Needs For and Alternatives To

APPENDIX 2.4

Developing the Keeyask and Conawapa Capital Cost Estimates

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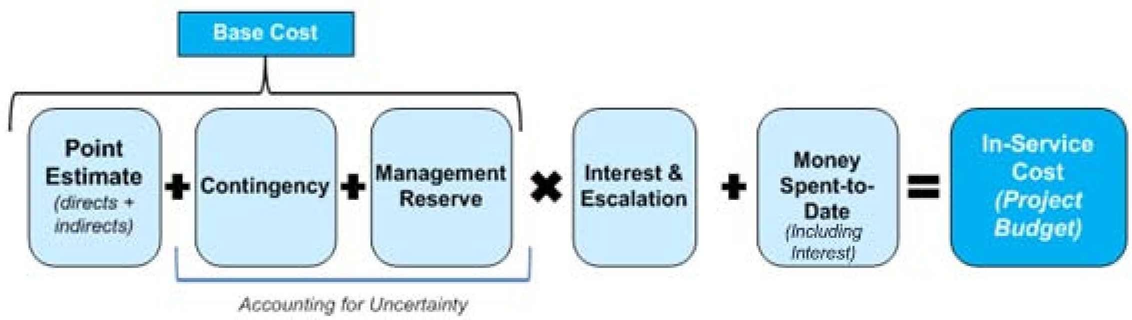
Developing the Keeyask and Conawapa Capital Cost Estimates

Cost Estimate Development Process

The Keeyask and Conawapa capital cost estimates were developed following Association for the Advancement of Cost Engineering International (AACEI) recommended practices for estimate development. The estimate development process is a structured approach that builds the estimate from the bottom-up. The basic estimate development process is as follows:

Figure 1. MANITOBA HYDRO'S COST ESTIMATE DEVELOPMENT PROCESS



The following sections provide further background on each step of the estimate development process and discuss how they are combined to produce a recommended project budget.

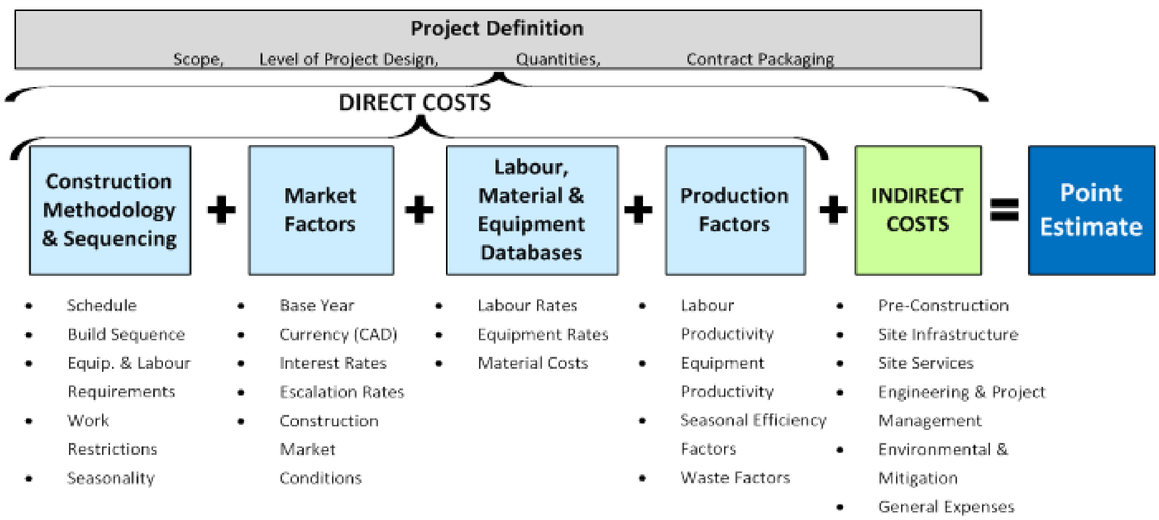
Point Estimate

The Point Estimate is the first step in the estimate development process. The Point Estimate is the risk-free, escalation-free (or bare) costs based on an initial set of assumptions and current market conditions (i.e. overnight cost). There are no allowances for risk or uncertainty in the Point Estimate. For example, the cost in the Point Estimate to construct an earth dam will be based on average quantities and average weather with no costs included for variation from the average amounts assumed. Furthermore, interest and escalation costs are not included in the Point Estimate. It is comprised of both direct and indirect costs and is a forward looking estimate (i.e. estimate of what will be spent) with money spent-to-date accounted for later in the estimate process. The assumptions that form the basis of the Point Estimate are derived from multiple sources:

- Learning/experiences from previous and current hydroelectric projects by Manitoba Hydro
- Information from recent North American hydroelectric and other heavy civil projects
- Broadly gathered market intelligence.

The following process, in accordance with AACEI Recommended Practice 36R-08, is followed to develop the Point Estimate:

Figure 2. POINT ESTIMATE DEVELOPMENT PROCESS



Project Definition

Before detailed estimates are developed the current project definition is explicitly outlined. Included is a clear definition of the project scope, compilation of all engineering design work completed, definition of all quantity information from the current design and establishment of expected contract packages. For items where definition is lacking assumptions are made based on previous Manitoba Hydro generating station projects and/or information from current North American hydroelectric projects. This information provides the basis upon which the Point Estimate will be developed.

Direct Costs

Direct cost items are those directly attributable to the construction of the primary asset under construction (e.g. concrete costs, excavation costs, major equipment etc.). These costs are developed in accordance with the design, quantities and contract packaging established by the project definition. Furthermore, as outlined in Figure 11-2, direct costs are determined based on the established construction methodology and market factors at the time of estimate. The assumed construction sequence and any specific work restrictions are especially critical factors to the cost estimate.

Estimating methods used to develop direct costs vary by work component. The majority of the direct construction costs are developed as first principles estimates. A first principles estimate is a detailed, rigorous, bottom-up estimating approach that builds up costs of the work based on the labour, material and equipment requirements for each discrete work component. These requirements are based both on the quantity of work and on productivity factors associated with the work. Labour, material and equipment cost databases as well as assumed productivities must be established in order to provide the inputs necessary to develop the first principles estimate.

Material Costs Database

The material costs database documents the estimated costs of all materials that are likely to be required to construct the asset. Material costs are documented based on a $/unit of measurement rate. Construction material costs (e.g. cement, reinforcing steel, lumber, formwork components, etc.) are based on quotations from multiple suppliers.

Labour Costs Database

The labour costs database is developed to document both craft and staff labour rates that will be applied to the work. The labour costs are established as $/man-hour rates. Craft labour rates are based on the Burntwood Nelson Agreement (BNA). The BNA is a nostrike, no-lockout collective bargaining agreement which applies to major northern Manitoba Hydro projects. The BNA defines items such as hiring preferences, wage rates, overtime provisions etc. for 'craft' workers. A craft worker is an employee who is working 'on the tools'. Supervisory employees (e.g. Superintendents, engineers, management), termed 'staff' workers, are not included under the BNA. Total labour rates include the base labour rate, overtime, employer paid benefits, employer paid burdens, shift premiums and Worker Compensation Board. Wage rates for staff positions (administration and management) are based on information from Canadian Human Resources Websites, APEGM Salary Survey, and other similar sources and are adjusted to reflect the remoteness of the site.

Equipment Costs Database

The equipment costs database outlines the cost of equipment that will be used for the work. The equipment costs are established as $/hour rates. Construction equipment rates are based on standard industry costs. Rates include equipment list price, maintenance costs, economic life, fuel consumption and resale price. Industry rates are then adjusted for exchange rates, mechanics' wage rates, sales tax, gas and diesel fuel rates, etc. to be applicable to the project. This is used to calculate both hourly operating and hourly ownership costs. Note that the cost associated with equipment transportation to site is not covered in this database; it is dealt with separately as part of mobilization costs.

Productivities

Productivities applied in the cost estimate are based on the assumed construction methodology, productivity levels achieved on previous Manitoba Hydro northern hydroelectric generating station projects and productivity rates being experienced in the construction industry at the time of estimate. Productivity rates are established to be consistent with the assumed construction equipment, methodologies and labour force for the work.

Contractor Indirect Costs

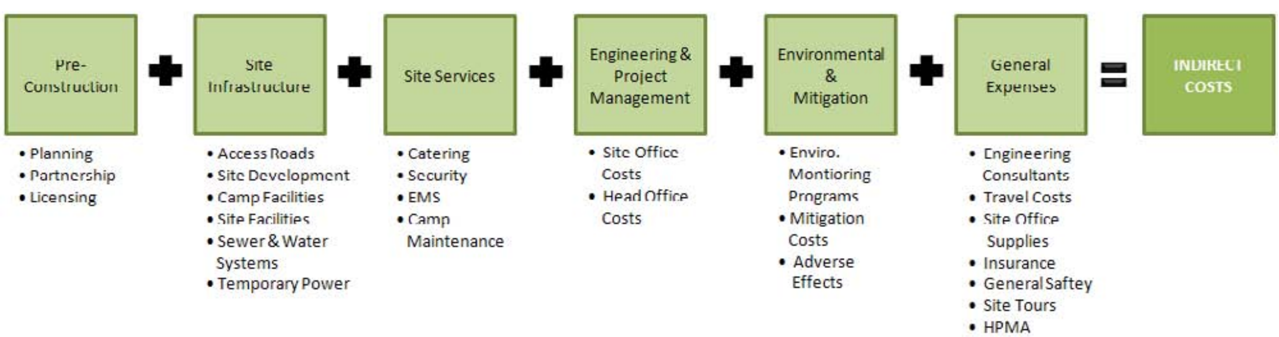
Contractor indirect costs are also included in the overall project direct costs and accounted for in the first principles estimate. Contractor indirects include items such as mobilization, supervisory staff costs, site facility costs etc. Additionally, allowances for profit and overhead (including subcontractor profit) are included as contractor indirect costs.

Costs for major pieces of equipment (turbines, generators, transformers, etc.) are estimated based on recent vendor quotations. and remaining smaller cost items are estimated based on industry standard cost information. These items are estimated separately and added to the results from the first principles estimate to develop the total project direct cost.

Indirect Costs

The other portion of the Point Estimate is made up of items termed indirect costs (or owner cost). Indirect costs include all temporary and permanent items not directly associated with the primary structures but still required to successfully implement the project. The following items are included as indirect costs:

Figure 3. INDIRECT COSTS IN THE POINT ESTIMATE



There are a substantial amount of indirect costs associated with remote mega-projects like Keeyask and Conawapa. The primary contributors of indirect costs are: camp/site infrastructure and services, site and office labour, and licensing costs. The share of indirect costs as a percentage of the total Point Estimate has increased over time.

Indirect costs are estimated using various methods and are provided by multiple areas within Manitoba Hydro. Some indirect costs are developed as first principles estimates, while the majority are based on vendor quotations and/or historical costs.

Contingency and Management Reserve – Accounting for Uncertainty

The Point Estimate is developed at a point in time based on a set of key variables (e.g. quantities, material costs, etc.) and key assumptions. These key items are dependant on numerous factors, which include the amount of design completed, the identified scope of work and market conditions at the time. As such, there is uncertainty associated with the Point Estimate.

Contingency

Contingency is an amount added to the estimate to address this uncertainty and to account for potential risks that could be encountered during project implementation. It is one of the steps within the project risk management process. Contingency is developed with the expectation that some or all of it will be spent. Therefore, the Point Estimate alone does not adequately represent the project's cost. Typical risks/uncertainties that affect the project budget include the following:

- Availability and productivity of skilled labour
- Contractor availability
- Amount of design completed at time of estimate development
- Specific on site construction problems. For example, unexpected ground conditions
- Variable equipment costs
- Schedule delays

- Interest and escalation rate changes

Contingency is developed using the AACE recognized Parametric and Expected Value Modeling method (RP's 40R-08, 42R-08, 44R-08). This contingency method explicitly links the level of risk and uncertainty on the project to the contingency amount developed. The model analyzes two types of risks: systemic risk and project specific risk. Systemic risk relates to items resulting from the project "system". The following categories of systemic risks were considered in our contingency development based on systemic risk definition in AACE RP 42R-08:

- Level of scope development and engineering deliverables completed
- Basis information used to develop the estimating and schedule
- Level of new project technology and overall project complexity

Specific systemic risks within the above categories that were especially relevant on Keeyask and Conawapa included:

- Level of project scope definition at time of estimate
- Definition of the project execution strategy
- Status of the project master schedule
- Level of detail, or inclusiveness of the estimate
- Quality of estimate information
- Estimate competitiveness (aggressive vs. conservative estimate and schedule)
- Project Execution complexity

Systemic risks have been shown to be reasonably predictable between projects within a system, and to some extent within an industry as a whole. These risks are the dominant risk type in early estimates. Systemic risks are best estimated using a parametric model. A parametric model is an equation, developed based on empirical data that explicitly links risk drivers to cost change, which takes the quantified systemic risks as an input and produces expected cost.

In the model used for contingency development, systemic risks are each rated quantitatively and then input into the parametric model to produce a contingency amount. The actual systemic risk ratings were those of the external risk expert and the Manitoba Hydro team

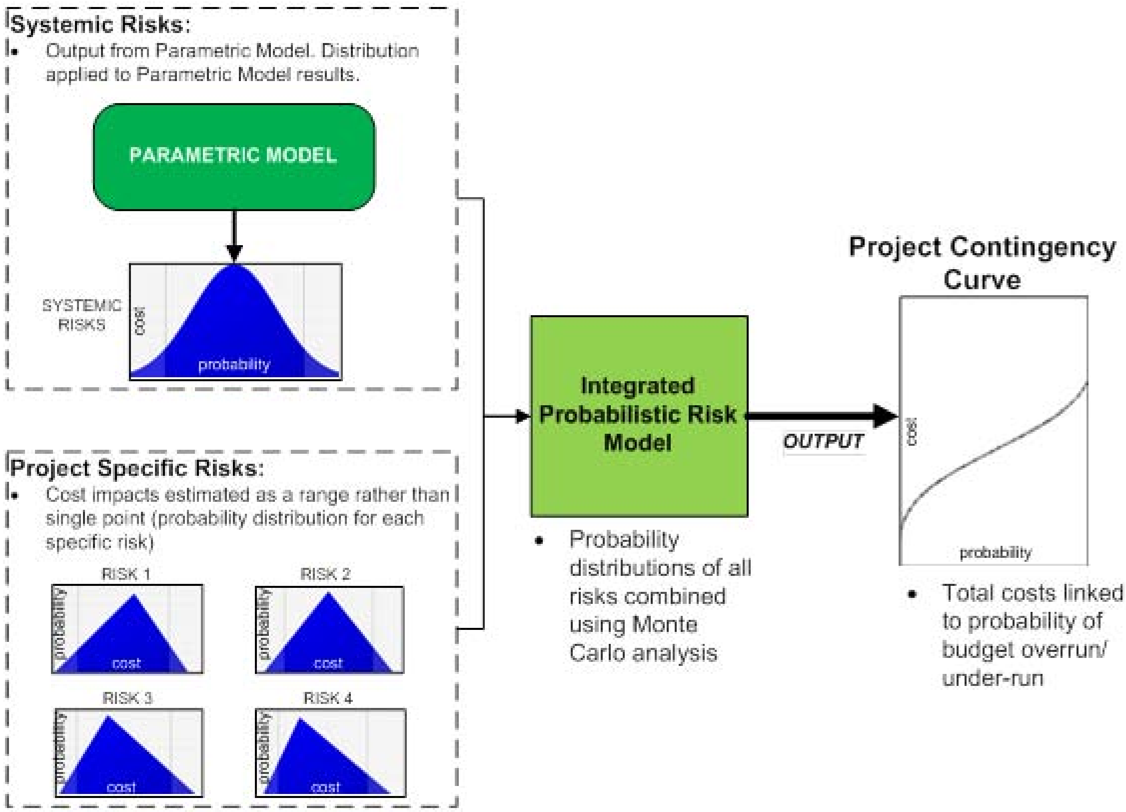
The other portion of the contingency model is project specific risk. Project specific risk relates to items specific to the conditions and attributes of a specific project. Details on these risks are not generally known at early stages of project definition but they are typically the dominant risk type at later stages of project definition. Typical project specific risks include the following (from AACE RP 42R-08):

- Weather
- Site subsurface conditions
- Delivery delays
- Constructability
- Resource availability
- Quality issues (e.g., rework)

For project specific risks, the link with the associated cost impact is deterministic in nature. As a result, these risks are best estimated using an expected-value method. The expected-value method quantifies the risk based on its probability of occurrence times its potential cost impact. In addition to this deterministic value, high and low scenarios are established for each specific risk in order to develop a range of values for each risk item.

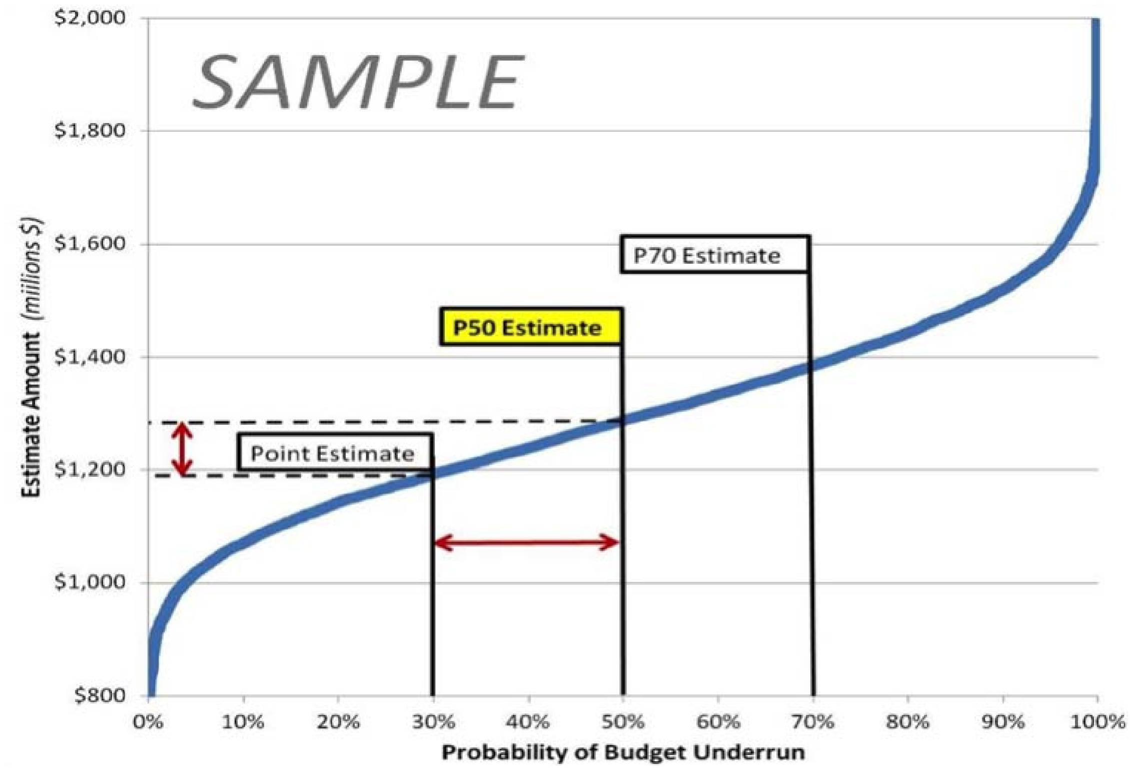
The Parametric and Expected Value Modeling method then combines the results for each risk type into a Monte Carlo simulation to produce an integrated probabilistic output. Monte Carlo simulation is a problem solving technique used to approximate the probability of certain outcomes by running a substantial number of “trial runs” or simulations. The model is shown below. Note that contingency analysis does not include uncertainty associated with the interest and escalation rates that the project will experience. This is dealt with separately.

Figure 4. PARAMETRIC AND EXPECTED VALUE CONTINGENCY MODELING METHOD



The resulting contingency is output as a range of amounts for different desired levels of confidence in achieving budget under-run. This range is represented by what is known as the contingency curve. Along this curve a larger contingency amount means a higher level of confidence in under-running the budget. Hence, contingency for a 70% confidence level or P70 estimate will be greater than the contingency for a 50% confidence level or P50 estimate. Manitoba Hydro's corporate standard is to set contingency at a P50 or 50% confidence level. A sample contingency curve is shown in the figure below:

Figure 5. SAMPLE CONTINGENCY CURVE



Inclusion of contingency at a P50 level addresses the majority of uncertainty associated with the Point Estimate. There are certain major items, though not covered by contingency (as developed above), that can cause the Point Estimate to change. Uncertainty related to these major items must be addressed separately through a project's management reserve funds. Examples of such items are outlined below. Note that interest during construction and potential changes to interest rates are not included as part of contingency or management reserve:

- Major scope changes (e.g. number of units or plant output)
- Significant changes in the construction marketplace
- Changes to escalation rates

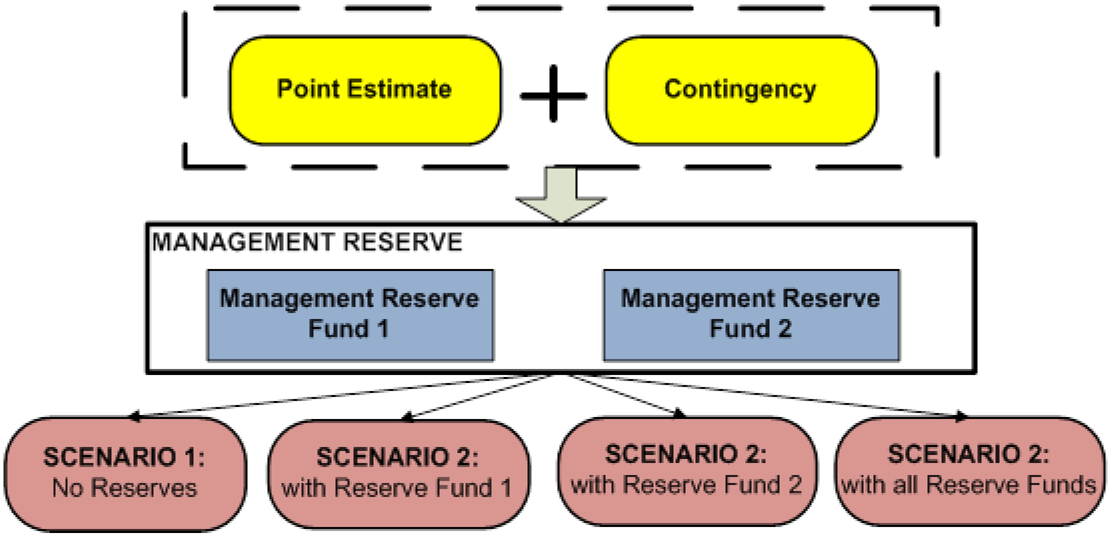
Management Reserve

Management reserve is the next step after contingency in the risk management process, as it relates to the project budget. Management reserve is an amount added to cover uncertainty items with very high impacts but lower likelihood of occurrence and/or substantial risk items not appropriate to be covered through contingency (e.g. major market shifts, etc.). Thus, several management reserve funds can be developed and recommended for inclusion in a project budget depending on the specific risks it faces. This also means that, unlike contingency, management reserve is not always recommended as part of the estimate. Determining whether management reserve funds are required and, if so, which reserve funds to include is addressed in the development of the recommended base cost.

Base Cost

The base cost represents the "overnight costs" to construct the project and as such is communicated in today's dollars. When establishing the base cost different budget scenarios are examined to establish the recommended base cost. Key considerations in analyzing the different budget scenarios and determining the recommended base cost include the level of exposure to cost increases and the magnitude of impact of potential risks. Scenario analysis is used to determine the required contingency and management reserve funds for the recommended base cost. Each scenario includes the Point Estimate and contingency, but differ based on the management reserve funds included. The base estimate is therefore, at minimum, the Point Estimate plus contingency (or the P50 estimate). If management reserve funds are recommended they will be included as part of the base cost. The figure below outlines this scenario analysis phase:

Figure 6. BUDGET SCENARIO DEVELOPMENT



To this stage we have considered only the "overnight" cost of the project. To develop the complete cost of the project we must also account for money spent-to-date and time-value of money aspects (interest and escalation). Addition of these items results in what is termed the "in-service" cost.

In-Service Cost

The in-service cost represents the budget for the project at the time it is brought into service and capitalized. In addition to the base cost, the in-service cost includes all money spent-to-date, interest costs and escalation costs. Interest and escalation rates are applied to the expected cash flow to determine in-service costs. Both interest and escalation costs are based on standard corporate rates (policy G911). It is important to note that interest and escalation costs on projects the size of Keeyask and Conawapa can represent upwards of 40% of the total in-service cost of the project. Furthermore, as project in-service dates are delayed or deferred, interest and escalation costs increase substantially, causing the overall project budget to increase.

Keeyask and Conawapa First Principles Cost Estimates

Keeyask

The last major re-estimate of the Keeyask project's costs was undertaken in 2009/2010. The re-estimate involved detailed revision of estimate assumptions, incorporation of current market conditions and inclusion of additional lessons learned from Wuskwatim. The estimate was developed based on the on-going Stage V Engineering for Infrastructure and near-complete Stage IV Engineering for the Generating Station. The estimate can be considered to be between a **Class 3** and **Class 2** estimate, as defined by the Association for the Advancement of Cost Engineering (AACE) Recommended Practice 69R-12 – Cost Estimate Classification System as Applied in Engineering, Procurement and Construction for the Hydropower Industry. The estimate is considered to be between these two classes because, despite a number of tender prices having been received, tender price for the General Civil Contract is still required. Please refer to the table 1. below for further details on estimate classifications:

Table 1. AACE Cost Estimate Classification for the Hydropower Industry

	Primary Characteristics	**Secondary Characteristics**		
Estimate Class	**Maturity Level of Protection Definition Deliverables** Expressed as % of complete definition	**End Useage** Typical purpose of estimate	**Methodology** Typical estimating method	**Expected Accuracy Range** Typical variation in low and high ranges*
Class 5	0% - 2%	Concept Screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with forced detailed take-off	L: -3% to -10% H: +3% to 15%

The major changes incorporated into the 2009/2010 Keeyask cost estimate were as follows:

- Cost reimbursable contracting strategy with the General Civil Contractor (GCC)
- Update of assumed subcontracts to the General Civil Contract and inclusion of subcontractor profit and overhead in GCC's profit and overhead
- Update to concrete placement methodology and associated labour productivity
- Update to assumed GCC and Manitoba Hydro site staffs based on Wuskwatim (previous estimates were based solely on experience at the Limestone Project)
- Updated Turbine and Generator Costs

Conawapa

The last major, first principles re-estimate of the Conawapa G.S. project's cost was undertaken in 2010/2011. The estimate was developed following the methodology outlined in the preceding sections. This re-estimate involved detailed review of estimate assumptions, incorporation of current market conditions and inclusion of lessons learned from Wuskwatim and the 2009/2010 Keeyask re-estimate. The estimate can be considered to be a **Class 3** estimate, as defined by the Association for the Advancement of Cost Engineering (AACE) Recommended Practice 69R-12 – Cost Estimate Classification System as Applied in Engineering, Procurement and Construction for the Hydropower Industry. Refer to Figure 11-8 above for further details.

The major changes incorporated into the 2010/2011 Conawapa re-estimate were as follows:

- Fish passage included in Base Estimate
- Update of partnership related costs based on lessons learned from Joint Keeyask Development Agreement (JKDA)
- Update to turbine and generator costs

- Update to concrete placement methodology and labour productivity based on current industry information
- Update of assumed subcontracts to the GCC and inclusion of subcontractor profit and overhead in GCC's profit and overhead based on current industry information
- Update to assumed GCC and Hydro site staffs based on Wuskwatim (previously based solely on Limestone)

Stress Testing of Capital Cost Estimates in 2012

Since the detailed estimates of Keeyask in 2009/2010 and Conawapa in 2010/2011 new cost and construction marketplace information has been gathered through activities on the Wuskwatim and Pointe Du Bois projects. Additionally, a number of contracts on Keeyask have been awarded, increasing the level of definition of the Keeyask budget. As a result, in order to ensure appropriate estimate values for the Needs For and Alternatives To (NFAT) process, there was a need to conduct a rigorous review of the approved budgets for Keeyask and Conawapa. Rather than a full, detailed re-estimate of each project a sensitivity analysis (or stress test) approach was undertaken. Use of a sensitivity analysis, rather than a complete re-estimate of project cost, was identified as the preferred method to determine the adequacy of the current project budgets. There was no change to the fundamentals of the estimate (design, scope, etc.) that would typically prompt a full project re-estimate.

The purpose of these stress tests was to determine whether the approved base estimates (Point Estimate + contingency) were sufficient to address a revised assessment of uncertainty and risk associated with each project based on the most up-to-date information.

Review Methodology

The sensitivity analysis was developed following a similar process to that followed for contingency development. Key estimate variables were analyzed to determine how they may change based on their level of uncertainty or risk, creating likely cost ranges for each variable. These ranges were then compiled into a Monte Carlo simulation to identify how total project cost could change as key variables change.

The key variables for both Keeyask and Conawapa were as follows:

- Labour cost (wage $/hour)
- Labour productivity ($/unit of work)
- Estimated costs for major contracts
    - General Civil Contract
    - Construction camp
    - Turbine and generator contract
    - Electrical and mechanical contract
- Schedule
- Escalation

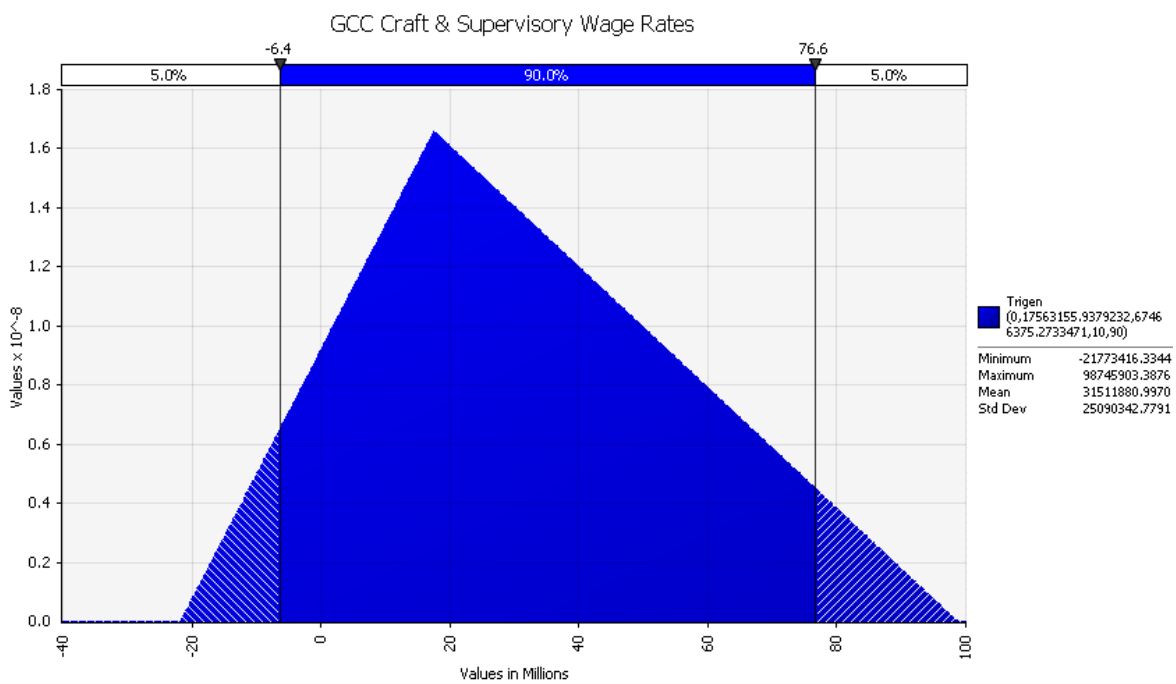
For each key estimate variable a low, deterministic (most likely) and high impact cost is estimated. The impact to the Point Estimate of these three scenarios is then established. The resulting values represent the range of potential change (increase or decrease) to the Point Estimate as a result of change in the key variable. These cost ranges were developed based on an assessment of the uncertainty and risk associated with each key variable, lessons learned from Wuskwatim and Pointe Du Bois and current market information. An example range is provided below:

Table 2.

Estimate Uncertainty Item: GCC Craft and Supervisory Wage Rates			
Point Estimate: $207,445,000			
RANGE			
	Low	**Deterministic**	**High**
Assumption	BNA Rates *$39.88/hr*	BNA + LOA Rates *$43.26/hr*	Horizon Oil Sands [1]Rates *$52.58/hr*
Impact to Estimate	$0	$19,244,000	$73,923,00

Using these three cost points we can represent the cost/risk item as a range of potential costs using a probability distribution function (pdf). A probability density (or distribution) function, in probability theory, is a function that describes the relative likelihood for this random variable to take on a given value. In this instance, it represents the likelihood of a specific cost impact to the project. A sample distribution is shown below:

Figure 7.



The resulting ranges are then entered into a Monte Carlo simulation to develop a cost curve. As part of the analysis, correlation factors were included to ensure that

[1] The Horizon Oil Sands project is a $9.7 billion oil sands project just north of Fort McMurray, Alberta. It is a remote camp operation that was constructed under a project specific labour agreement. Horizon represents a specific benchmark for wages & benefits paid to workers in the construction of a remote mega-project in the Oil Sands.

interrelated variables moved together accordingly. Over 1000 simulations were run in both the Keeyask and Conawapa analysis models. The resulting cost curve outlines the amount of funds required to cover the range of uncertainty and risk for different levels of confidence. The value at P50 in the resulting cost curve is then compared to the current project contingency to determine whether we have adequate funds to achieve a minimum 50% confidence level.

Results and Application Base Estimates

Adjustments to P50 Base Estimates

In interpreting the results of the stress analysis for the Keeyask Generating Station it was determined that the contingency amount in the approved Keeyask budget was still sufficient to meet a 50% confidence level (P50) in the overnight cost. Therefore, the P50 base estimate did not require any adjustment. The only update made to the Keeyask estimate was for actual escalation rates that had occurred (versus projected escalation) since the last detailed estimate.

Conversely, the results of the stress analysis for the Conawapa Generating Station showed that the contingency amount in the approved budget was no longer sufficient to meet a 50% confidence level (P50) in the overnight cost. As a result there was a need to increase the Conawapa contingency included in the base estimate in order to achieve a P50. As with the Keeyask estimate, the Conawapa estimate was also updated for actual escalation rates that had occurred since the last detailed estimate.

Need for Management Reserves

The other key result of the sensitivity analyses was the identification of the impact that both labour and escalation can have on the estimates. The analyses showed that labour (cost to attract/retain labour and labour productivity related costs) and escalation were by far the dominant drivers of estimate variation. At their maximum (high scenario) each risk would cause the entire contingency to be consumed. There would therefore be no contingency to address any other risks during project execution.

Based on the research conducted to develop each sensitivity analysis there was considered to be some possibility that the high scenario for labour risk could occur. Additionally, it was found that there was a reasonable likelihood that escalation would exceed the expected CPI rate.

As such, due both to the uncertainty around their occurrence and significance of their impacts, it was determined that a method should be developed to address these risks outside of the established P50 project contingency. This resulted in the development of separate Labour and Escalation Management Reserve funds. Development of each management reserve is described further in the sections that follow.

Labour Reserve

Over the past several years skilled construction labour has been in great demand and the overall costs of training, recruiting, housing and remunerating appropriately skilled workers has also increased. Labour productivity and availability has also declined based on the following drivers below:

- Major investments in oil, gas, mineral and other natural resource developments in Canada
- Federal and Provincial 'economic stimulus' initiatives targeting infrastructure renewal, largely involving the heavy construction industry
- Demographic and social trends resulting in overall shortages of skilled and experienced construction trades people

For Keeyask and Conawapa, uncertainty related to labour availability and productivity represents a significant risk due to the magnitude of the cost variation they could cause. The P50 base estimate already has some measures and contingency to deal with a degree of the labour availability and productivity issues. Based on what was experienced on Wuskwatim and what is considered within the control of the project team, the following is covered by the P50 contingency on Keeyask and Conawapa:

- Letter Of Agreements on Burntwood Nelson Agreement (BNA) wages used on Wuskwatim
- Increased staff-to-craft ratio for the General Civil Contractor (staff refer to all workers that are not on the tools (ie. superintendant, project manager, etc..) and craft refers to all workers that are on the tools (ie. carpenters, labourers etc..)
- High quality camp accommodations to aid in attracting workers comparable to other northern remote Canadian project camps
- Cost associated with increased turnarounds (2:1) for craft workers compared to standard in BNA
- Significant adjustment to electrical and eechanical estimated costs based on Wuskwatim experiences

However, the impact of labour availability and productivity issues are anticipated to exceed what is included in the P50 contingency. This is largely due to the restrictions that could be placed on the projects ability to address the current and expected state of the Canadian construction labour market. These restrictions include:

- Modifying BNA wages and turnaround schedules
- Potential restrictions on the ability to source labour from outside of Manitoba and Canada in an efficient and timely manner

Therefore, while the P50 includes a degree of contingency associated with labour availability and productivity risks, it is expected to be inadequate to address the full impact of these risks based on the potential labour environment. Hence the need for

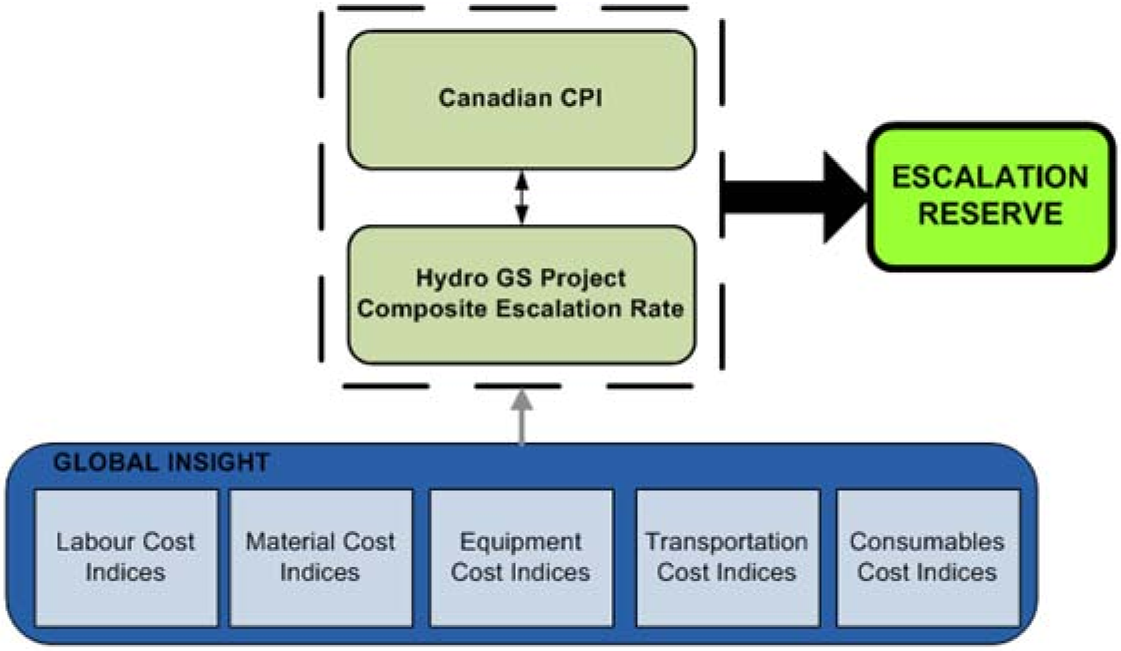
Labour Management Reserve funds to supplement the P50 contingency funds in each project's budget. In the event that the impact of these risks is less than anticipated, then the P50 contingency may be capable of fully addressing labour availability and productivity risks and the labour reserve funds will not be expended.

However, there remains a possibility that restrictions will not be removed and the labour reserve will be required. Additionally, there is a possibility that a portion of the labour reserve could still be spent even if there are no restrictions on labour due to lower than expected productivity or costs associated with obtaining labour.

Escalation Reserve

Escalation Reserve is intended to cover the anticipated additional costs to the project associated with cost escalation greater than Canadian CPI. The reserve is based on the additional costs associated with a standard year-over-year escalation rate of 2.5%, compared to escalation following Canadian CPI. This standard rate was obtained by taking the average escalation rate between the Canadian CPI and a composite escalation rate (or "basket" rate) of commodities typical of a hydroelectric generating station (e.g. steel, cement, construction labour, etc.). The composite escalation rate is developed by combining a number of individual market escalation indices (items such as construction labour, steel, cement, etc.), based on their estimated use in the construction of a generating station, to form a single composite rate. This is outlined in the figure 8 below:

Figure 8. DEVELOPMENT OF ESCALATION RESERVE



Market indices and forecasts for the items that make up the composite escalation rate were obtained from IHS Global Insight. IHS Global Insight provides omprehensive and timely analysis of economic conditions and business and investment climates for over 95 industries in 75 countries. They cover the world's industries with unparalleled expertise, market perspectives, and global analysis. IHS Global Insight also has expertise in all major industries, with special emphasis and dedicated staff providing in-depth coverage in industries including construction, energy, steel and global commerce and transport[2].

[2] Taken from Global Insight website

Current Keeyask and Conawapa Capital Cost Estimates

Keeyask Cost Estimate

The Keeyask cost estimate has been developed as per the process outlined above. The following sections provide further details on the components that constitute the overall in-service cost for the Keeyask project.

Point Estimate

Due to the advanced level of project definition, the majority of the costs in the Keeyask Point Estimate have been developed as first principles estimates. As such, the estimate includes unit rates, wage rates and other construction costs at a detailed level for all civil construction costs. Items not amenable to first principle estimating methods, such as major equipment costs, are based on quotations from potential suppliers. In all cases, costs for Keeyask are based on current construction market information and learning from projects currently under construction.

Contingency and Management Reserve

Risk Assessment

Detailed risk identification and quantification have been carried out on the Keeyask project. Both systemic and project specific risks were identified on Keeyask. Activities are on-going to mitigate identified risks. Based on its more advanced development, project specific risks are the dominant risk type on Keeyask.Of the project specific risks, there are two distinct types on Keeyask. There are manageable, “typical” project risks within the ability of the project team to manage and control through the use of contingency, and there are certain risks that fall outside of the project team’s control that can cause substantial impacts to project cost. Those risks are best addressed through management reserve funds.

Project Contingency

Contingency has been developed based on the identified risks on the Keeyask project and, as outlined, is intended is intended to address all those risks considered to be within the project teams ability to manage and control. Contingency has been developed to bring the base estimate to a P50 level.

Management Reserve

Management reserve is intended to address major risk items not amenable to being addressed through contingency. In the case of Keeyask, risks related to labour and escalation are addressed through use of management reserve funds due to the nature of these risks and the magnitude of cost variation they cause. As such, the Keeyask estimate includes both a Labour Reserve fund and an Escalation Reserve fund.

Base Cost

The Keeyask base cost includes the Point Estimate, project contingency to bring the estimate to a P50 confidence level and management reserve funds to address the critical risks associated with labour and escalation. The base cost does not include money spent-to-date, any interest costs or CPI escalation. As such, the base cost represents overnight cost to construct the project and is communicated in current dollars.

In-Service Cost

The Keeyask in-service cost includes all base costs as well as money spent-to-date, interest costs and escalation costs. It represents the total cost of the project once in-service. The total anticipated in-service cost for Keeyask based on a 2019 first unit in-service date and including all items outlined above is $6.2 Billion.

Conawapa Cost Estimate

Like Keeyask, the Conawapa cost estimate has been developed as per the process outlined above. The following sections provide further details on the components that constitute the overall in-service cost for the Keeyask project.

Point Estimate

Sufficient project definition and design work has been completed on Conawapa to allow for the majority of the costs in the Point Estimate to be developed as first principles estimates. As such, the estimate includes unit rates, wage rates and other construction costs at a detailed level for all civil construction costs. Items not amenable to first principle estimating methods, such as major equipment costs, are based on quotations from potential suppliers. In all cases, costs for Conawapa are based on current construction market information and learning from projects currently under construction.

Contingency and Management Reserve

Risk Assessment

Detailed risk identification and quantification has been carried out on the Conawapa project. As detailed stage V engineering on Conawapa has not yet begun, both systemic and project specific risks exist on the Conawapa project with neither being the dominant risk type. Project development activities, including finalization of Stage IV engineering, are on-going to mitigate identified risks.

Risks on Conawapa, both systemic and project specific, can be categorized into two distinct types. There are manageable, “typical” project risks within the ability of the project team to manage and control through the use of contingency, and there are certain risks that fall outside of the project team’s control that can cause substantial impacts to project cost. Those risks are best addressed through management reserve funds.

Project Contingency

Contingency has been developed based on the identified risks on the Conawapa project and, as outlined, is intended is intended to address all those risks considered to be within the project teams ability to manage and control. Contingency has been developed to bring the base estimate to a P50 level.

Management Reserve

Management reserve is intended to address major risk items not amenable to being addressed through contingency. In the case of Conawapa, as with Keeyask, risks related to labour and escalation are addressed through use of management reserve funds due to the magnitude of the cost variation they cause. As such, the Keeyask estimate includes both a Labour reserve fund and an Escalation Reserve fund.

Table 3. In-service costs (project budget).

	Conawapa 2025/26 CEF12/IFF12	Keeyask 2019/20 CEF12/IFF12
	(Billions of Dollars)	
Generating Station		
Point Estimate	4.53	3.05
Contingency	0.75	0.53
Management Reserve		
Labour Reserve	0.51	0.38
Escalation Reserve	0.34	0.12
Total Base Dollars	**6.1**	**4.1**
Total Dollars Spent As of March 31, 2012	0.23	0.50
2012 Base Estimate	6.13	4.08
Escalation @ CPI	1.24	0.40
Capitalized Interest	2.59	0.85
In-Service Cost:	**10.2**	**5.8**
Interest on MH Equity	**N/A**	**0.2**
Generation Outlet Transmission (GOT)		
Total Dollars Spent As of March 31, 2012	0.00	0.00
2012 Base Estimate	0.01	0.16
Escalation @ CPI	0.00	0.02
Capitalized Interest	0.00	0.03
In-Service Cost:	**0.0**	**0.2**
Total In-Service Cost:	**10.2**	**6.2**