Nalcor Energy – Lower Churchill Project

Cost Escalation Methodology Overview

March 2011

Introduction

This document outlines the cost escalation methodology employed by Nalcor Energy to estimate the cost escalation for the Lower Churchill Project.

Cost escalation for large, long-term construction projects such as the Lower Churchill Project (NE-LCP or the Project) is an important factor in determining the ultimate in-service capital costs. Given the long time period required to construct the Project and the lag between cost estimate development and the start of construction, it is critical to understand the causes and effects of cost escalation to be able to make an estimate of the additional costs required as a result of cost increases expected to be incurred over the course of the construction period.

Background

Escalation refers to cost changes which result from changes in price levels. These changes in price levels in turn are driven by underlying economic conditions. Escalation is driven by changes in productivity, technology, and market conditions, including high demand, labour and material shortages, profit margins, and other factors. Escalation includes the effects of inflation, but is fundamentally different. Inflation refers to general changes in price levels caused by changes in the value of currency and other broader monetary impacts.

Historically, escalation was treated in a simplistic manner. An overall escalation rate was decided upon using global aggregate indices and applied across the entire project costs (i.e. "use 2% per year"). Given changes in the economic climate, particularly volatility in commodity prices, skilled labour shortages, overall global economic uncertainty, globalization of the economy, just-in-time inventories, and shortened supply cycles it was determined that a more sophisticated approach to estimating escalation was required.

Approach and Methodology

Following extensive research on the topic, Nalcor Energy engaged the services of Validation Estimating [1] – a US-based consultancy which provides various cost engineering services, including cost escalation services - to assist with developing a cost escalation model for the NE-LCP. In its assessment, Validation Estimating recommended a number of best practices for cost escalation. Table 1 below lists the recommended best practices and identifies the extent to which they were met for the Lower Churchill Project escalation model.

Building on these recommended best practices, Nalcor Energy developed a methodology for estimating cost escalation that links the capital cost estimate with the project scheduling activities, resulting in a model and system that provides time-phased escalation estimates on commodity, project component and aggregate levels.

[1] Validation Estimating has provided services to numerous large companies, including Aramco, BP, Black&Veatch, Chevron, Dow Corning, Eastman, Enbridge, Manitoba Hydro, Ontario Power, Petro-Canada, Rio Tinto Alcan, and Suncor among others.

Table 1: Cost Escalation Best Practices

Best Practice as Recommended by Validation Estimating	Included in NE-LCP Escalation Model
Differentiate between escalation, currency and contingency	Yes
Use indices that address differential price trends between accounts	Yes
Use indices that address levels of detail for various estimate classes	Yes
Leverage procurement/contracting specialist's knowledge of markets	Yes
Leverage economist's knowledge (i.e., based on macroeconomics)	Yes
Ensure that a consistent approach is applied in a model that facilitates best practice	Yes
Calibrate data with historical data	Yes
Use probabilistic methods	To be determined pending further investigation
Use the same economic scenarios for business and capital planning	Yes
Include as a part of an integrated project/cost management process	Yes
Facilitate estimation of appropriate spending or cash flow profile	Yes

Step-by-Step Methodology

The methodology employed to estimate escalation for the Lower Churchill Project involved the following steps:

- The detailed cost estimates for the project components are contained in PRISM Project Estimator [2]. Each line item is detailed with quantities, costs and units for labour, materials, equipment, process equipment and sub-contracts. The costs are expressed in Q1 2010 Canadian dollars.
- The detailed PRISM Project Estimator data was exported to MS Excel identifying each line item by Physical Component of the Project's Work Breakdown Structure (e.g. powerhouse, spillway, switchyard, etc.), quantity, units of measurement, unit costs and current dollar cost.
- Materials were coded against applicable cost indices from Global Insight and Power Advocate.

[2] PRISM Project Estimator is a project cost estimating tool contained within the PRISM software suite provided by Ares Corporation.

- Cost indices were selected based on a review of the available indices. Where suitable indices were not available, indices were developed based on our understanding of the breakdown of the costs.
- The PRISM costs were adjusted to remove labour, parts, tires, etc. from the equipment rental costs. The residual amount represented the ownership costs and was escalated at the rates for construction machinery and equipment.
- The PRISM output was entered into the escalation model and each line item was coded with an escalation index category (referred to as Escalation Bins).
- The costs were then compiled into a matrix with all items allocated to Escalation Bins by Physical Component of the plant.
- The costs by bin and physical component were then entered into Primavera[3] and matched against the project schedule. The output from this step was a monthly cash flow by Physical Component and Escalation Bin. Following input of the cost data, Primavera generates a time-phased cost flow for the project for each Escalation Bin, which is then entered back into the escalation model. The escalation model applies the annual escalation factor for each Escalation Bin and generates the escalated cash flows for the Project by physical component. The model then generates results for the escalated costs both by Escalation Bin and by Physical Component over the life of the project.
- The totals are then compiled by both Physical Component and Escalation Bin showing the annual escalation by Physical Component and Escalation Bin for the entire Project. Escalation is calculated quarterly for the first two years and annually thereafter.

Escalation Indices

Indices applied to each of the escalation bins were obtained from one of two forecasting services used by the NE-LCP. Global Insight and Power Advocate are two commercial services which provide price and economic forecasting services. A brief overview of each service follows.

[3] Primavera Project Planning software is an enterprise project management suite provided by Oracle Corporation.

Global Insight

IHS Global Insight provides the most comprehensive economic, financial, and political coverage available from any source to support planning and decision making. Using a unique combination of expertise, models, data, and software within a common analytical framework, Global Insight covers over 200 countries and more than 170 industries.

Recognized as the most consistently accurate forecasting company in the world, IHS Global Insight has over 3,800 clients in industry, finance, and government with revenues in excess of $100 million, 700 employees, and 25 offices in 14 countries covering North and South America, Europe, Africa, the Middle East, and Asia.

Power Advocate

Established in 1999, Power Advocate is a US-based consultancy which specializes in providing market intelligence and cost forecasting services for the power industry. They provide cost forecasting services at a number of levels from base commodities to the plant/project level (e.g. combined-cycle gas turbine plant or a transmission project). While Global Insight was used as the primary source of indices, they were supplemented where deemed appropriate by information from Power Advocate. The use of Power Advocate's market intelligence was limited because they do not provide any hydro-specific indices or analysis.

The indices from Global Insight are the primary indices used in the analysis. The specific indices used in this report are from Global Insight's Q1 2010 report. For the first two years of the analysis, quarterly indices were used, followed by annual indices thereafter.

Calculated Escalation Factors

The calculated cumulative escalation factors for Muskrat Falls, Labrador – Island Transmission Link, and Maritime Link using the Escalation Model developed in accordance to the above methodology are provided in the table below.

Component	2010	2011	2012	2013	2014	2015	2016	2017	2018
Muskrat Falls	1.00	1.02	1.05	1.11	1.16	1.20	1.23	1.26	1.30
Labrador – Island Transmission Link	1.00	1.02	1.04	1.08	1.12	1.16	1.20	1.24	1.29
Maritime Link	1.00	1.02	1.03	1.10	1.12	1.16	1.18	1.22	1.28