projected to be 45.6M. The projected capital in-service amount is $36.3M with an in-service date of April 2015.

7.2.6 Electrical Power Distribution System

Electrical power from the grid is supplied to Darlington site facilities and buildings located outside the protected area by a feeder line from Hydro One's Wilson Transformer Station. This system was designed and installed 25 to 30 years ago, and has reached the end of its operational life. Capacity in the existing system has diminished due to growth in electricity demand resulting from the addition of several new buildings on site. The performance and reliability of the existing system has gradually degraded over time. The existing system is not capable of supplying power to the new buildings needed to support Darlington Refurbishment and operations.

This project will upgrade the existing site power distribution system to meet the incremental demands of the new building/facilities, as well as to facilitate the supply of reliable electrical power to the existing and new buildings at the Darlington station. The upgrades include refurbishment / overhaul of the two existing power distribution substations and construction of a new power distribution substation and associated distribution system.

The total project cost for the Electrical Power Distribution System is projected to be $17.8M; with projected in-service amounts of $4.4M in 2014, $6.2M in 2015, and the rest in 2016.

7.2.7 Powerhouse Steam Venting System

This safety improvement project is a DRP EA commitment to the CNSC and is to be in-service prior to the first unit refurbishment. The project will improve the reliability of powerhouse venting to avoid damage to safety-related systems, structures and components in the event of a secondary side piping failure (e.g., steam, feed water, condensate and heating system piping breaks) that may result in harsh environmental conditions.

The total cost for the Powerhouse Steam Venting System project is forecast to be $10.2M, with projected in-service in the fourth quarter of 2015.

7.2.8 Emergency Power Generator

This safety improvement project is a DRP EA commitment to the CNSC and is required to improve availability and reliability of the Emergency Power System.

The project involves installation of a third Emergency Power Generator (EPG) that can withstand a higher level seismic event than the Design Basis Earthquake to which the existing two EPGs are designed, and that can operate following a severe site flood. It will also address availability in cases where either both current EPGs fail or where one of the two EPGs is undergoing maintenance and the second EPG fails.

In addition, the third EPG is one of a suite of modifications required to support safe plant operation during Darlington Refurbishment. These modifications will allow for the removal of support services as needed to perform refurbishment activities.

The total cost for the Emergency Power Generator 3 project is forecast to be $32.5M, to be placed in service in the fourth quarter of 2015.

7.2.9 Miscellaneous Balance of Plant Projects

Some miscellaneous modifications under the Balance of Plant work package will be placed in-service in the test period, including Emergency Service Water Header Connections, Primary Heat Transport Connection, and Heavy Water Management System Modifications. These modifications are required to address reliability issues related to valves from the Emergency Service Water system to the moderator, install a connection between Heat Transport System and the Emergency Service Water system, replace switch cables and connecting cables for some Primary Heat Transport pump motors, and install unit Heavy Water transfer header isolation valves and alternate pressure relief valves. The total projected in-service capital costs are $2.1M in 2014, and $11.1M in 2015.

7.2.10 Historical Capital Expenditures

The capital cost variance for 2011 is $14.2M below the approved OEB amount of $105.2M (Ex D2-2-1 Table 2 Col. f Line 7). Major contributors to the variance include construction delays on several major facilities and infrastructure projects, partially offset by an early staff ramp up for the preliminary planning activities, and advancement for the detailed planning activities.

The capital cost variance for 2012 is $23.4M below the approved OEB amount of $255.8M (Ex D2-2-1, Table 2, Col. b, Line 16). Major contributors include the delay of several major facilities and infrastructure projects beyond 2012, partially offset by better defined 2012 cost estimates for the detailed planning activities.

OPG has budgeted expenditures of $529.8M for 2013 consisting of $422.0M definition phase planning activities, and $107.9M facilities and infrastructure projects. The definition phase planning activities include implementation of major contracts namely RFR, Turbine Generator and Balance of Plant contracts, completion of planning including engineering and tool development, finalizations of all project scope and preparation of the RQE and the updated DRP Business Case. The facilities and infrastructure projects include completion of the DEC, execution of the Water and Sewer, Heavy Water Storage and Drum Handling Facility, Auxiliary Heating System projects and Electrical Power Distribution System projects, and definition of the OSB Refurbishment, RFR Island Support Annex and Refurbishment Project Office.

8.0 OM&A EXPENSES

The Darlington Refurbishment project OM&A expenses are presented in Ex. F2-7-1.

9.0 BALANCE IN THE CAPACITY REFURBISHMENT VARIANCE ACCOUNT

The DRP is covered by the CRVA established, effective April 1, 2008, under section 6(2) 4 of O. Reg. 53/05. As a result, the account records variances between the actual capital and non-capital costs and firm financial commitments incurred for the DRP and the corresponding forecasts reflected in the revenue requirement approved by the OEB. The CRVA is discussed in more detail in Ex. H1-1-1.

For non-capital costs, differences between actual and forecast OM&A expenses for the DRP are captured by the account. Such variances recorded in December 31, 2012 were approved for disposition in EB-2012-0002. For 2013, this variance is forecast to be a recovery from ratepayers of $13.0M (Ex. H1-1-1, Table 12, line 9). OPG is not seeking to clear the 2013 variance related to non-capital DRP costs in this proceeding.

For capital costs, the account records depreciation expense, cost of capital and associated income tax impact for amounts placed or forecast to be placed in-service in respect of the DRP. The income tax impact includes variances between actual and forecast Capital Cost Allowance ("CCA") deductions.[2] The derivation of the DRP capital cost components of the 2012 (actual) and 2013 (projected) CRVA additions are shown in Ex. H1-1-1 Table 12a. These additions reflect the impact of the portions of the DEC and Water and Sewer project being placed in-service in these years.

[2] OPG elected to claim early CCA related to the DRP available under the *Income Tax Act* (Canada). The forecast CCA deductions in 2014 and 2015 reflected in the calculation of the test period income tax provision, as presented at Ex. F4-2-1 Table 5, line 12 and detailed in Ex. F4-2-1 Tables 9 and 10, include $39.3M and $94.3M, respectively, related to the DRP.

As discussed in Ex. H1-2-1, OPG is seeking approval to clear in this proceeding the capital cost portion of the actual audited balance of the CRVA as at December 31, 2013. As shown in Ex. H1-1-1 Table 1, line 17, the year-end amount to be cleared is forecast as a recovery from ratepayers of $3.7M. The detailed calculations of this amount are found in Ex. H1-1-1 Table 12.

10.0 CONCLUSION

In its EB-2010-0008 Decision with Reasons the Board indicated that it "*expects OPG to file updated information on its progress for examination at the next proceeding*." OPG believes that its evidence has met the Board's expectation. The Project is currently in the Definition Phase which consists of project planning including completion of all regulatory requirements, required facility and infrastructure upgrades, tooling, detailed engineering and the development of the project scope, cost, and schedule. The Definition Phase work is proceeding on schedule towards its expected completion in 2015.

A number of major contracts have already been awarded and several remain to be awarded over the next few years. OPG's Commercial Strategy and the Contracting Strategies for major work packages are based on industry best practices. Commercial and Contracting Strategies were reviewed by an independent consultant that found them to be appropriate and reasonable and that they met the regulatory standard of prudence. OPG expects that the Board will agree with that finding and will determine that it's Commercial and Contracting Strategies are reasonable.

OPG presented evidence on its proposed capital expenditures of $837.4M in 2014 and $631.8M in 2015, and OM&A expenditures of $19.6M in 2014 and $18.2M in 2015 (Ex. F2-7-1) and has asked the Board to find that these expenditures are reasonable. OPG also presented evidence in support of its request for approval of in-service additions of new facilities to rate base of $5.0M in 2012, $104.2M in 2013, $18.7M in 2014, and $209.4M in 2015 and recovery of the $3.7M balance in the CRVA.

As a result of its work to date, OPG continues to have high confidence that the LUEC of refurbishing and continuing to operate the Darlington units for an additional 30 years is less than 8.6¢/kWh (2012$), which is equivalent to 8¢/kWh (2009$).

LIST OF ATTACHMENTS

Attachment 1
Minister's Letter to the Chair of OPG of March 8, 2011

Attachment 2
CNSC Regulatory Document RD-360, Life Extension of Nuclear Power Plants

Attachment 3
Project Management Standard (Nuclear Standard N-STD-AS-0028)

Attachment 4
Program Management Plans:

- Refurbishment Program Structure and Summary Management Plan
- Refurbishment Program Scope Management Plan
- Program Cost Management Plan
- Program Schedule Management Plan
- Refurbishment Program Reporting Management Plan
- Darlington Refurbishment Risk Management Plan
- Refurbishment Program Communications Management Plan
- Refurbishment Program Staffing Management Plan
- Program Documentation and Project Closure Management Plan
- DNGS Refurbishment Management Plan – Refurbishment Engineering
- Program Assurance Plan for Darlington Nuclear Refurbishment
- Program Environmental Management Plan
- Program Management System Oversight Management Plan
- Program Site Implementation and Construction Management Plan
- Program Licensing Management Plan
- Nuclear Refurbishment Program Health and Safety Management Plan
- Program Contract Management Plan
- Program Return to Service Management Plan
- Darlington Refurbishment Supply Chain Management Plan

Attachment 5
Darlington Refurbishment Business Case Summary – November 14, 2013, Revision 1

Attachment 6
Commercial and Contracting Strategies:

- Commercial Strategy
- Retube and Feeder Replacement Contracting Strategy
- Turbine Generators Contracting Strategy
- Turbine Generators Alternate Contracting Plan
- Fuel Handling Defueling Contracting Strategy

Fuel Handling Refurbishment Contracting Strategy
Steam Generators Contracting Strategy
Balance of Plant Contracting Strategy

Attachment 7
Concentric Energy Advisors Assessments:

Assessment of Commercial Strategies Developed for the Darlington Refurbishment Project's Retube & Feeder Replacement Work Package

Assessment of Commercial Strategies Developed for the Darlington Refurbishment Project's Turbine Generators Work Package

Assessment of Commercial Strategies Developed for the Darlington Refurbishment Project's Fuel Handling Work Package

Assessment of Commercial Strategies Developed for the Darlington Refurbishment Project's Steam Generators Work Package

Assessment of Commercial Strategies Developed for the Darlington Refurbishment Project's Balance of Plant Work Package

Concentric Energy Advisors Engagement Letter

Attachment 8
Facility and Infrastructure Projects – Business Case Summaries of Projects over $20 million:

Darlington Energy Complex BCS
Water and Sewer BCS
Heavy Water Storage and Drum Handling BCS
Operations Support Building BCS
Auxiliary Heating System BCS