Pacific NorthWest LNG

Task Force
Industrial Electricity Policy Review
April 3, 2013

Overview

- Project Overview & Status Update
- PNW LNG Electricity Considerations

Providing Substantial Economic Benefits to BC

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- Significant Capital Investment by PNW LNG by 2019:
  - ✓ Upstream Drilling and Exploration - $15.0 Billion
  - ✓ Pipeline Development – $6.0 Billion
  - ✓ LNG Plant Development - $11.0 Billion
- Creating up to 6000 new construction jobs in BC at peak activity
- Creating up to 600 permanent high skilled jobs in BC during operations
- Additional $50 Billion in BC natural gas royalty revenues over 20 years[1]
- Possible benefits accruing to Canada from the development of an LNG Export Industry:[1]
  - ✓ Contribution to GDP ~ $1.0 Trillion
  - ✓ Wages ~ $250 Billion
  - ✓ Taxes ~ $240 Billion (An amount that is equivalent to the BC Personal Income Tax and PST paid by BC Residents for the next 20 years)
- Export of BC LNG cargos displaces global demand for coal-fired generation resulting in a significant global reduction in GHG emissions

[1.] Canadian Energy Research Institute's (CERI) June 2012 Report.

Project Overview – Positioned for Success

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Upstream Supply

- ✓ North Montney Natural Gas Resource, 53Tcf Contingent Reserves
- ✓ Management and employees of Progress Energy are continuing on with the new company named Progress Energy Canada Ltd (PECL)
- ✓ Progress Energy appraisal phase is designed to reach 2P reserves sufficient to supply 20 year off-take agreements(s) by FID date of late 2014
- ✓ 14 drilling rigs to be operating in early 2013
- ✓ 25 drilling rigs operating by the end of 2013

Natural Gas Pipeline

- ✓ Trans Canada Pipelines Ltd. was selected to design, build, own and operate the proposed Prince Rupert Gas Transmission Project
- ✓ ~ 750 kilometers of provincially regulated pipeline to safely deliver natural gas from northeast BC to our LNG export facility in Port Edward
- ✓ Pipeline construction is expected to take approximately three years and employ up to 2,500 people
- ✓ Aboriginal and community engagement already underway
- ✓ Environmental field studies and regulatory applications to occur as soon as practical in 2013

LNG Plant

- ✓ PETRONAS' proven capability in operating a fully integrated LNG operation and have successfully developed one of the world's largest LNG production facilities at a single location - the PETRONAS LNG Complex in Bintulu, Sarawak.
- ✓ Investment in the facility is estimated to be $9-$11 billion
- ✓ Two 6-MTPA LNG trains (liquefaction plants) are initially planned, with the potential to add another train in the future
- ✓ Up to 3.0 Bcf/day of natural gas exports

Shipping

- ✓ PETRONAS' LNG business is ably supported by the world's largest LNG carrier fleet owned and operated by their subsidiary, MISC Berhad.
- ✓ Shipping distance from Canada to Asia competitive with Australia

Customers

- ✓ PETRONAS already selling to Japan/Korea/Taiwan markets and building on relationships to secure future contracts
- ✓ Market trend for long-term and multi-decade contracts
- ✓ The market window is approximately 2018 to 2020

Project Status| Engineering and Environmental

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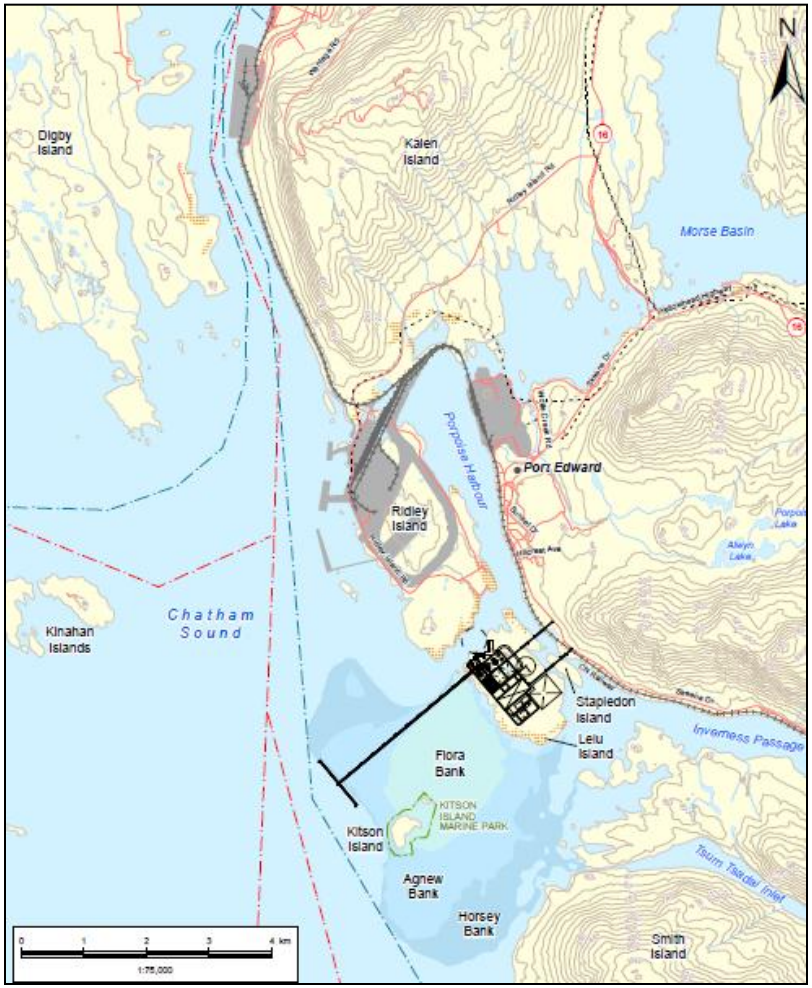
- Detailed Feasibility Study completed in November 2012 and project is now in final stages of Pre-FEED (Front End Engineering Design)
- The FEED contract is expected to be awarded in late Spring 2013 with work to begin soon after
- Environmental field studies on Lelu Island and surrounding water started in mid-2012 and continue in 2013
- Project Description submitted to CEAA on February 8, 2013; accepted February 18, 2013
- Environmental Assessment expected to be completed by 4th Quarter 2014
- Construction expected to begin late 2014 and take approximately 4 years
- First LNG shipment in late 2018

Project Overview | Schedule

Project Overview | Facility

- Site is on land federally administered by the Port of Prince Rupert and is within the District of Port Edward
- Completed site studies: geotechnical survey, archaeological inventory studies, terrestrial ecosystem study.
- Now undertaking further evaluations on and around island; soil studies, trestle studies;
- Secured exclusivity of the site until FID subject to execution of Project Development Agreement

Project Overview | Facility

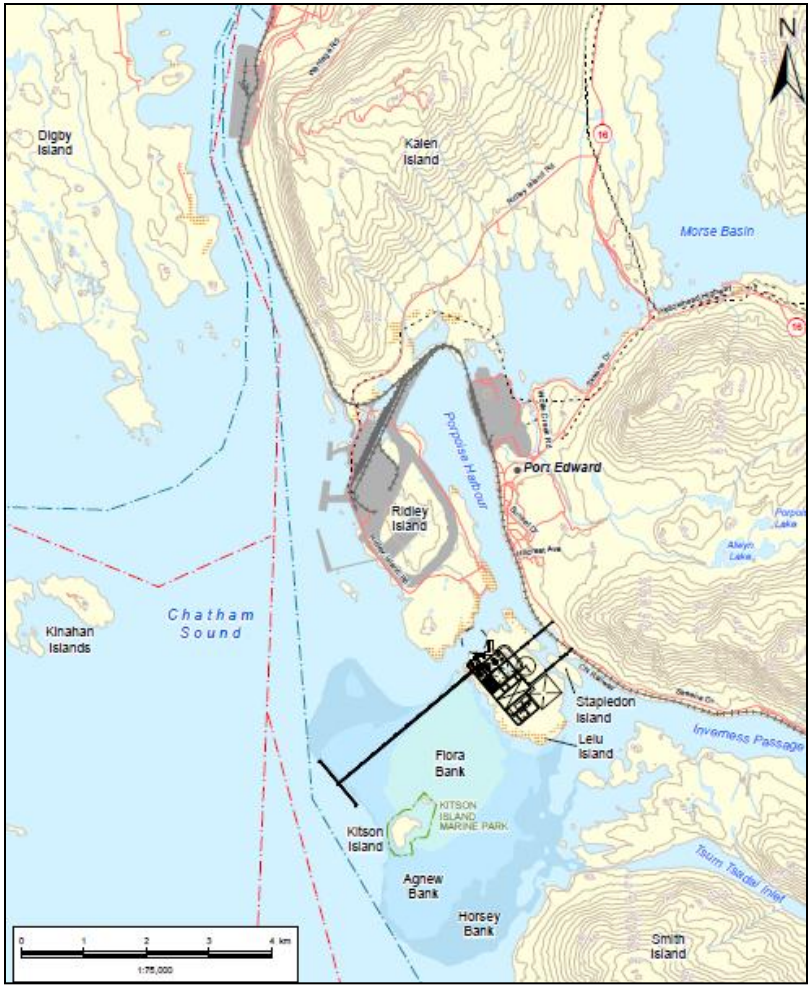


- The facility would include:
  - 3 – 6 MTPA liquefaction trains (3.0 Bcf/day)
  - 3 – 180,000 m3 LNG storage tanks

Project Overview | Supporting Infrastructure

- Supporting infrastructure includes:
  - Construction camp
  - Wastewater treatment facility
  - Firewater system
  - Administration and maintenance buildings
  - Two-lane bridge connecting Lelu Island to the mainland (two options)

Project Overview | Marine Terminal



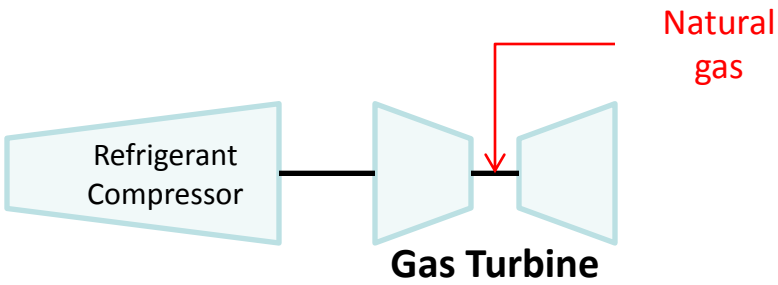
- The marine terminal would include:
  - 2.7 km long trestle
  - Loading/off loading equipment, control room, and cryogenic infrastructure
  - LNG carrier berths
  - Bunkering facilities

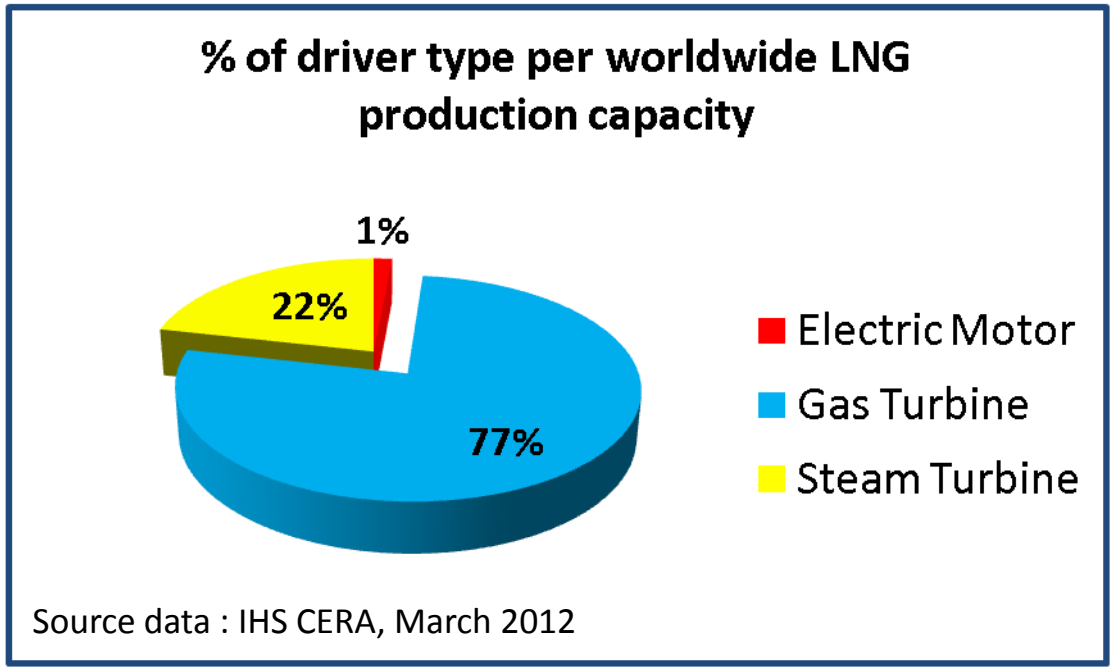
Photo: Trestle and marine terminal at Malaysia LNG Facility

Project Overview | Shipping

- The marine terminal will be designed for LNG Carriers up to the Q-Flex size
  - Up to 315 m in length; 50 m wide; 12 m draught
  - Up to 217,000 m^3 of LNG
- Up to 350 carriers would visit the terminal per year
- Use pre-established shipping routes
- All LNG Carriers would be piloted (from Triple Island) and assisted by tugboats according to PRPA policies and procedures

Gas turbine drivers are most commonly used in modern LNG facilities





- Simplest refrigerant compressor drive system
- Used in all modern LNG plants due to reliability and efficiency
- Greenhouse gas emissions can be reduced with modern gas turbine combustion technologies
- PNW LNG design will use latest GHG emission technologies

Project Overview | Facility Electricity Overview

- Currently considering two options for powering the facility:
  - **Mechanical Drive:** Natural gas-fired turbines that use mechanical energy to power the liquefaction compressors. A separate set of natural gas fired turbines couples with waste heat recovery, steam generators and turbines to provide ancillary power.
  - **Electric Drive:** Natural gas-fired turbines, coupled with heat recovery generators and steam turbines to generate electricity for the entire facility. The combined electrical energy generated would power large electric motors which in turn drive the liquefaction compressors and provide ancillary power.

Project Overview | Load Interconnection Challenges

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- **Reliability of Power Supply - Critical:**
  - LNG process requires 99%+ reliability while plant is in operation
    - ✓ Stable power – micro second outage could trip facility
    - ✓ Restart process is 10-12 hours
    - ✓ Trains must be purged and recharged prior to restart
    - ✓ Reliability of transmission lines uncertain due to adverse weather events and terrain
  - Pipeline gas supply considered a reliable source of energy
- **Timing of Availability - Uncertain:**
  - Require firm certain Load Interconnection by Q3 2018
  - Site generation outside of Prince Rupert would require significant transmission reinforcements
  - Timing of transmission reinforcements can be mitigated by siting new gas generation in the Prince Rupert area
- **Cost of Power Supply - Uncertain:**
  - LNG proponents required to reimburse BC Hydro for transmission reinforcements costs and the cost of new generation to serve their load
  - Rate 1823 may not be available to LNG proponents
  - LNG proponents required to install inside the fence back-up power generation systems in the event of a power outage
  - LNG proponents may be required to pay carbon tax in the event BC Hydro is required to build new gas generation to service load.

Project Overview | Key Risks

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- **Project In-Service Date by 2019:**
  - More than 650 million tonnes of LNG capacity in planning stages around the world – first movers will win by gaining access to premium priced markets in Asia
  - Potential for Regulatory Approvals and First Nations support to delay a final investment decision past Q1 2015
  - Collapse in the outlook for the World Price for oil
- **Containment of LNG Project Costs:**
  - Canadian LNG developers will need to keep costs down to compete globally
  - Project proponents will relocate capital to lower cost jurisdictions
- **Containment of "High Risk" Economic Variables:**
  - Exposure to Carbon Tax regimes and the requirement to "offset" GHG emissions
  - First Nations agreements
  - Managing future tax expectations by the BC Government

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Discussion