



# HOLISTIC APPROACHES TO LNG EXPORT FACILITIES SITE SELECTION

Environmental Managers Association of British Columbia 2015 Workshop Supporting BC's Resource Sectors toward Successful Development Presented by: Daniel Leonard P.Eng., Director, WorleyParsons North America West

February 19, 2015



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#### **Global Overview**



#### **Relevant Capabilities**



resources & energy





# Tremendous Growth Planned for BC

An Overview of LNG Export Terminals and Pipelines Proposed for BC

#### **Overview of BC LNG**



Fortis Tilbury LNG





# **A Holistic Approach**





# Methodology

# Methodology

- Identify potential site locations (under 20 is ideal)
- Multi-criteria decision analysis:
  - Environmental Sensitivities
  - Community & First Nations
  - Regulatory Issues
  - Geohazards / Geotechnical Issues
  - Facility Constructability / Installation
  - Pipeline Routing & Permitting
  - Safety / Navigation
  - Optionality & Expandability
  - CAPEX / OPEX
  - Schedule



#### **Criteria Weightings**

#### Confirm weightings with customer based on project-specific requirements



#### **Decision Table**

# Table is used for guidance in decision making Input qualitative rankings for main and sub criteria items

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#### **Environmental Sensitivities**



# Coastal Sensitivities & Cumulative Effects

- If highly industrialized area
- If there is an existing port
- If slightly industrialized
- If Greenfield

#### Community



#### Local Community Outlook on Industrial Development

- Local community is positive about development
- Local community is mostly positive about development
- Unknown
- Local community is against development



#### **Regulatory Issues**



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#### Regulatory Regime and Permitting Requirements

- Port Authority, Province and Federal government agencies support development/industry in the area
- Some government support for development
- Assume Federal and Provincial government regulatory procedures
- Government agencies do not support development in this area

# Status within Land and Resource Management Plan

- LRMP supports industrial development
- LRMP supports some development
- LRMP has specific conservation objectives



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#### **Pipeline Routing & Permitting**

#### **Pipeline Route Sensitivities**

- If there is an existing pipeline to the area
- If the area is near an existing pipeline corridor
- If there are no existing pipelines or corridors, but seems plausible
- If there are no existing pipelines or corridors and geographic boundaries to pipelines exist

#### Existing or Planned Pipeline Proximity / Available Gas

- Proximity to a publicly announced pipeline.
- Sufficient gas within region to support export.



#### **Geohazards / Geotechnical**



#### **Constructability / Installation**

#### Safety / Navigation



#### **Optionality & Expandability**





#### **CAPEX / OPEX**

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#### LNG Facilities

- Benching of the site to deal with steep slopes.
- Soil improvement.
- Marine piling on sloping bedrock.
- Material offloading facility (MOF).



# Support Services and Supporting Infrastructure

- Proximity to construction services.
- Proximity to skilled labour.
- Proximity to materials for construction.



#### **Eco**Nomics<sup>™</sup>



#### **Sensitivity Analyses**

# **Eco**Nomics delta









# Lessons Learned

#### **Lessons Learned**

- Where projects have run into trouble:
  - Geotechnical issues
  - Soil and dredgeate disposal locations
  - Marine environmental impacts
  - Meeting emissions targets (hydro power; water cooling)
  - First Nations engagement
  - Proximity to communities
  - Worker mobilization logistics (fly-in/fly-out; ferries; etc.)
  - Pipeline routing











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