

**From:** [pharrington@nalcenergy.com](mailto:pharrington@nalcenergy.com)  
**To:** [briancrawley@nalcenergy.com](mailto:briancrawley@nalcenergy.com); [gbennett@nalcenergy.com](mailto:gbennett@nalcenergy.com); [dawndalley@nalcenergy.com](mailto:dawndalley@nalcenergy.com)  
**Cc:** [jasonkean@nalcenergy.com](mailto:jasonkean@nalcenergy.com)  
**Subject:** Deck for use with NS, NL, Feds  
**Date:** Wednesday, August 8, 2012 10:35:41 AM  
**Attachments:** [\\_png](#)  
[Reasons for cost growth - NL,NS,Feds.pptx](#)

---

I have worked on the deck that Jason developed to explain the cost growth since DG2 and have had to add a few slides and take out a few points that could trigger a reaction from NS,NL or the Feds - Ed is always asking how we can explain how we could not predict the DG3 costs - so I have tried to answer that question - Comments , I may need to run with this at short notice

Regards Paul



Reasons for cost growth - NL,NS,Feds.pptx



Paul Harrington  
Project Director  
LC Mgmt & Support  
Nalcor Energy - Lower Churchill  
Project  
t. 709 737-1907 c. 709 682-1460  
f. 709 737-1985  
e.  
[PHarrington@nalcenergy.com](mailto:PHarrington@nalcenergy.com)  
w. [nalcenergy.com](http://nalcenergy.com)  
1.888.576.5454

This email communication is confidential and legally privileged. Any unauthorized reproduction, distribution or disclosure of this email or any attachments is strictly prohibited. Please destroy/delete this email communication and attachments and notify me if this email was misdirected to you.

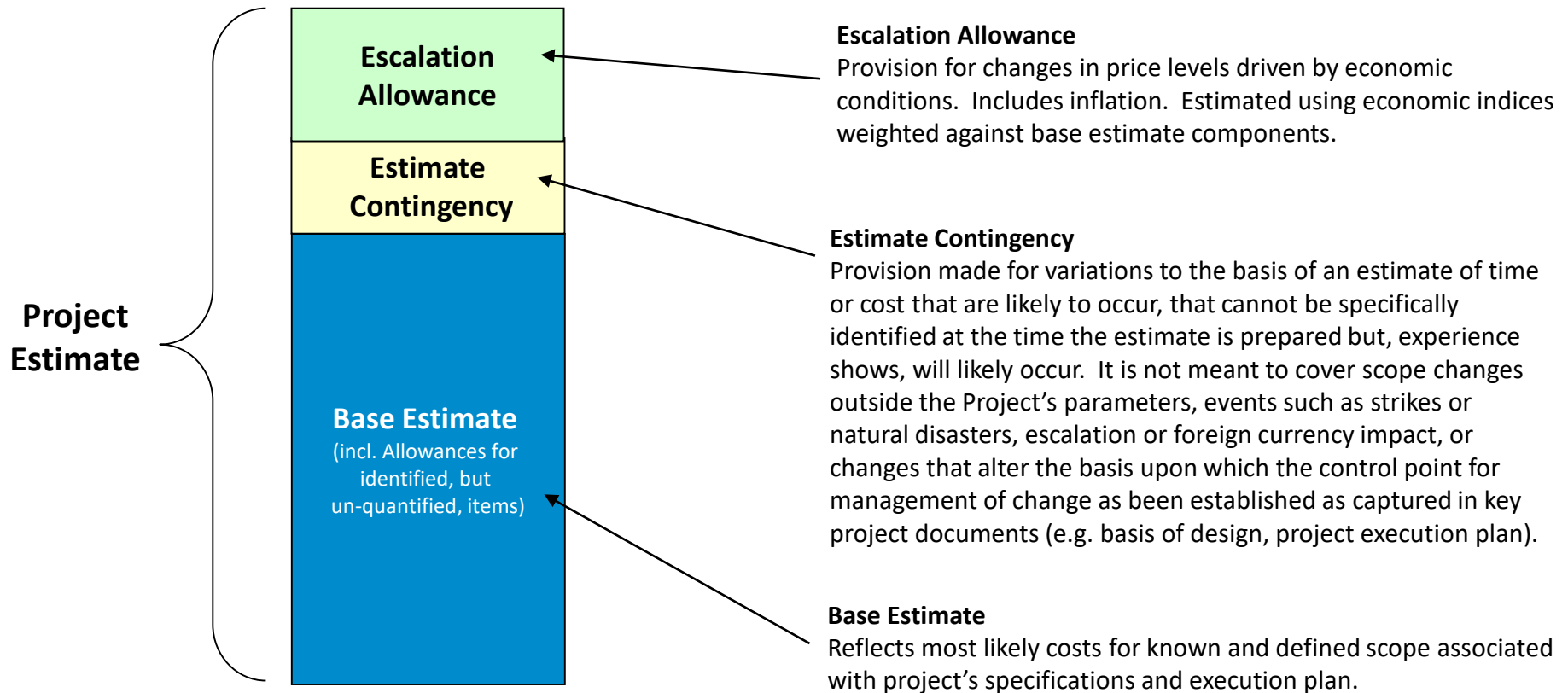
# DG3 Estimate Overview

8 August-2012

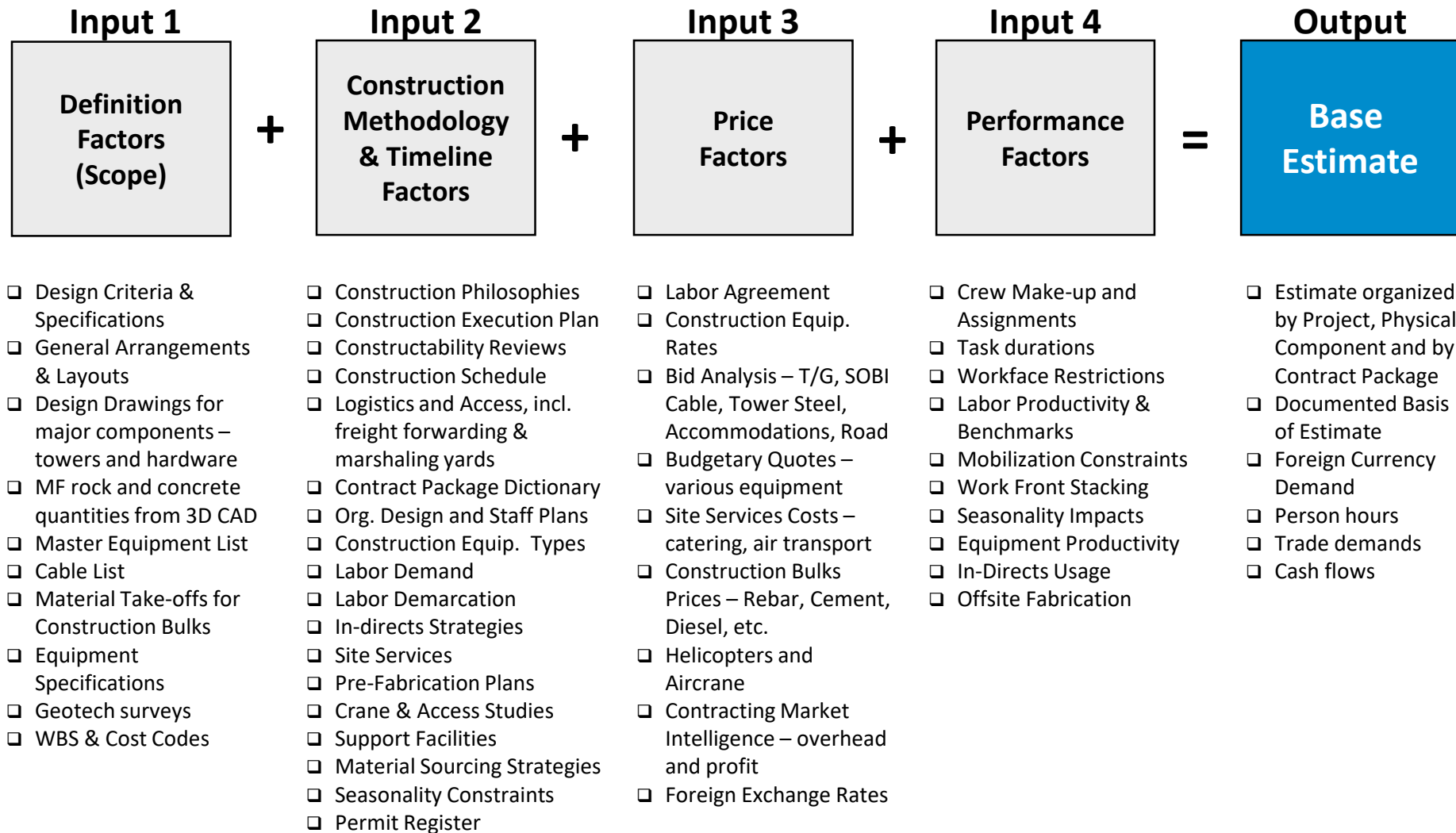
Boundless Energy



# Cost Estimate is comprised of 3 Primary Components



# Estimate Leverages Extensive Information



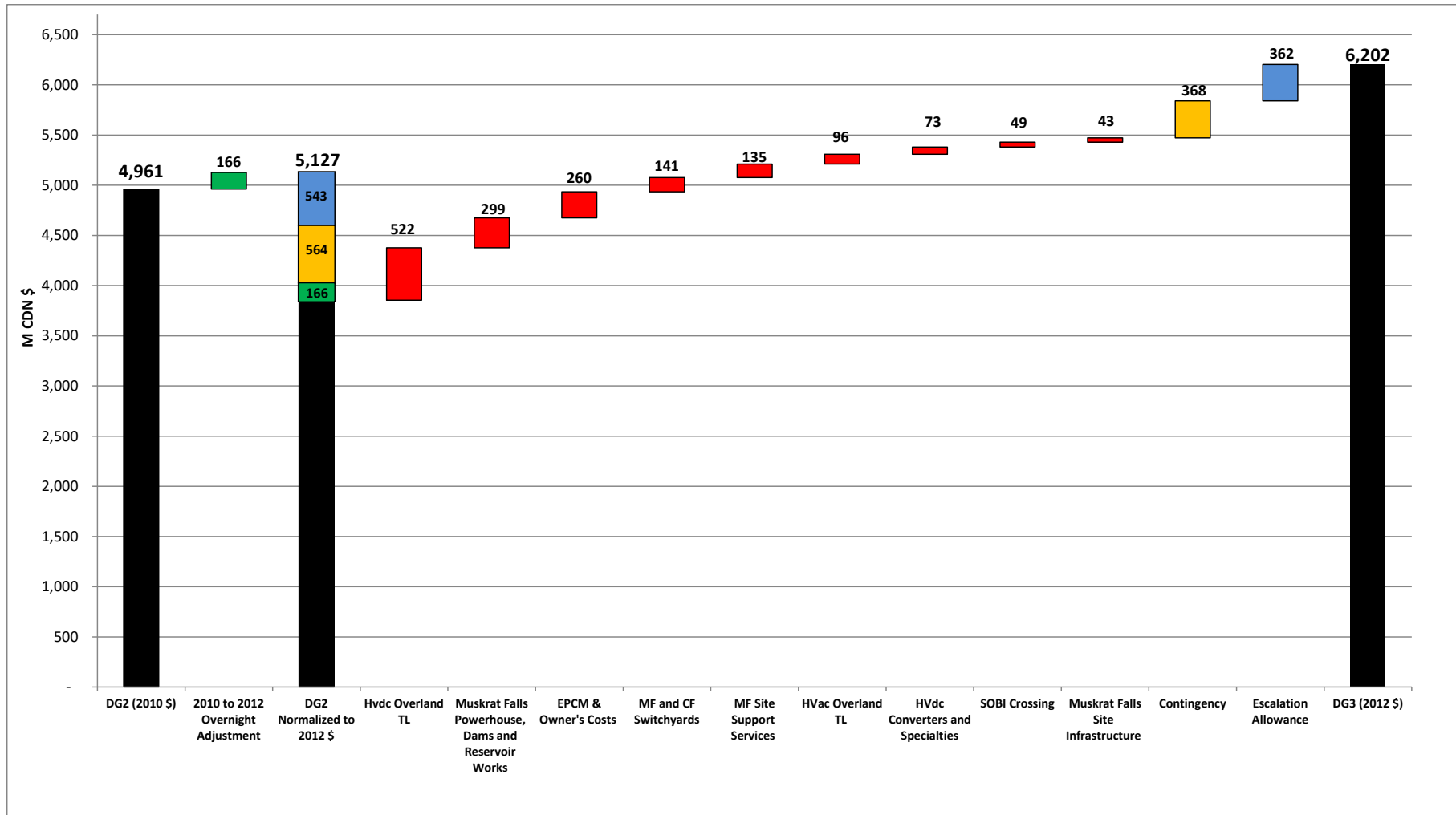
# DG3 Estimate Summary

**LCP Phase 1 (Excluding Maritime Link)**  
**DG3 Estimate Summary (millions Jan 2012 CDN \$)**

	MF	LTA	LITL	Totals
Base Estimate	\$2,511.92	\$601.31	\$2,359.61	\$5,472.84
Contingency	\$226.69	\$54.83	\$86.48	\$368.00
Escalation Allowance	\$162.54	\$35.44	\$163.66	\$361.64
<b>Totals</b>	<b>\$2,901.15</b>	<b>\$691.58</b>	<b>\$2,609.75</b>	<b>\$6,202.48</b>

<b>% of Total</b>	<b>46.8%</b>	<b>11.2%</b>	<b>42.1%</b>	<b>100.0%</b>
-------------------	--------------	--------------	--------------	---------------

# Cost Growth Since DG2



# Why do cost increases occur between DG2 and DG3?

- Main reason is the amount of project definition on which to base the estimate.
- Up until DG2 the project team was evaluating many options for the Lower Churchill Project
- Site investigation, detailed engineering , computer/physical models all follow the DG2 decision on the selected development alternative
- You need to carry out the detailed work in order to have a mature DG3 estimate, costs will change with better definition of the selected alternative

# Selecting and Detailing the Selected Alternative

## Alternatives Considered and Screened

- Gull Island first plus Lab Island Link
- Gull Island first plus Lab Island Link and Maritime Link
- Isolated Island alternatives
  - Wind, LNG, Offshore Gas, Small Hydro, conservation, Holyrood life extension and scrubbers & precip combinations,
- Import power until 2041
- Muskrat Falls first plus Lab island link-various voltages and HVdc technologies
- Muskrat Falls plus Lab Island Link and Maritime Link – various voltages and HVdc technologies
- SOBI crossing method – tunnel/sea bed option

Phase 2 Generate and Select Alternatives  
Engineering between 2% to 5%

## GATE 2 DECISION

## Selected Alternative carried forward into detailed engineering

- Muskrat Falls plus Lab Island Link and Maritime Link using SOBI sea bed option and selected voltages, ratings, HVdc technology

Phase 3 Engineering & Procurement/Contracting of Selected Alternative  
Engineering > 40%

## GATE 3 DECISION

Go/NoGo



# Why are costs not accurately predictable at DG2?

- A DG2 decision is made based on limited engineering definition < 5%
- It is not recommended practice, economic or practical to advance into detailed engineering all alternatives
- The DG2 decision is used to select the alternative to move forward with
- It is only after spending the time, effort and energy after DG2 on the selected alternative that the final quantities of rock, material, concrete, steel, person hours are known based on site investigation work, analysis and detailed engineering > 40%
- Market conditions known at DG2 change and are firmed up after DG2 with actual contract bids
- The DG3 estimate contains actual firm contract prices and reflect the prevalent market conditions
- Moving ahead with the selected alternative involves significant cost investment to arrive at a DG3/Sanction Quality estimate based on firm quantities, person hours and design basis –LCP has incurred ~ \$155M since DG2 to advance our understanding of the project costs

# HVdc Overland TL

**Cost increases were driven by information not known at DG2 and required detailed engineering and analysis to firm up:**

1. Operating voltage optimization (320 to 350kV) – less losses – results higher towers and different conductor
2. Ice loading criteria and physical data collection –results in more robust towers
3. Detailed line routing and construction methods, longer route and more difficult access (e.g. helicopter construction)
4. Definition of ROW Clearing Scope – approx. \$130M
5. Increased Labor cost
6. Increased Material cost – budgetary prices or bids for all material
7. Material handling cost – marshalling yards and shipment

# MF Powerhouse, Intake, Dams and Reservoir

**Cost increases were driven by information not known at DG2 and required detailed engineering, computer/physical modeling and analysis to firm up:**

- Layout / design change to resolve:
  1. Hydraulic flow conditions for turbines
  2. Stability of Intake Structure
  3. Operability of Spillway Gates in winter
- Results in significant increase in concrete quantities, thus Materials and Person-hours which is the major cost driver for MF.
- Changes identified with computer model were subsequently confirmed with Physical Model built in Edmonton.
- Secondary drivers include general material costs, batch plant, etc.

# EPCM and Owner Cost

- **Primarily driven by the highly competitive market in engineering and procurement that has developed in Canada and NL since DG2 compounded by limited availability of hydro/transmission specialists:**
  1. Market conditions require a change from an Integrated to EPCM Model
  2. Market conditions for engineers and technologists in the Province have driven rates up above that allowed for in the DG2 estimate
  3. Engineers, specialists and project management personnel brought in from out of Province to meet the project demand with associated additional costs, travel, living allowance, project uplift
  4. Increase the estimated resources for Construction Management to manage and provide oversight of the contractors.
  5. Rates for EPCM O/H and Profit were previously estimated, now based upon executed contract.
  6. Additional carrying costs associated with delays to Environmental Assessment process and legal costs associated with legal challenges.
  7. Additional unplanned reviews by PUB , MHI and Navigant

# MF and CF Switchyards

**Cost increases were driven by information not known at DG2 and required detailed engineering, site investigation to firm up:**

- Including:
  1. Finalization of Single-Line Diagrams for Switchyards
    - 735kV switchyard – was previously part of Gull Island then included in the Muskrat scope post DG2 and the switchyard and equipment was relocated to the Churchill Falls yard, working in a brownfield site results in additional costs.
  2. Requirement to establish site services support at CF for 2+ years
  3. Sparing requirements – now established and included
  4. Material prices
  5. Logistics / transport cost for heavy lift items (i.e. transformers) now considered

# MF Site Support Services

- **Primarily driven by the highly competitive market in Camps and services that has developed in Canada and NL since DG2**  
Including:
  1. Operating costs for increased person-hours of construction effort for Muskrat Falls
  2. Market costs for services such as catering and housekeeping
  3. Laboratory and Surveying Scope increase for larger, more complex MF plant
  4. Medical and security requirements
  5. Increased Cost of services such as ground transportation, drug and alcohol testing, pre-employment medical screening, road maintenance, vehicles

# HVac Overland TL

**Cost increases were driven by information not known at DG2 and required detailed engineering, site investigation to firm up:**

- Including:
  1. Detailed line routing and construction methods
  2. Definition of ROW Clearing Scope
  3. Communication costs
  4. Increased Labor cost
  5. Increased Material cost – budgetary prices or bids for all material
  6. Increased support services costs – marshalling yards, catering, camp, travel, medical support, etc.

# HVdc Converters & Specialties, and Island Upgrades

**Cost increases were driven by information not known at DG2 and required detailed engineering, site investigation to firm up:**

- Including:
  1. Operating voltage optimization (320 to 350kV)
  2. Increased scope of Holyrood Conversion for Synchronous Condenser support
  3. Finalization of Electrodes Sites
    - The electrode line length in Labrador was increased to the SOBI in order to achieve the required technical grounding requirements.
  4. Requirement for Indoor Cable Transition compounds to reduce salt contamination risk
  5. Redundancy/reliability requirements resulting in additional cable switching facilities to facilitate remote energization of the spare cable



# SOBI Crossing

**Cost increases were driven by information not known at DG2 and required detailed engineering, site investigation to firm up:**

- Including:
  1. Final project definition and cable routing
  2. Confirmed cable supply / install prices from RFP
  3. Confirmed ice protection requirements for shoreline and seabed
  4. Actual HDD drilling rates from 2011/12 pilot program

# MF Site Infrastructure

**Cost increases were driven by information not known at DG2 and required detailed engineering, site investigation to firm up:**

- Including:
  1. Scope growth
    - Requirement to replace existing forestry access road
    - Increase in construction power load
    - Construction telecommunications
  2. Movement of MF Accommodations Complex due to poor geotechnical issues
  3. Allowances for offsite access upgrades – port facilities and bridging for movement of heavy items
  4. Market conditions for packages that are IBA designated

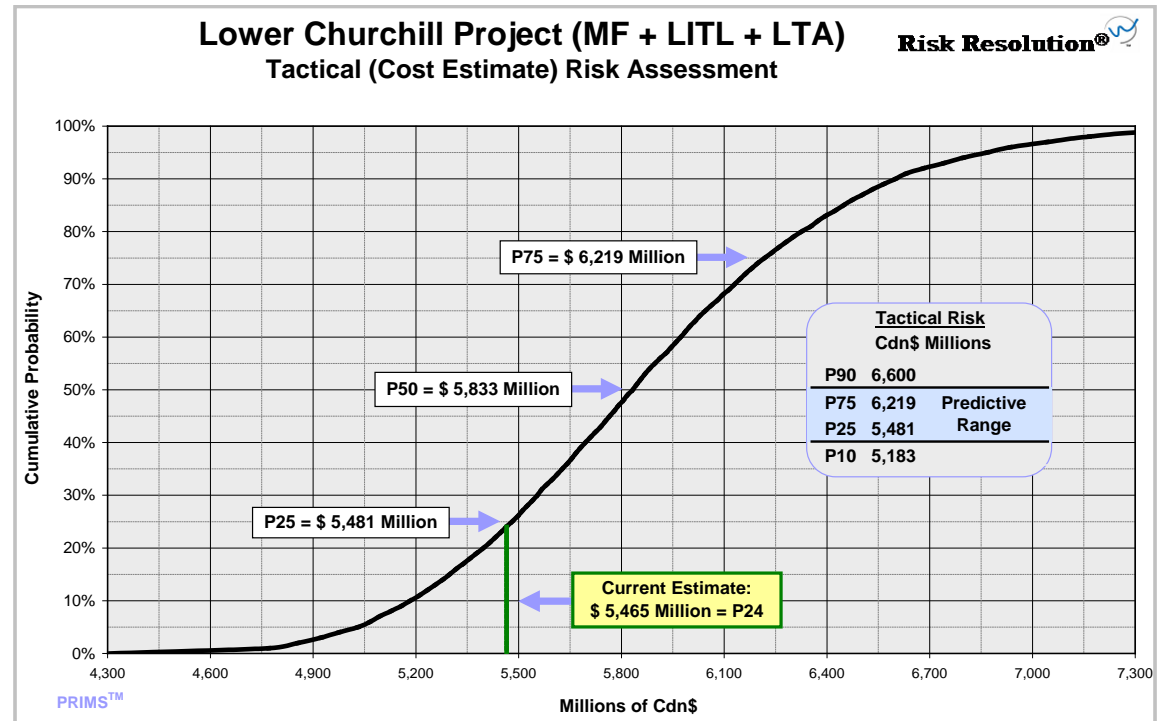
# Contingency Recommendations

- Westney engaged to conduct risk assessment in late May / early June with Project Team. Key Findings:

1. *The scope for the project is well defined and represents design development consistent with project sanction. Considerations, such as likely geotechnical conditions and quantity variations due to further design development, were quantified based on the experience of the project team and used as a basis for assessing the possible outcomes.*
2. *The estimate and quantification are consistent with the requirements of project sanction. In many cases, pricing was based on actual bids and budgetary quotes. “Check” estimates were developed by industry experts for key areas, including the Muskrat Falls powerhouse and dam works. Other pricing was benchmarked against representative projects. The effects of weather, labour /skills availability, and supervision were also considered and/or benchmarked. Overall, this project’s degree of design development, definition, and methodology is consistent with an AACEI Class 2 estimate.*
3. *The estimate, plus an amount to reach the P50 on the results curve, should represent the cost at which the project can be executed according to the plan exclusive of external uncertainties.*
4. *A P50 contingency is \$368 million which equates to 7% of the estimate.*

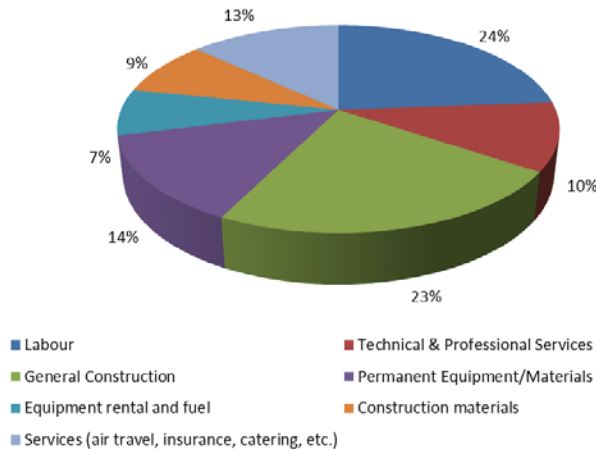
# Tactical Risk Analysis Results (Westney)

*Risk Analysis for the overall Lower Churchill Project suggests, at a P50 value, the project contingency would be \$368 million (\$5,833 million minus \$5,465 million), which equates to 7% of the estimate.*

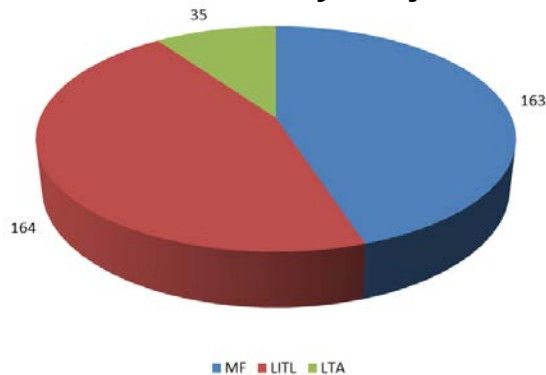


# Escalation Allowance

**Escalation by Cost Type**



**Escalation by Project**



- \$360 million in total escalation
- Custom project-specific model developed
- Used a combination of Global Insight, Power Advocate and LCP market intelligence
- Costs broken down into 30 bins
- Contract pricing provides greater certainty for some project components

# Back-up Material



# DG2 Estimate Summary

**LCP Phase 1 (Excluding Maritime Link)  
DG2 Estimate Summary (millions Jan 2010 CDN \$)**

	MF	LTA	LITL	Totals
Base Estimate	\$1,947.46	\$290.95	\$1,615.93	\$3,854.34
Contingency	\$284.33	\$43.64	\$236.12	\$564.09
Escalation Allowance	\$273.49	\$61.35	\$208.00	\$542.84
<b>Totals</b>	<b>\$2,505.27</b>	<b>\$395.94</b>	<b>\$2,060.05</b>	<b>\$4,961.27</b>

<b>% of Total</b>	<b>50.5%</b>	<b>8.0%</b>	<b>41.5%</b>	<b>100.0%</b>
-------------------	--------------	-------------	--------------	---------------

# Questions

