



INDEPENDENT PROJECT ANALYSIS

*excellence through measurement*

# **Mid-Execution Assessment**

## **Nalcor Lower Churchill Project**

**Presented to Lower Churchill Project Team**  
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**December 2015**



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# Objectives

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- **Assess management approaches and practices used in Lower Churchill Project\* (LCP)**
  - LCP is currently in mid construction phase
- **Identify relative risks that may affect the project as field construction progresses**
  - Learn from past megaprojects to prepare for potential risks that may need to be adequately managed
- **Provide recommendations to reduce execution risks and to achieve successful completion**

\* Information used in the analysis is based on project interviews, documentation received, and subsequent communications with the LCP team



## Key Message

- **LCP has characteristics that are comparable to those of successful megaprojects:**
  - **LCP established solid foundations for team effectiveness, overall good staffing, and Transition to Operations (TTO) organization to ensure optimal business value**
  - **Clear understanding of progress recently confirmed by the September 2015 re-baseline and systems are in place to manage and control progress**
- **To succeed, LCP should continue strengthening its organization and planning**
  - **Focus on Muskrat Falls generation construction management and team alignment and ensure targets are achievable**
  - **Strive to maintain continuity of senior project management and construction safety focus**
  - **Continue strengthening TTO organization**



# Overall Key Findings (1)

- **Organization is well staffed and teams are well developed**
  - **Solid foundations for team effectiveness established early in project development**
  - **LCP teams are well developed and the organization has overall good staffing**
  - **Continuity of senior management is a strength**
- **Important opportunities remain**
  - **Increasing alignment between owner and non-owner staff and vertical alignment among senior and lower management levels**
  - **Increasing construction management staffing and interfaces for Muskrat Falls Generation scope and ensure adequate management field presence**



## Overall Key Findings (2)

- **LCP Project has achieved significant progress in execution and is organizing to complete construction and to start operations**
  - **Clear understanding of progress recently confirmed by the September 2015 re-baseline**
  - **Systems are in place to manage and control progress**
  - **Proactive collaborative approach with contractors**
  - **Transition to Operations (TTO) strategy is sound and well established**



## Overall Key Findings (3)

- **The assessment revealed that LCP strategies are consistent with the focus on achieving successful LCP execution to completion**
- **Opportunities remaining**
  - **Update the execution plan to completion (e.g., Muskrat Falls' schedule) to reflect the latest re-baseline**
  - **Increase details of TTO plans**



# Outline

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- ***Introduction***
  - ***Independent Project Analysis Expertise***
  - ***Basis of Analysis***
- **LCP Development and Execution**
- **Organization and Team Effectiveness**
- **Selected Megaproject Lessons**
- **Conclusions and Recommendations**



# IPA Is the World's Leading Advisory Firm on Capital Project for the Last 30 Years

CIMFP Exhibit P-01902

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## Data

*Build carefully normalized project databases*

- **17,000+ capital projects from multiple industries**
  - 500+ megaprojects and 400+ Canadian projects
  - Owners, operators, EPCs, and service providers
  - Information obtained from project teams several points in project cycle

## Empirical Research

*Develop statistical models & build comparison groups*

- **First principles and statistical analysis**
  - 500+ project research studies
  - Practices vs. results
  - Industry/sector trends and whitepapers
  - Customized research for individual companies
- **30+ research professionals**

## Knowledge Transfer & Exchange

*Tools provide robust basis for quantitative analysis*

- **Performance and plans**
  - Individual project or system assessments
  - System and portfolio benchmarking, process improvements
  - Organization and staffing analysis
  - Customized consulting
  - Implementing Best Practice programs



- **IPA has worked in the past 25 years with leading private and state-owned companies and joint ventures worldwide**
  - **Exxon Mobil, Shell, Chevron, Total, BP, Conoco Phillips, Anadarko, Nexen, Marathon, and other major oil companies**
  - **State-owned or partially state owned companies such as Saudi Aramco, Pemex, Petronas, Petrochina, Statoil, Petrobras, PDVSA, ADNOC, OMV, Oman Oil, Sabic, Repsol, and Codelco**



# Basis of Analysis

- **Organization charts and team staffing for 50 global megaprojects**
  - **Over 20 functions, both line and support positions**
  - **Over 8,000 individual positions**
  - **Model-based approach that controls for project characteristics such as project size and scope, contracting strategy, number of sub-scopes, and project type**
- **Lessons from over 500 global megaprojects and over 500 research studies**



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- Introduction
- ***LCP Development and Execution***
- Organization and Team Effectiveness
- Selected Megaproject Lessons
- Conclusions and Recommendations



- **LCP is providing renewable electrical energy and contributing to Newfoundland Labrador (NL) development**
- **Design and install hydroelectric generation facilities, transmission links, and support structures**
  - **Muskrat Falls Generation (MFG) includes 4 206-MW (totaling 824-MW) turbine/generators, dams/spillways, river diversion, north spur stabilization, reservoir, access road, and buildings**
  - **Labrador Island Transmission Assets (LITL) includes:**
    - **Island Link  $\pm$ 350-kV HVdc transmission connection from Muskrat Falls to Soldier's Pond (over 1,050 km of Transmission Line)**
    - **HVac to HVdc converter stations, shore electrodes, and 30 km of 350-kV HVdc cable crossing at Strait of Belle Isle (SOBI)**
  - **Labrador Transmission Assets (LTA) includes 315-kV HVac transmission interconnection from Muskrat Falls to Churchill Falls and HVac switchyards**



- **Owner developed business case and did Front-End Loading (FEL) with assistance from consultants**
- **In February 2011, SNC Lavalin in St. John's continued project definition and started detailed engineering under reimbursable contract\***
- **LCP team obtained environmental permits, agreements with Innu Nation, local communities, and other stakeholders**
- **Nalcor reached agreement with Emera to build Maritime Link to Nova Scotia**

\* Execution phase start with production of issue for construction drawings and ends in mechanical completion. LCP's start of detailed engineering followed Nalcor's Gateway process



- **Canadian government provided \$5 billion loan guarantee and NL province provided equity guarantee for completion**
- **LCP's December 2012 authorization was supported by the Canadian and NL governments and NL stakeholders**



# LCP Project Execution Organization

- **LCP execution was organized under an Executive Committee, LCP Vice-president, LCP Corporate Integrator, and Project Director**
- **LCP use a Project Delivery Team Model that consists of Nalcor staff, significant SNC-Lavalin resources, third party consultants, and independent consultants**
- **Project Director leads Functional Managers, General Project Manager, and SOBI Manager**
- **LCP team has significant participation from non-owner staff (consultant and agency professionals) in leadership roles**





# LCP Status and Progress Key Findings (1)

- **LCP has achieved significant progress in execution and is organizing to complete construction and start operations**
  - **Systems in place and coordinated effort by quality management, project controls, procurement, and technical integration**
  - **Collaborative approach with contractors**
  - **LCP team is updating its detailed construction plan and schedule to completion as part of the re-baseline effort for MFG**
- **Re-baseline efforts helped LCP team communicate progress and organize path forward**
- **Established TTO organization manages mechanical completion, transition to operations, and optimizes commercial value**



## LCP Status and Progress Key Findings (2)

- **LCP has the following characteristics that are comparable to those of successful megaprojects moving forward:**
  - **Clear understanding of progress recently confirmed by re-baseline of September 2015**
  - **Systems in place to manage and control progress**
  - **Organization to manage all execution scopes and transition to operations**
  - **Proactive collaborative approach with contractors**
- **LCP should continue the continuous control and detailed planning to ensure meeting the recently updated project targets**



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- ***Organization and Team Effectiveness***
- Selected Megaproject Lessons
- Conclusions and Recommendations

# Components of Team Development Index (TDI)

## Project Objectives

- Specific project objectives developed
- Objectives clearly communicated to and understood by team members

## Team Composition

- All functions that can influence project outcomes adequately represented on team

## Roles & Responsibilities

- Roles, responsibilities, and expectations clearly defined
- Responsibilities and tasks agreed on
- Project team aligned
- Problem areas identified

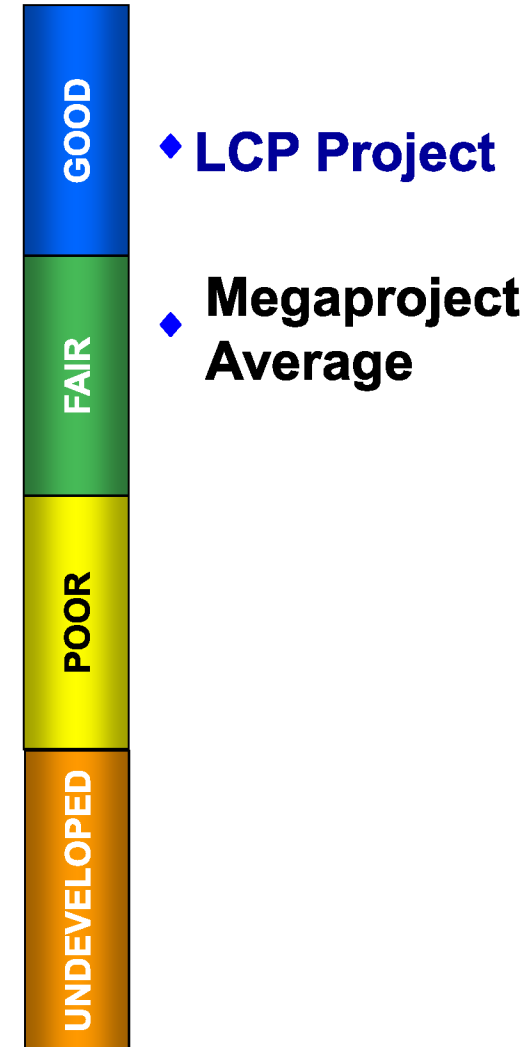
## Project Implementation Process

- Common work process in place for developing and executing projects
- Process understood by project team

# LCP TDI Is Good

## *LCP Project Team Is Integrated*

- **Business and project objectives are clearly defined and communicated**
- **Project team is fully integrated with all functions that have influence on project success**
- **Roles and responsibilities are defined, and risks have been frequently assessed**
- **Nalcor's Gateway work process followed**



# Key Drivers of Megaproject Performance

## *LCP Team Established Drivers of Team Effectiveness*

<b>Key Project Characteristics of Successful Megaprojects</b>	<b>LCP Status</b>
<b>Clear Defined Objectives</b>	<b>Yes</b>
<b>Critical Owner Team Members*</b>	<b>Yes</b>
<b>Team Development Index</b>	<b>Good</b>
<b>Integrated Team</b>	<b>Yes</b>
<b>Project Director/Manager Continuity</b>	<b>Yes</b>

\* Critical functions include Project Controls, Scheduling, Estimating, Operations, and Construction Management



- **LCP established solid foundations for team effectiveness early in project development that are characteristic of successful megaprojects**
  - **Clearly defined business and project objectives**
  - **Integrated project team**
  - **Defined roles and responsibilities**
  - **Frequent risk assessments**
  - **Use of work processes**
- **Continuity of Project Director and senior key team members during execution is a characteristic typical of successful megaprojects**



- **LCP organization comprises more levels than typically observed for similar projects, suggesting additional communication efforts required**
- **Overall team staffing, team continuity, and colocation at St John's are strengths, but opportunities to improve communications and strengthen alignment remain**
  - **Top vs. lower level management levels**
  - **Owner vs. non-owner staff**
  - **MFG and Island Link teams**
- **Organization staffing analysis indicates that MFG would benefit from additional construction management**
- **LCP lower level management comments suggest an increased management field presence will be beneficial**





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# Introduction to Megaproject Lessons

- This lessons learned section include typical issues that megaprojects experience during execution
- These lessons provide insights that LCP can use to increase focus on aspects that can help avoid or mitigate potential risks

***Megaproject teams tend to underestimate execution risks because they feel better prepared than ever before to manage organization and execution***



# **Selected Megaproject Lessons**

## ***Execution Risks Are Often Underestimated***

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- **Organizational complexity and team issues**
- **Failure to establish achievable schedule targets**
- **Unclear safety/schedule trade-offs**
- **Engineering and procurement schedule slip**
- **Inadequate effort to maintain value during construction**
- **These lessons are presented in the context of LCP path forward to completion as basis for recommendations**



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# Conclusions

- **LCP has the following characteristics that are comparable to those of successful megaprojects:**
  - **LCP established solid foundations for team effectiveness early in project development**
  - **Organization has overall good staffing to manage all execution scopes, teams are well developed**
  - **Established a TTO organization to ensure effective start of operations and optimal business value**
  - **Clear understanding of progress recently confirmed by the September 2015 re-baseline**
  - **Systems in place to manage and control progress**
  - **Proactive collaborative approach with contractors**
  - **Continuous focus on construction safety**



# Opportunities

- **IPA assessment revealed opportunities to continue strengthening organization and planning**
  - **Increase detail of execution plans and further define the construction schedule to reflect the most recent re-baseline**
  - **Establish achievable schedule milestones and completion target**
  - **Increase alignment between owner and non-owner and vertical alignment among organization levels**
  - **Increase construction management organization**
  - **Ensure clarity of responsibilities and interfaces for Muskrat Falls Generation team**
- **The assessment revealed that LCP strategies are consistent with the focus on achieving successful LCP execution to completion**



## Recommendations

- **We offer recommendations based on assessment of LCP status and extensive experience with megaproject execution issues**
- **Most megaprojects underestimate execution issues, which often appear without advance warning and have effects across multiple dimensions**
- **LCP team is addressing these issues that industrial megaprojects experienced as it moves forward to complete construction**
- **These recommendations are presented as an explicit reminder that they should not be forgotten**



# Key Recommendations (1)

- **All megaprojects have to be vigilant and exercise due diligence in reacting to capital productivity challenges**
- **Facilitate team effectiveness**
  - Continue engagement with sponsors
  - Ensure effective interface management
  - Foster team continuity
  - Strengthen Team Functionality
- **Continue to strengthen execution and TTO plans and optimize schedule to completion**





## Key Recommendations (2)

- **Continue to influence construction contractors' performance**
  - Understand and use current contractors' capabilities
  - Continue leading construction safety
  - Monitor alignment with contractors
  - Monitor and avoid potential claim issues
  - Continue managing construction productivity
  - Monitor procurement delivery and management
  - Avoid late changes and maintain effective controls
  - Help contractors achieve their incentives
- **Complete remaining engineering deliverables**
  - Implement engineering control and management

# IPA

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