

# MAJOR WORK BUNDLE STRUCTURE AND CONTRACTS

## 1.0 OVERVIEW

This exhibit describes how OPG structured the major work bundles and developed the distinct contracting approaches that it is using to execute each of the bundles.

## 2.0 STRUCTURE OF MAJOR WORK BUNDLES

Dividing the Darlington Refurbishment Program ("DRP") into five work bundles, each comprised of individual projects, is consistent with recommendations from the Project Management Institute ("PMI")<sup>1</sup> for large multi-faceted programs such as the DRP. The work bundles were developed as the most logical way to effectively and efficiently execute the refurbishment scope.

Work bundles have been used by OPG for purposes of assigning project management accountability, as well as for purposes of contracting DRP work to outside contractors. As noted in Ex. D2-2-2, OPG has established project management teams comprised of OPG staff within each of the five work bundles shown below. The manner in which OPG determined the scope of the DRP, including how it grouped that scope into the work bundles, is discussed in Ex. D2-2-5. A summary of the major work bundles is provided in Chart 1 below. The costs of the major work bundles are set out in Ex. D2-2-8. The execution strategy of each of the major work bundles is described in greater detail in Ex. D2-2-9.

Chart 1

Summary of the Major Work Bundles

BUNDLE	SUMMARY DESCRIPTION
<b>Major Work Bundles</b>	
<b>1. Retube and Feeder Replacement</b>	RFR is the highest cost work bundle and is usually on the critical path. It includes full engineering, procurement and construction services for: <ul style="list-style-type: none"><li>• replacement of fuel channels, feeders and supporting hardware and associated parts;</li><li>• internal inspection of calandria vessels;</li><li>• development of tooling and systems to perform replacement and inspection tasks;</li></ul>

<sup>1</sup> PMI is a leading international association for project, program and portfolio management.

	<ul style="list-style-type: none"> <li>• fuel channel and feeder mock-ups in the Darlington Energy Complex (“DEC”) for tool testing and training; and</li> <li>• commissioning.</li> </ul>
<b>2. Turbine Generator</b>	The <b>Turbine Generator</b> sets, auxiliaries, and controls are highly specialized equipment designed and supplied as an integrated system for the Darlington station. This work involves maintenance and modifications work for the turbine, generator and moisture separator re-heater, as well as installation of new electronic controls.
<b>3. Balance of Plant</b>	<b>Balance of Plant work</b> includes scope on both nuclear and conventional systems that could not be effectively grouped with other major work bundles. Balance of Plant work includes engineering modifications and many non-modification scopes of work (like-for-like replacements). This bundle involves work on more systems than any other bundle and has more equipment and components than any other bundle and, as a result, requires an increased level of integration.
	<b>Unit Islanding work</b> is needed to create a work area that is separated from the operating plant through a system of physical barriers and controls. The objective of this work will be to maximize the ability for OPG and contract staff to perform work safely and efficiently on the unit that is being refurbished while minimizing the impact on the operating units.
	<b>Refurbishment Support Facilities work</b> is required to support the refurbishment scope and staff in and around the station. It includes common areas such as shops and storage, washrooms, and offices for refurbishment workers.
	<b>Shutdown, Layup and Services work</b> is required to establish specific conditions for shutdown of the Darlington unit(s) and layup of systems to maintain a protected environment until the systems are returned to service following refurbishment activities.
	<b>Specialized Projects work</b> includes replacement of Shutdown System Computer Network and like-for-like replacement of Vault Cooler coils and fan motors to improve and regulate vault temperatures.
<b>4. Fuel Handling and Defueling</b>	<b>Defueling</b> involves the safe removal of all fuel from each reactor core in order to minimize outage duration. Defueling is the first segment on critical path once the refurbishment breaker is open. The bundle includes provision of the equipment required to defuel the reactor, including the Dummy Fuel Bundles, the Flow Restricting Outlet Bundle, and the Fuel Push Tool.
	<b>Fuel Handling</b> involves improvements to fuel handling reliability through inspections and replacement of critical components. The Darlington Fuel

	Handling System loads ~ 20,000 fuel bundles/year and must remain reliable until the post-refurbishment end of life.
<b>5. Steam Generator</b>	The Steam Generator work is driven by OPG's Steam Generator Life Cycle Management Plan and Component Condition Assessment program, which identified elements of the Steam Generator and other Heat Exchangers which require inspection, maintenance and/or modifications in order to support the extension of Darlington's operating life.

### **3.0 CONTRACTS FOR MAJOR WORK BUNDLES**

This section describes the contracts used for the major work bundles, as well as the Extended Services Master Services Agreement ("ESMSA"), which is the contract used for the majority of the Balance of Plant work bundle, F&IP, SIO and the majority of projects in the Nuclear Operations Project Portfolio (see Ex. D2-1-1 for consideration of the Nuclear Operations Project Portfolio).

Section 3.1 provides an overview of the different forms of contracting and some of the common terms across the contracts. Sections 3.2 through 3.6 consider the contracts for the RFR, Turbine Generator, Fuel Handling and Defueling, Steam Generator and Balance of Plant major work bundles, respectively. Section 3.6 additionally considers the ESMSA form of contract.

#### **3.1 Contracting Overview**

Chart 2 below provides an overview of the contracting for the major work bundles.

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**Chart 2 - Overview of Major Work Bundle Contracts for DRP Four Unit Refurbishment**

Work Bundle (Contractor)	Description	Contract Model	Pricing Model	Value of Contract
RFR • SNC/Aecon	<ul style="list-style-type: none"> <li>Definition Phase Work <ul style="list-style-type: none"> <li>Retube Waste Processing Building design and construction</li> </ul> </li> <li>Execution Phase Work (Refurbishment of units 2, 1, 3 &amp; 4): <ul style="list-style-type: none"> <li>Removal/replacement of 480 pressure and calandria tubes</li> <li>Replacement of 960 feeder pipes</li> <li>Support Services &amp; Equipment</li> </ul> </li> </ul>	EPC	Target Price	\$3.4B See section 3.2 for detailed breakdown
	<ul style="list-style-type: none"> <li>Construction of the mock-up facility</li> <li>Design and production of tooling</li> </ul>	EPC	Fixed Price	
	<ul style="list-style-type: none"> <li>Owner Specified Materials (OSM) and Goods</li> <li>Commissioning</li> </ul>	EPC	Cost + Markup	
Turbine Generators • Alstom	<ul style="list-style-type: none"> <li>Engineering Support and Equipment Supply Agreement</li> </ul>	ESESA	Fixed/Firm Price + Limited Target Price	\$333M
Turbine Generators • SNC/Aecon	<ul style="list-style-type: none"> <li>Fieldwork required for inspections, repairs and retrofits of hardware and hydraulics on the turbine generators</li> <li>Control system upgrades from analog to digital system</li> </ul>	EPC	Target Price	\$284M
Defueling - defuel hardware, software and services • GE-Hitachi	<ul style="list-style-type: none"> <li>Design, supply and technical support for OPG work for defueling of all four reactors</li> </ul>	ESESA	Fixed/Firm Price + Limited Reimbursable Costs	\$23M
Fuel Handling – powertrack refurbishment • ES Fox	<ul style="list-style-type: none"> <li>Supply and install replacements for the main components of the fueling machine power track system</li> </ul>	ESMSA – Procure / Construct	Target Price	\$126M
Steam Generators • BWXT + Candu Energy	<ul style="list-style-type: none"> <li>Inspections and maintenance work</li> </ul>	EPC	Fixed/Firm Price + Limited Target Price	\$110M
Balance of Plant • Many	<ul style="list-style-type: none"> <li>Various smaller equipment repair and replacement projects and system upgrades</li> <li>Includes: Balance of Plant, Unit Islanding, Refurbishment Support Facilities, Shutdown Layup and Services, and Specialized Projects</li> </ul>	ESMSA, EPC	Target Price	\$783M

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### 4 3.1.1 Pricing

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OPG's major contracts include the following pricing models:

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- *Target Price* – Under target pricing, the contractor is paid its actual (allowed) costs (other than overhead costs) incurred in performing the work and is entitled to a fixed fee as compensation for all of its overhead costs, profit and risk. Parties share savings below targets and overruns above targets. The target price incentive and

disincentive mechanism, which includes a neutral band, is structured to achieve alignment of contractor interest and limit cost increases and schedule delays.

- *Fixed Price/Firm Price* – Contractors complete their work within a set budget and time period. Price only varies in specified circumstances or where OPG changes scope. The price of fixed price contracts is a defined value whereas firm price contracts allow escalation for inflation.
- *Reimbursable Costs or Cost Plus Mark-up* – Contractors are paid actual labour and materials with mark-ups for overhead and profit (as a percentage of costs).

Figure 1 below illustrates the pricing models for the major contracts and the risk transfer associated with the pricing model.

**Figure 1 - Pricing Models and Associated Risk Transfer**

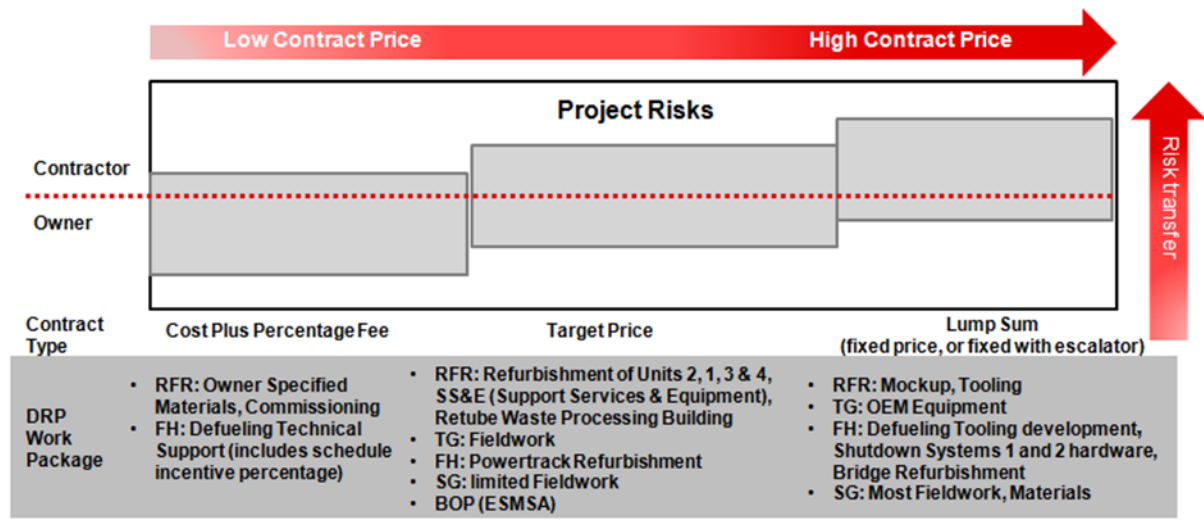
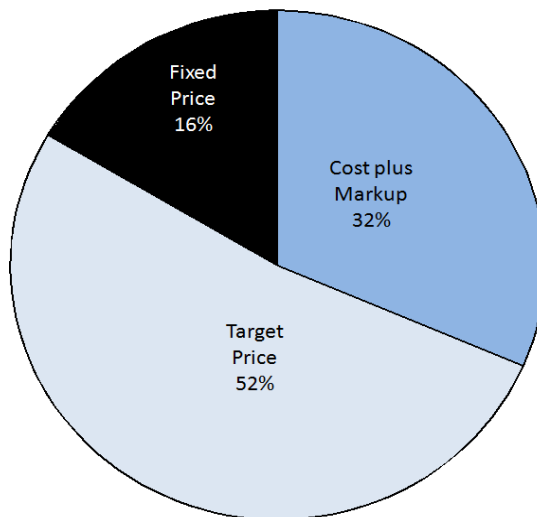


Figure 2 provides a breakdown of the contract costs across the three pricing models.

Figure 2 - Breakdown of contract costs across the pricing models



### 3.1.2 Contract Terms and Conditions

A number of terms and conditions are consistent across the contracts. These are described below and not repeated in the detailed discussion of each major work bundle:

- *Project Change Directives* – The major work bundle contracts limit the ability for the contractors to initiate project change directives, except in limited circumstances (e.g., force majeure)<sup>2</sup>. The limitation on contractor initiated project change directives reduces OPG's risk exposure to changes in target costs, target schedules or fixed fees.
- *Excusable Delays and Force Majeure* – For a specific set of circumstances beyond its control, the contractor could receive schedule or cost relief.
- *Warranty Provisions* – The warranty periods are sufficiently long for OPG to identify any potential defects with work performed by the contractors or owner-specified materials supplied by the contractors.
- *"Open Book" Approach and OPG Audit Rights* – OPG may review, audit and dispute invoiced costs.
- *Termination for Convenience* – OPG may terminate the contracts for convenience at any time, providing an important off-ramp to OPG.

<sup>2</sup> The ESMSA does not include this limitation on project change directives.

- *Suspension of the Work* – OPG has the option to suspend the work at any point during the contract. This provides an important cost-saving measure in the event of a delay in execution.

### **3.2 RFR**

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 to two proponents: (1) Babcock & Wilcox Canada Ltd., with GE-Hitachi Canada and Black & MacDonald as sub-contractors (“Babcock & Wilcox”), and (2) a joint venture of SNC-Lavalin Nuclear Inc. and Aecon Industrial, a division of Aecon Construction Group Inc. (“SNC/AECON JV”).

Responses to the Request for Proposals 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 JV was selected and OPG executed a final agreement with them on March 1, 2012.

A summary of the RFR contract is provided in Attachment 1 and a copy of the contract is provided in Attachment 6.

The contracting strategy selected by OPG for the RFR major work bundle is to use an EPC arrangement that combines fixed/firm pricing for known or highly definable tasks, and target pricing for the remaining scope of the RFR major work bundle where work is less definable. Following the Definition Phase work, the “execution phase target price” was determined to estimate the total cost to complete the Execution Phase work, with a neutral band within which there will be no incentives or disincentives for coming above or below the target. If the neutral band is surpassed, the incentives or disincentives will be triggered and, as a result,

OPG and the SNC/AECON JV will jointly share in cost savings or overruns, by paying, as an incentive or a disincentive, a specified percentage of cost savings or overruns.

The financial incentives/disincentives mechanism is tied to the target cost and is also tied to the contractually negotiated "Fixed Fee". The Fixed Fee is comprised of the contractor's profit, overhead and a risk amount. If the contractor has to pay cost disincentives, it would lose up to 48 per cent of its Fixed Fee. Although the contractor would still be reimbursed for its actual (allowed) costs, it would, in effect, be providing the services after the loss of its profit, overhead and risk amount. As a result, the contractor's return on the project is diminished, which is significant to the contractor since it is motivated to earn its profit and not simply pass costs through to the owner. As such, the contractor has the incentive to avoid this consequence. Financial incentives are also provided for early completion of each unit outage, and financial disincentives are imposed for failure to complete unit outages within the agreed upon schedule. If the contractor is required to pay schedule disincentives, it can lose up to 80 per cent of its Fixed Fee in aggregate for cost and schedule overruns. Cost incentives paid by OPG are sub-capped at 24 per cent of the contractor's Fixed Fee and 40 per cent of the Fixed Fee in aggregate for cost and schedule savings.

For the RFR major work bundle, the EPC model is expected to result in greater risk transfer to the contractor. The use of fixed pricing where possible provides greater certainty (e.g. for the construction of the mock-up and development of testing for tooling). The use of target pricing where appropriate promotes a lower cost and avoids a risk premium (e.g., for Definition Phase work and Execution Phase work related to removal and replacement of tubes and pipes). Cost plus mark-up pricing is used for Owner Specified Materials ("OSM") and Goods, and commissioning work.

The target price incentive and disincentive mechanism is structured to achieve alignment between contractor interests and OPG's objective of limiting cost increases and schedule delays. Figure 3 below illustrates how the neutral band and the incentives/disincentives would apply to the Execution Phase.

**Figure 3 - RFR Contract Cost and Schedule Incentives and Disincentives**



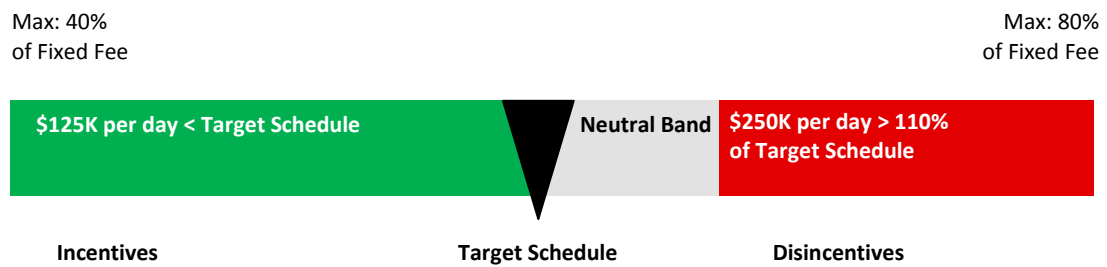
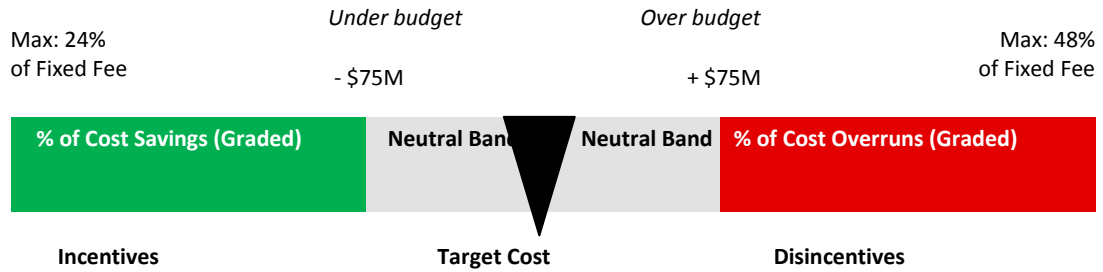


Chart 3 provides a breakdown of the costs of the RFR agreement. The costs are for the 4-unit refurbishment and were factored into RQE.

**Chart 3 - RFR Contract Cost Breakdown**

Phase	Definition	Execution	Commissioning
Target Cost	\$93M	\$1,591M	\$8M – estimated (from class 2)
RWPB Target Cost	\$60M		
Fixed Fee	\$48M	\$ 480M	
RWPB Fixed Fee	\$21M		
SS&E Target Cost	\$26M	\$68M	
SS&E Fixed Fee	\$4.5M	\$12M	
Mock-up Fixed Price	\$38M		
Non-target Reimbursable Work/Costs			\$6M – estimated (from class 2)
Tooling Fixed Price	\$375M		
OSM (estimate)	\$185M	\$394M	
Goods (estimate)	\$15M	\$33M	
Mark-up for Owner - Specified Materials– 10%			
Mark-up for Goods – 5%			
Profit percentage for Commissioning Phase Reimbursable Work – 11.1%			

Charts 4 to 7 below demonstrate how the different pricing mechanisms, incentives and disincentives in the RFR agreement come into play in four different scenarios. Each of the scenarios is described separately below. The following features are common to all scenarios:

- Scenarios are based on approved scope at the time of the Release Quality Estimate.
- The contractor Fixed Fee was negotiated as a percentage of target cost. Once established, the Fixed Fee paid by OPG does not change as actual costs change, and is subject to the incentive/disincentive mechanism. In the examples, the “contractor cost” for the Fixed Fee varies with the scenarios to represent changes in contractor overheads and profits based on changes in actual costs.
- For simplicity, an incentive or disincentive adjustment of 20 per cent is used for target cost savings or overruns outside of the neutral band. The actual percentage is calculated using a graded approach.
- Also for simplicity, the cost categories of OSM, Reimbursable Costs and Goods assume the increased costs all include any contractor markups, and any cost savings or overruns are excluded from the Fixed Fee incentives/ disincentives.

- 1 • Also for simplicity, the cost categories of OSM, Reimbursable Costs and  
2 Goods assume the increased costs all include any contractor markups, and  
3 any cost savings or overruns are excluded from the Fixed Fee incentives/  
4 disincentives.
- 5 • the target cost for both the Definition Phase and Execution Phase Support  
6 Services and Equipment (“SS&E”) are added to each of the Definition Phase  
7 and Execution Phase Target Costs respectively, and the Definition Phase and  
8 Execution Phase SS&E incentives and disincentives were calculated  
9 consistently with the Definition Phase and Execution Phase Target Costs.  
10 Under the contract, the Definition Phase and Execution Phase SS&E would  
11 be subject to its own neutral band and graded scale for incentives and  
12 disincentives.
- 13 • No schedule disincentives are applied.
- 14 • The numbers may not add due to rounding.

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16 In the first scenario set out in Chart 4 below, the contractor achieves a 1 per cent cost  
17 savings. For the fixed price portions of work, there is no impact to OPG (Chart 4, lines 2, 5, 7  
18 and 9). For the target cost portions of work, OPG shares in the contractor’s cost savings as  
19 the contractor is reimbursed for only its actual costs incurred (Chart 4, lines 1 and 4), which  
20 are less than the negotiated target costs. As the 1 per cent cost savings fall within both the  
21 Definition Phase and Execution Phase neutral bands (\$2.5M and \$75M respectively), there is  
22 no cost incentive payment for coming in below the target (Chart 4, lines 3 and 6). OSM are  
23 paid at the actual costs.

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25 **Chart 4 - Illustrative Scenarios of RFR Target Pricing (Contractor 1% Cost Savings)**

			% Contractor Cost Savings = 1%				
#	Category (\$ Million)	Contract Costs (from table 3)	Contractor Cost	Cost Variance	Impact to Contractor	Impact to OPG	OPG Payment to Contractor
1	Definition Phase Target Cost (Incl RWPB)	185	183	(2)	0	(2)	183
2	Definition Phase Fixed Fee	74	73	(1)	(1)	0	74
3	Definition Phase Fixed Fee Incentive/ Disincentive				0	0	0
4	Execution Phase Target Cost	1,667	1,650	(17)	0	(17)	1,650
5	Execution Phase Fixed Fee	492	487	(5)	(5)	0	492
6	Execution Phase Fixed Fee Incentive/ Disincentive				0	0	0
7	Mock-up Fixed Price	38	38	(0)	(0)	0	38
8	Non-target Reimbursable Costs	6	6	(0)	0	(0)	6
9	Tooling Fixed Price	375	371	(4)	(4)	0	375
10	OSM	579	573	(6)	0	(6)	573
11	Goods	48	48	(0)	0	(0)	48
12	Total	3,464	3,429	(35)	(10)	(25)	3,439

In the second scenario set out below in Chart 5, the contractor achieves a 10 per cent cost savings. For the fixed price portions of work, there continues to be no impact to OPG (Chart 5, lines 2, 5, 7 and 9). For the target cost portions of work, OPG shares in the contractor's cost savings as the contractor is reimbursed for only its actual costs (Chart 5, lines 1 and 4). At 10 per cent cost savings, the savings for the Definition Phase Target Cost are \$19M and fall outside the \$2.5M neutral band for Definition Phase. As a result, an incentive payment of \$3M applies. For the Execution Phase Target Cost, the savings are \$167M and also falls outside the \$75M Execution Phase neutral band. OPG pays the contractor a cost incentive for coming in below the target (Chart 5, lines 3 and 6). As the total demonstrates (Chart 5, line 12), the contractor is incented to come in below target cost in order to take advantage of the cost incentive payments, and OPG benefits from significant cost savings even after payment of the cost incentive. OSM and Goods are paid at actual costs and OPG retains those savings.

**Chart 5 - Illustrative Scenarios of RFR Target Pricing (Contractor 10% Cost Savings)**

			% Contractor Cost Savings = 10%				
#	Category (\$ Million)	Contract Costs (from table 3)	Contractor Cost	Cost Variance	Impact to Contractor	Impact to OPG	OPG Payment to Contractor
1	Definition Phase Target Cost (Incl RWPB)	185	167	(19)	0	(19)	167
2	Definition Phase Fixed Fee	74	66	(7)	(7)	0	74
3	Definition Phase Fixed Fee Incentive/ Disincentive				(3)	3	3
4	Execution Phase Target Cost	1,667	1,500	(167)	0	(167)	1,500
5	Execution Phase Fixed Fee	492	443	(49)	(49)	0	492
6	Execution Phase Fixed Fee Incentive/ Disincentive				(18)	18	18
7	Mock-up Fixed Price	38	34	(4)	(4)	0	38
8	Non-target Reimbursable Costs	6	5	(1)	0	(1)	5
9	Tooling Fixed Price	375	338	(38)	(38)	0	375
10	OSM	579	521	(58)	0	(58)	521
11	Goods	48	43	(5)	0	(5)	43
12	Total	3,464	3,117	(346)	(119)	(227)	3,237

In the third scenario, the contractor incurs a 1 per cent cost overrun. For the fixed price portions of work, there is no negative cost impact to OPG (Chart 6, lines 2, 5, 7 and 9). For the target cost portions of work, OPG reimburses the actual (allowed) costs of the contractor and pays the cost variance to the contractor (Chart 6, lines 1 and 4). As the 1 per cent cost overrun falls inside both the Definition Phase and Execution Phase neutral bands (\$2.5M and \$75M respectively), there is no cost disincentive payment from the contractor for coming in above the target (Chart 6, lines 3 and 6). OSM is at actual cost and OPG pays the 1 per cent cost overrun.

**Chart 6 - Illustrative Scenarios of RFR Target Pricing (Contractor 1% Cost Overrun)**

#	Category (\$ Million)	Contract Costs (from table 3)	% Contractor Cost Overrun = 1%				
			Contractor Cost	Cost Variance	Impact to Contractor	Impact to OPG	OPG Payment to Contractor
1	Definition Phase Target Cost (Incl RWPB)	185	187	2	0	2	187
2	Definition Phase Fixed Fee	74	74	1	1	0	74
3	Definition Phase Fixed Fee Incentive/ Disincentive				0	0	0
4	Execution Phase Target Cost	1,667	1,684	17	0	17	1,684
5	Execution Phase Fixed Fee	492	497	5	5	0	492
6	Execution Phase Fixed Fee Incentive/ Disincentive				0	0	0
7	Mock-up Fixed Price	38	38	0	0	0	38
8	Non-target Reimbursable Costs	6	6	0	0	0	6
9	Tooling Fixed Price	375	379	4	4	0	375
10	OSM with Fee(estimate)	579	585	6	0	6	585
11	Goods with Fee(estimate)	48	48	0	0	0	48
12	Total	3,464	3,498	35	10	25	3,488

In the fourth scenario, the contractor incurs a 10 per cent cost overrun. For the fixed price portions of work, there continues to be no negative cost impact to OPG (Chart 7, lines 2, 5, 7 and 9). For the target cost portions of work, OPG reimburses the actual (allowed) costs of the contractor and pays the cost variance to the contractor (Chart 7, lines 1 and 4). For the Definition Phase Target Cost, the cost variance is \$19M (Chart 7, line 1), which is outside the \$2.5M Definition Phase neutral band. As a result, the contractor must pay a disincentive payment of \$3M to OPG. The 10 per cent cost overrun for the Execution Phase Target Cost is \$167M (Chart 7, line 4) and also falls outside the \$75M Execution Phase neutral band. As a result, the contractor must additionally pay OPG a disincentive payment of \$18M for coming in above the target (Chart 7, lines 3 and 6). OSM and Goods are paid at actual costs and the cost overrun is paid by OPG.

As the total line demonstrates (Chart 7, line 12), the pricing mechanisms and disincentives discourage the contractor from incurring cost overruns as it will not be paid for any cost overrun on fixed price portions of work, and it will also have to pay OPG cost disincentive payments (a specified percentage of its Fixed Fee portions of work, as described above) for overruns it incurs on target price portions of work that fall outside of the neutral band. Cost overruns outside of the neutral band therefore reduce the contractor's expected profits. Since the contractor's Fixed Fee was established as a percentage of the Execution Phase Target Cost, and contractor overheads increase in a cost overrun scenario, the contractor's lost profit includes both the disincentive payments and the loss associated with the requirement to pay incremental overheads not covered in the fixed fee.

**Chart 7 - Illustrative Scenarios of RFR Target Pricing (Contractor 10% Cost Overrun)**

#	Category (\$ Million)	Contract Costs (from table 3)	% Contractor Cost Overrun = 10%				
			Contractor Cost	Cost Variance	Impact to Contractor	Impact to OPG	OPG Payment to Contractor
1	Definition Phase Target Cost (Incl RWPB)	185	204	19	0	19	204
2	Definition Phase Fixed Fee	74	81	7	7	0	74
3	Definition Phase Fixed Fee Incentive/ Disincentive				3	(3)	(3)
4	Execution Phase Target Cost	1,667	1,834	167	0	167	1,834
5	Execution Phase Fixed Fee	492	541	49	49	0	492
6	Execution Phase Fixed Fee Incentive/ Disincentive				18	(18)	(18)
7	Mock-up Fixed Price	38	42	4	4	0	38
8	Non-target Reimbursable Costs	6	7	1	0	1	7
9	Tooling Fixed Price	375	413	38	38	0	375
10	OSM with Fee(estimate)	579	637	58	0	58	637
11	Goods with Fee(estimate)	48	53	5	0	5	53
12	Total	3,464	3,810	346	119	227	3,690

OPG also conducted a rigorous vetting process to establish the Execution Phase Class 2 estimate for the RFR. The process included detailed review of the elements of the estimate by the project management team and a strategy to validate elements of the estimate and assess the gaps OPG identified in the original estimate submission. Further information on the vetting process is provided in Ex. D2-2-8.

Also discussed in Ex. D2-2-8, Burns & McDonnell Canada Ltd. and Modus Strategic Solutions Canada Company ("BMCD/Modus") were engaged by OPG to assess the process undertaken by OPG in developing the RQE. A copy of the BMCD/Modus report is provided in Ex. D2-2-8 Attachment 2. In their assessment, BMCD/Modus addresses the costs of the RFR contract and concludes that the results are appropriate:

**Chart 4 - Illustrative Scenarios of RFR Target Pricing (Contractor 10% Cost Overrun)**

#	Category (\$ Million)	Contract Costs (from table 3)	% Contractor Cost Overrun = 10%				
			Contractor Cost	Cost Variance	Impact to Contractor	Impact to OPG	OPG Payment to Contractor
1	Definition Phase Target Cost (Incl RWPB)	185	204	19	0	19	204
2	Definition Phase Fixed Fee	74	81	7	7	0	74
3	Definition Phase Fixed Fee Incentive/ Disincentive	0			0	0	0
4	Execution Phase Target Cost	1,667	1,834	167	0	167	1,834
5	Execution Phase Fixed Fee	492	541	49	49	0	492
6	Execution Phase Fixed Fee Incentive/ Disincentive	0	0	0	18	(18)	(18)
7	Mock-up Fixed Price	38	42	4	4	0	38
8	Non-target Reimbursable Costs	6	7	1	0	1	7
9	Tooling Fixed Price	375	413	38	38	0	375
10	OSM with Fee(estimate)	579	637	58	0	58	637
11	Goods with Fee(estimate)	48	53	5	0	5	53
12	Total	3,464	3,810	346	116	230	3,694

OPG also conducted a rigorous vetting process to establish the Execution Phase Class 2 estimate for the RFR. The process included detailed review of the elements of the estimate by the project management team and a strategy to validate elements of the estimate and assess the gaps OPG identified in the original estimate submission. Further information on the vetting process is provided in Ex. D2-2-8.

Also discussed in Ex. D2-2-8, Burns & McDonnell Canada Ltd. and Modus Strategic Solutions Canada Company ("BMCD/Modus") were engaged by OPG to assess the process undertaken by OPG in developing the RQE. A copy of the BMCD/Modus report is provided in Ex. D2-2-8 Attachment 2. In their assessment, BMCD/Modus addresses the costs of the RFR contract and concludes that the results are appropriate:

BMCD/Modus closely monitored the development of SNC/Aecon's cost estimate and OPG's vetting of same, and believes the process the parties used to develop the cost estimate was reasonably robust, producing an estimate with significant detail. Moreover, we have witnessed the relationship between the parties substantially improve at every level, which will be important as issues arise. Based on the initial commercial goals the parties set forth, the contract and the resultant cost and schedule estimating process appears to have thus far driven appropriate behaviours and a beneficial result.

Further contractual safeguards, including limitations on contractor-initiated change directives, will reduce OPG's exposure to increases in RFR target cost, target schedule and the fixed fee. In addition, provisions allowing for OPG to terminate for convenience and to take ownership of critical tooling provide OPG with the flexibility to adapt the RFR contracting strategy if required.

1  
2 By implementing the RFR procurement process early in the Definition Phase, OPG and the  
3 SNC/AECON JV have been able to work together, on an open book basis, to develop the  
4 engineering, refine the schedule and budget estimates, and jointly identify, monitor and  
5 address risks as they arise. An important feature of the RFR contract is that it provides for full  
6 transparency between the parties. For example, OPG has the option to audit the costs  
7 invoiced by the SNC/AECON JV at any point during the contract term and up to two years  
8 following the final completion date. OPG's audit rights with respect to payroll burdens (an  
9 agreed payroll burden percentage is used as a proxy for actual payroll burden costs) and  
10 work that is performed on a fixed price basis or firm price basis are narrower.

### 11 12 **3.3 Turbine Generator**

13 The turbine generator sets are highly specialized machines designed and manufactured to  
14 order specifically for Darlington by BBC Brown Boveri Canada Inc. A series of corporate  
15 mergers and acquisitions resulted in Alstom Power Canada Inc. ("Alstom") becoming the  
16 Original Equipment Manufacturer ("OEM"). In 2015, as part of the global sale of the Alstom  
17 group's power and grid business to General Electric Company, the control of Alstom and its  
18 affiliates which are part of the power and grid business transferred to a legal entity ultimately  
19 controlled by General Electric Company. While as a result of this transaction the ultimate  
20 parent company of Alstom changed, OPG's contracting party remains the same.

21  
22 The Turbine Generator major work bundle was divided into two contracts. The first contract  
23 for Engineering Services and Equipment Supply ("ESES") was awarded as a single source  
24 contract to Alstom on March 27, 2013. Since the original design was specifically for  
25 Darlington and given the technical complexity of the work, the single source strategy was  
26 selected to ensure that no technical or operational risks were introduced as a result of  
27 component replacements and converting from analog to digital turbine and excitation control  
28 systems. Operating experience across other major refurbishments has shown that the OEM  
29 is the only provider capable of ensuring the compatibility of the new systems to existing  
30 equipment. A complete steam path retrofit is not being undertaken since the turbine  
31 generator sets are in excellent condition and have performed extremely well over the years,  
32 and replacement is not required. As a result, the OEM provides the consistency needed to  
33 ensure compatibility.



1  
2 A summary of the Turbine Generator ESES contract with Alstom is provided in Attachment 2  
3 and a copy is provided in Attachment 7.

4  
5 The equipment supply component of the work, including preliminary design and factory  
6 testing, is conducted using a fixed/firm price model (see section 3.1.1 above) and accounts  
7 for the majority of the contract value (approximately 85 per cent). The first unit is fixed price  
8 and the other units are firm price (i.e., with escalation for inflation). Installation support work,  
9 static commissioning work and dynamic commissioning work, are conducted using a  
10 reimbursable cost model accounting for ~15 per cent of the contract price. Most of the  
11 reimbursable work is done on a target cost basis, with separate targets for different scopes of  
12 work. The total estimated value of the contract is ~\$333M.

13  
14 The Alstom contract includes extended warranty periods to ensure the equipment performs  
15 as required, and fixed/firm price for equipment and component delivery to ensure cost  
16 certainty.

17  
18 The scope of the work for the second contract includes the field work required for  
19 installations, repairs and replacements of equipment and components, and engineering  
20 integration of the OEM equipment with the OPG engineering change control process. The  
21 contract is a target price EPC contract with the SNC/AECON JV. The estimated value of the  
22 contract is \$284M.

23  
24 A summary of the Turbine Generator EPC contract with the SNC/ AECON JV is provided in  
25 Attachment 3 and a copy is provided in Attachment 8.

26  
27 There is full transparency between the parties and OPG has the option to audit the costs  
28 invoiced by the SNC/AECON JV at any point during the term of the contract and up to two  
29 years following the final completion date. OPG's audit rights with respect to payroll burdens  
30 (an agreed payroll burden percentage is used as a proxy for actual payroll burden costs) and  
31 work that is performed on a fixed price basis or firm price basis are narrower. Additional  
32 contract terms and conditions, including termination for convenience, limitations on project

1 change directives, and warranty provisions, serve to optimize the transfer of design,  
2 construction, cost and scheduling risks to the contractors.

3  
4 A Memorandum of Agreement between OPG, Alstom and the SNC/AECON JV is in place to  
5 ensure that the three parties work closely together to mitigate technical and operational risks.

### 6 7 **3.4 Fuel Handling and Defueling**

8 The Fuel Handling and Defueling major work bundle has two distinct areas of work: (i)  
9 defueling of the reactor core; and (ii) refurbishment of the fuel handling equipment.

10  
11 Defueling is a critical path element for each unit's refurbishment since it involves the removal  
12 of all irradiated fuel from each reactor prior to each refurbishment outage. The defueling work  
13 will include field and non-field work. All defueling field work will be done by OPG. Defueling  
14 non-field work involving engineering, manufacturing and technical support will be performed  
15 under an Engineering Services and Equipment Supply contract issued to GE-Hitachi Nuclear  
16 Energy Canada Inc. ("GHNEC"). The contract consists of firm/fixed price for components and  
17 equipment and a cost reimbursable element for technical support during the defueling  
18 operation. The estimated value of the contract is \$23M, however, the contract contains  
19 clauses that allow for additional scope such as additional "dummy" fuel bundles and flow  
20 restricted orifice bundles.

21  
22 The Darlington fuel handling system was originally designed and manufactured by GHNEC.  
23 GHNEC, as the OEM, has provided OPG with fuel handling related equipment, components  
24 and services including test facilities, systems engineering, and materials and troubleshooting  
25 support for over 30 years. Engaging a supplier other than the OEM would introduce  
26 integration, compatibility, operational and nuclear safety risks. The contract strategy selected  
27 to mitigate these risks was to single source the supply component and equipment related to  
28 defueling, along with the technical experts required to support OPG during the defueling  
29 operations, to the OEM. Given the relatively small value of this contract, a contract summary  
30 and copy of the agreement have not been provided.

31  
32 The second work area involves refurbishment of the fuel handling systems, specifically  
33 power track refurbishment. Project scope is a "like-for-like" replacement of components for

1 the power track, and is contracted to ES Fox under an ESMSA. This is a procurement and  
2 construction contract, and no engineering is required for this work. The estimated value of  
3 the contract is \$98.6M.

4  
5 The ESMSA is considered in section 3.6 below.

### 6 7 **3.5 Steam Generator**

8 This major work bundle does not include any critical path elements. After evaluating various  
9 alternatives, OPG decided to bundle all the Steam Generator work into one package,  
10 competitively bid under an EPC contract model with fixed/firm pricing and target  
11 reimbursable pricing. The decision to bundle the entire Steam Generators scope of work for  
12 procurement through a single EPC contract offers the best opportunity to meet this particular  
13 bundle's key cost, schedule and quality objectives. It enables an optimal transfer of risk, as  
14 the contractor is responsible for design, engineering, procurement of long lead materials, and  
15 construction work. The EPC approach also supports OPG's preference for a single point of  
16 accountability with lower interface and hand-off risks and reduces the burden of significant  
17 coordination, integration and oversight.

18  
19 An EPC agreement has been entered into with a joint venture of BWXT Canada Ltd.  
20 (formerly Babcock & Wilcox Canada Ltd) and CANDU Energy Inc. ("BWXT/CANDU JV"). The  
21 agreement covers work on the primary and secondary sides of the steam generators. The  
22 bulk of the scope of work is subject to fixed/firm pricing where tasks are highly definable and  
23 consistent with those performed at other nuclear facilities. The estimated value of the  
24 contract is \$110M.

25  
26 A summary of the Steam Generator EPC agreement with the BWXT/CANDU JV is provided  
27 in Attachment 4 and a copy is provided in Attachment 9.

28  
29 Cost reimbursable target pricing will be used for limited field execution work where some  
30 unknowns exist (e.g. primary side mechanical cleaning of the insides of the tubes). OPG's  
31 Inspection and Maintenance Services ("IMS") group will be performing the inspections and  
32 repairs with the option to contract some routine inspection work if needed.

1 The fixed pricing model will allow for greater cost certainty and the incentive/disincentive  
2 mechanism for some amount of the target price components will align contractor interests  
3 with OPG's objectives of limiting cost increases and schedule delays. The EPC contract  
4 includes a number of incentive and disincentive structures for cost and schedule variances.

5  
6 There is full transparency between the parties, and OPG has the option, through contract  
7 terms and conditions, to audit the costs invoiced by the BWXT/CANDU JV at any point  
8 during the contract term and up to two years following the final completion date. Additional  
9 contract terms and conditions, including OPG's ability to terminate for convenience,  
10 limitations on project change directives, and warranty provisions appropriately transfer  
11 design, construction, cost and scheduling risk to the contractor.

### 12 13 **3.6 Balance of Plant**

14 The ESMSA is the form of contract used for the majority of the Balance of Plant work bundle,  
15 as well as for the F&IP, SIO and the majority of projects in the Nuclear Operations Project  
16 Portfolio (see Ex. D2-1-1 for consideration of the Nuclear Operations Project Portfolio). The  
17 ESMSA is a form of contract that establishes a set of terms and conditions in advance with a  
18 contractor, enabling OPG to significantly shorten the procurement cycle for obtaining  
19 engineering, procurement, or construction services, or any combination of the three types of  
20 services, as required.

21  
22 In 2012, OPG established ESMSAs with ES Fox and Black & McDonald. In 2015, in order to  
23 increase competition and to mitigate capacity risks, OPG selected the SNC/AECON JV as a  
24 third ESMSA contractor. The SNC/AECON JV participated in the initial competitive process  
25 for the ESMSAs. The initial contract term under each ESMSA was for five years. The term  
26 has since been extended to 2027 for each of ES Fox, Black & McDonald and the  
27 SNC/AECON JV. The current form of agreement in place for all three of these contractors  
28 has benefitted from clarifications and adjustments based on OPG's experience with the work  
29 conducted under the ESMSAs.

30  
31 Entering into substantially similar agreements with the ESMSA contractors through a  
32 competitive process has allowed OPG to achieve a number of benefits with respect to pricing

1 and terms and conditions, as well as flexibility and control by OPG. Some of the key contract  
2 features and benefits are highlighted below:

- 3 • *Core Team* – Contractor will own the work from start to finish under a “one-stop shop”  
4 approach. Each contractor is required to establish and maintain a core team capable  
5 of managing, controlling and administering the provision of all work pursuant to the  
6 ESMSA. Key personnel for an individual project may be designated in the purchase  
7 order for such project with OPG’s consent. Members of the core team and any  
8 designated key personnel cannot be replaced without OPG’s prior written consent.  
9 This approach ensures committed and focused contractor leadership for OPG work  
10 and reduces the complexity and costs relating to OPG’s ongoing interface with and  
11 management of the contractors.
- 12 • *Pricing and Profit at Risk Model* – Fixed labour rates for trades and non-trades as well  
13 as set fees for material management provide cost certainty under the ESMSA. At the  
14 same time, for each project awarded pursuant to the ESMSA, OPG may adopt the  
15 appropriate pricing model (i.e., fixed/firm price, time and materials, target price, or  
16 other types as appropriate). Under each ESMSA, the contractor is required to submit  
17 an application to OPG for payment for work completed. OPG withholds a percentage  
18 (specified in the contract) of each corresponding payment and contributes these  
19 amounts to a performance fee pool for each ESMSA contractor.<sup>3</sup> As a result, a  
20 percentage of the contractor’s costs, including the contractor’s profits and overhead,  
21 are at risk through the performance fee mechanism. Performance fees are paid out of  
22 the performance fee pool based on a performance scorecard included in each  
23 ESMSA and which is comprised of approved performance indicators, including in the  
24 areas of safety, human performance, cost and schedule. The performance  
25 scorecards and indicators are established on an annual basis and reviewed regularly  
26 by OPG. Altogether, the performance fee mechanism aligns each contractor’s  
27 incentives with OPG’s interests in terms of ongoing performance improvement and  
28 delivery of projects in a timely and cost effective manner. To enhance the  
29 effectiveness of the performance mechanism, OPG is also in the process of

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<sup>3</sup> The percentage withheld does not apply to applications for payment related to fixed price work, payments of performance fee, or the fixed fees associated with a core team of personnel identified in each ESMSA.

1 developing project-specific performance scorecards for the Balance of Plant work  
2 packages awarded under the ESMSAs.

- 3 • *Work Request Processes and Change Management* – OPG retains the sole  
4 discretion to issue a work request to any of the ESMSA contractors, and is not  
5 restricted in its ability to issue the work request to other contractors regardless of  
6 whether they have entered into a similar ESMSA with OPG. While the ESMSA  
7 contractor is required to respond to all work requests from OPG, OPG does not  
8 guarantee that any specific amount of work will be provided to the contractor, nor  
9 does OPG guarantee the exclusive right of the contractor to submit a work request  
10 response in respect of any work. The ESMSA also sets out a process for addressing  
11 changes by way of project change authorizations.
- 12 • *Other Terms and Conditions* – Risks have been optimized and transferred to the  
13 contractors where appropriate through a number of terms and conditions, including  
14 but not limited to performance security and indemnity, limits of liability and exclusions,  
15 nuclear liability, requirements regarding delays, termination and events of default, and  
16 warranty and rework. A robust dispute resolution process has also been agreed to  
17 between OPG and each of the ESMSA contractors.

18  
19 A summary of the ESMSA form of agreement is provided in Attachment 5. A copy of the  
20 most recently executed ESMSA, with the SNC/AECON JV, is provided in Attachment 10. The  
21 ESMSA with the SNC/AECON JV is substantially similar to the ESMSAs that are in place  
22 with each of ES Fox and Black & McDonald.

## ATTACHMENTS

- |                |   |
|----------------|---|
| Attachment 1:  | Summary of EPC Contract for RFR with SNC/AECON JV                                   |
| Attachment 2:  | Summary of ESES Contract for Turbine Generator with Alstom                          |
| Attachment 3:  | Summary of EPC Contract for Turbine Generator with SNC/AECON JV                     |
| Attachment 4:  | Summary of EPC Contract for Steam Generators with BWXT/CANDU JV                     |
| Attachment 5:  | Summary of ESMSA Contract   |
| Attachment 6:  | EPC Contract for RFR with SNC/AECON JV (including Amendments 1 to 5)                |
| Attachment 7:  | ESES Contract for Turbine Generators with Alstom (including Amendment 1)            |
| Attachment 8:  | EPC Contract for Turbine Generators with SNC/AECON JV                               |
| Attachment 9:  | EPC Contract for Steam Generators with BWXT/CANDU JV (including Amendments 1 and 2) |
| Attachment 10: | ESMSA with SNC/AECON JV (including Amendment 1)                                     |

Note: Agreements included in Attachments 6 to 10 may not include the following schedules/information, which may be either (1) detailed technical information, including information which may constitute nuclear prescribed or security protected information, or (2) information that OPG's contractors claim to be confidential information. OPG does not believe this information is necessary for a complete understanding of the contracts relative to OPG's Application:

- Contractors' Workplace Safety and Insurance Board identification numbers, banking account numbers, and tax numbers;
- Technical Specifications, including detailed scopes of work, reactor laser scans, and OPG reference information or information on which the contractor may rely;
- Designated Substances;
- Site and Designated Areas, including potential site modifications; and
- Tooling information, including tool testing and design requirements.

As Attachments 6 to 10 are large in size, they are provided in the accompanying CD of "Darlington Refurbishment Program Contracts".