Muskrat Falls Development

Board of Trade

February 28, 2012

Boundless Energy

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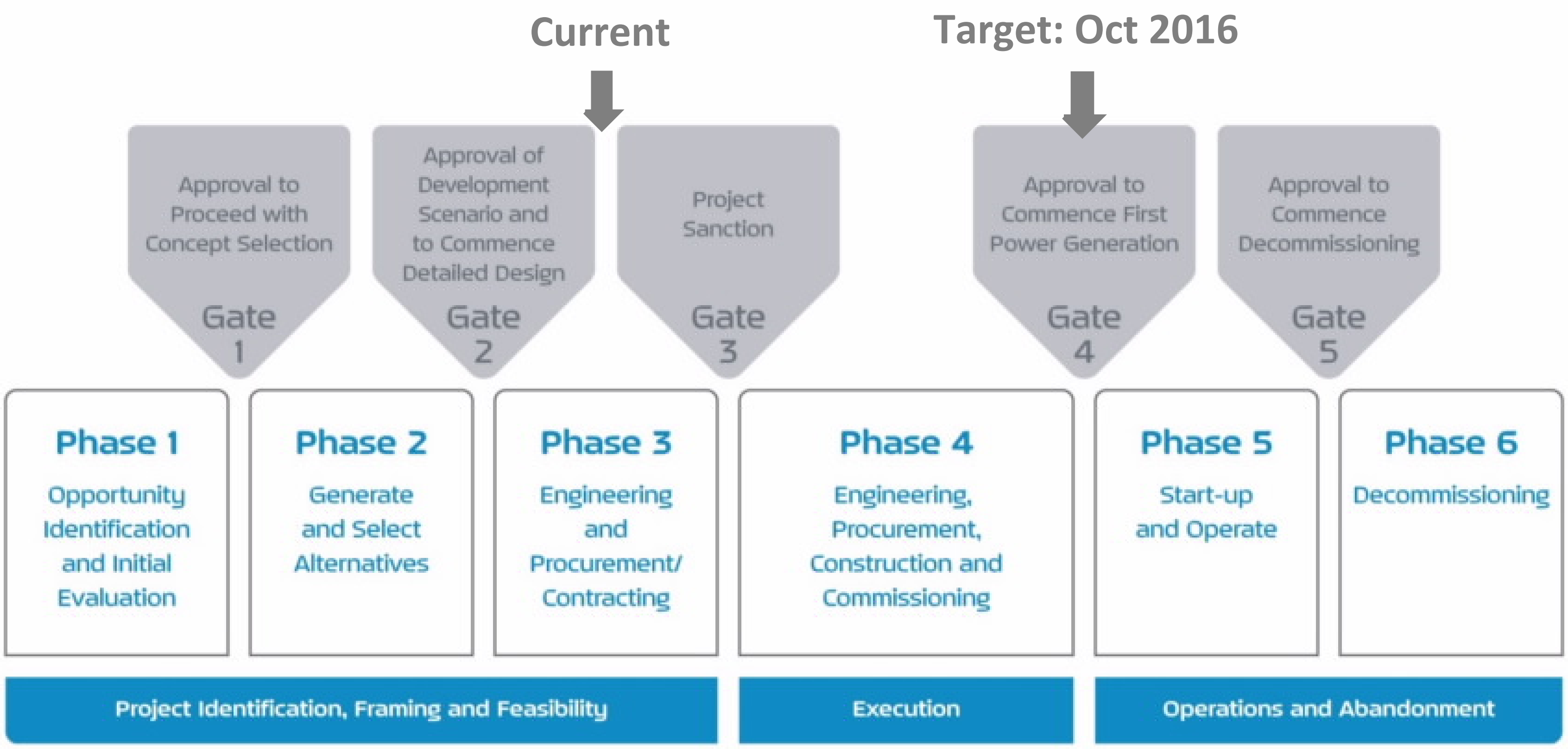
PROCESS OVERVIEW

Stage-Gate Process



ALTERNATIVE SCREENING

Assessment of Alternatives

Many generation alternatives assessed and screened at Gate 2:

- Nuclear
- Coal
- Continued use of Holyrood (with capture equipment)
- Combustion turbines
- Combined cycle combustion turbines
- Small hydro
- Wind
- CDM
- Natural gas
- Liquefied natural gas
- Biomass
- Solar
- Wave and tidal
- Deferred Churchill Falls
- Recall power from CF
- Gull Island
- Electricity imports

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Option Evaluation Criteria

Five key criteria used to evaluate alternatives

- Security of supply and reliability
- Cost to ratepayers
- Environment
- Risk and uncertainty
- Financial viability of non-regulated elements

LNG ANALYSIS

LNG Analysis

- LNG is **Liquefied natural gas** or **LNG** is natural gas (CH_4) that has been converted to liquid form for ease of storage or transport by cooling to below -73C.
- Liquefied natural gas takes up about 1/600th the volume of natural gas in the gaseous state.
- It must be "regassed" by warming the LNG through storage and piping processes. Once the LNG is regasified it ceases to be 'LNG' and is indistinguishable from the conventional piped natural gas.

LNG Analysis

- The advantage of LNG is primarily its utility as a fuel of diversification.
  - Oil is becoming more scarce. In some markets there is a discount to fuel-oil price parity.
  - Because of its continental abundance, uses of natural gas are increasing.
  - Offers superior GHG advantage over crude or coal fired generation.

LNG Analysis

- There are several elements of cost that derive the price of natural gas delivered as LNG.
  - The source natural gas price.
  - The cost of liquefaction.
  - The cost of transport.
  - The cost of receiving and storage.
  - The cost of regasification (conversion back to natural gas).
  - The cost of electricity generation.

Basis and Assumptions – NL Regas Terminal

Parameter	Basis / Assumed	Note[s]
Terminal Type	Baseload – 35 year life	N/A
Gas Send-out Rate	100 – 150 MMScf/d	365 – 550 MW electrical power generation at 30% overall plant efficiency
Tanker Size	145,000 m^3	Isolated location, require ability to accommodate typical existing LNG fleet tankers [125,000 – 145,000 m^3]. Larger tankers now available [>200,000 m^3] for Qatar exports, but not necessary for current evaluation. May require new build ice strengthen hulls.
Marine Facilities	All new facilities required	No existing facilities suitable for cryogenic piping exist in the region
LNG Storage Tank Size	2 × 160,000 m^3 [~ 35 days supply at 150 MMScf/d]	Large tank required to accommodate full parcel of typical tanker. Most existing tankers cannot dispense a partial LNG parcel due to tank sloshing effects while in transit.

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NL LNG Regas Capital and Operating Cost Estimates

Capital

Unit	Cost (2011 $ CDN)
Equipment	$ 272 467 000.00
Materials	$ 155 482 000.00
Prefabrication	$ 50 037 000.00
Construction	$ 236 862 000.00
Design & Project Management	$ 104 581 000.00
Insurance & Certification	$ 12 291 000.00
Contingency	$ 207 930 000.00
Total	**$ 1 039 649 000.00**

Annual Operating

	Double Train Annual Costs (2011 $ CDN)
Operating Personnel Costs	$6,739,000.00
Inspection & Maintenance Costs	$5,620,000.00
Logistics & Consumables Costs	$1,485,000.00
Insurance Costs	$5,677,000.00
Field/Project Costs	$6,120,000.00
Total	**$25,641,000.00/Year**

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Benchmarks

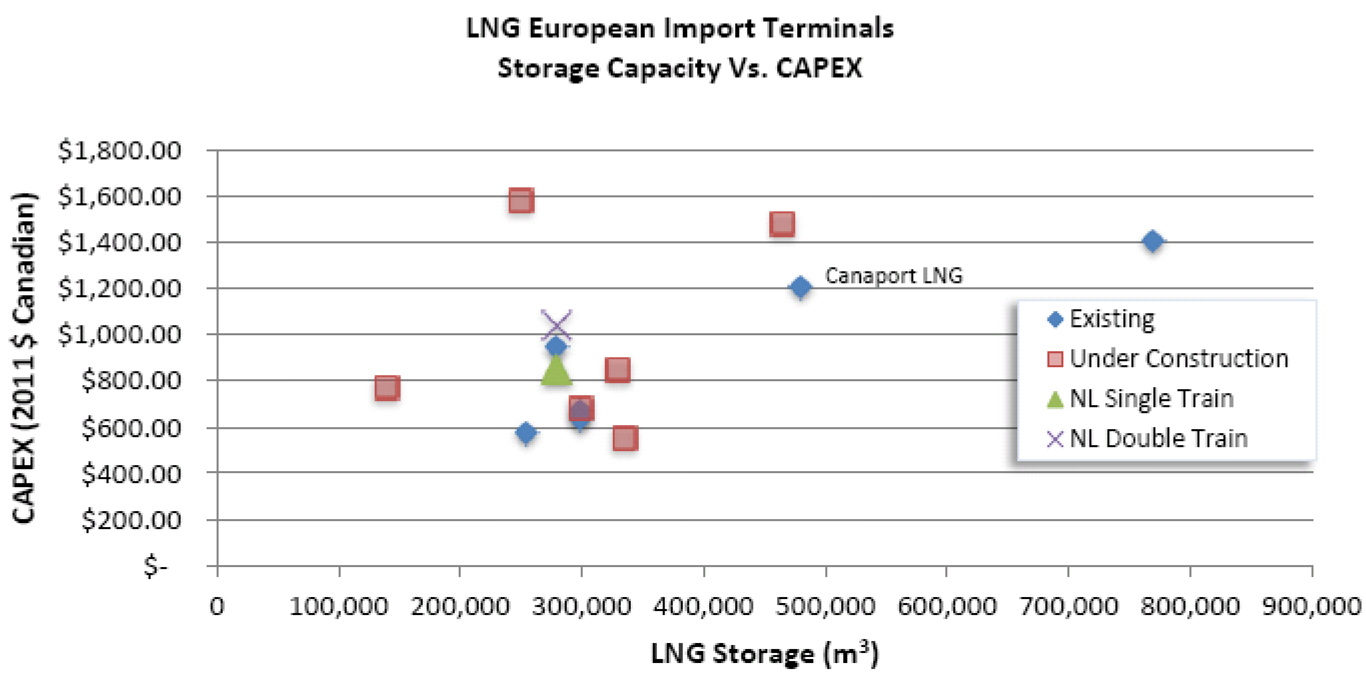

Figure 3: LNG European Import Terminals Storage Vs. CAPEX (King & Spalding, 2006)

LNG MARKETS

LNG Global Market Forecasting

- Natural Gas is currently bought and sold in three distinct global markets—North America, Europe and Asia—and prices differ widely between the three.
  - In North America, with a competitive market and plenty of shale gas to augment conventional supplies, prices are low.
  - In Asia, where gas is largely traded using a system of long-term contracts tied to the price of oil, prices are high.
  - Europe sits in between with pricing at “spot” and oil indexed.
- Prices at the moment are around $4 per million British thermal units (MMBtu) in the US, $8-11 in continental Europe and $13-16 in Asia.

Global Markets

- LNG is traded in an inefficient market. It is more commonly sold on a “avoided costs” basis verses the more efficient market based “supply cost ”.
- Within Asian and European regions there are two main models of supply contracts. Long term oil price indexed contracts and short term spot contracts.
- LNG in a ship will now sail around the world to find the best market. The unconventional gas boom has freed up supplies of liquefied natural gas (LNG) once destined for the US. In the US, companies are now examining the potential to export gas to the lucrative markets of Northern Europe and Asia.

Analysts Advice

- The consensus opinion of analysts is that LNG prices will remain at a significant premium to North American continental prices for the foreseeable future.
- The reasons are that most LNG purchases are made far ahead of time. Doubts linger on the reliability of the emerging spot market, especially among utility buyers. So they buy early and utilities often pay premium to the spot market to have delivery certainty. Predominantly on an "oil-indexed basis".
- Wood McKenzie in a recent report says LNG oil indexation will endure: *"Our analysis suggests, perhaps surprisingly to some, that many buyers and policymakers will struggle to be weaned off oil indexation. Consequently, oil indexation will remain the backbone of long-term contracts in Asia and Europe for some time. Europe and Asia continues to increasingly rely on a few large exporters with the power to set prices. A reliable and familiar price mechanism such as the long established oil indexation remains entrenched."*

US IMPORTS

Analysts Advice

- Based on the NL's isolation and lack of alternatives, Nalcor requires a high level of security of supply *and* a level of defensive stockpiling.
- This discourages purchasing LNG from nearby United States projects, should any of them be built.
- Long-term stability in LNG exports depends on US political support in such endeavor. Although a reasonable conclusion that LNG exports are logical in the U.S., it is uncertain that the U.S. government or the American public will stay supportive of LNG exports in the continental United States in the long term.
  - Today's relatively low North American gas prices have not given the public reasons to object to liquefaction projects en mass yet, but there is a credible likelihood that should natural gas prices escalate, they may cause the public to single out LNG export projects as the key contributing factor.
- LNG buyers that have other supply alternatives such as pipeline gas, oil, equity LNG production, or well-developed relationship with other LNG producers are better able to handle this risk. (e.g. India/Spain)

Analysts Advice

- There are proposals in the United States to export LNG. However there is political risk, supply risk and price risk to consider.
- Analysts believe that U.S. LNG volumes to be commanding no less than Western Europe parity.
- Therefore, no matter what the cost of supply would be, a U.S. Gulf Coast LNG project that can alternatively sell to Western Europe should demand at least $10.21/MMBtu for 2017 deliveries from Newfoundland to maintain parity on pricing.
  - As an example, Qatar LNG natural costs only $5-7 MMBtu to deliver to Japan, but buyers pay market price of $13-$17 MMBtu.
- This price therefore serves as a floor price expectation for LNG "spot" deliveries to the island Newfoundland. However, due to supply risk concerns and the desire for long term contracted certainty <u>reliance on the US for LNG is not recommended by our advisors.</u>

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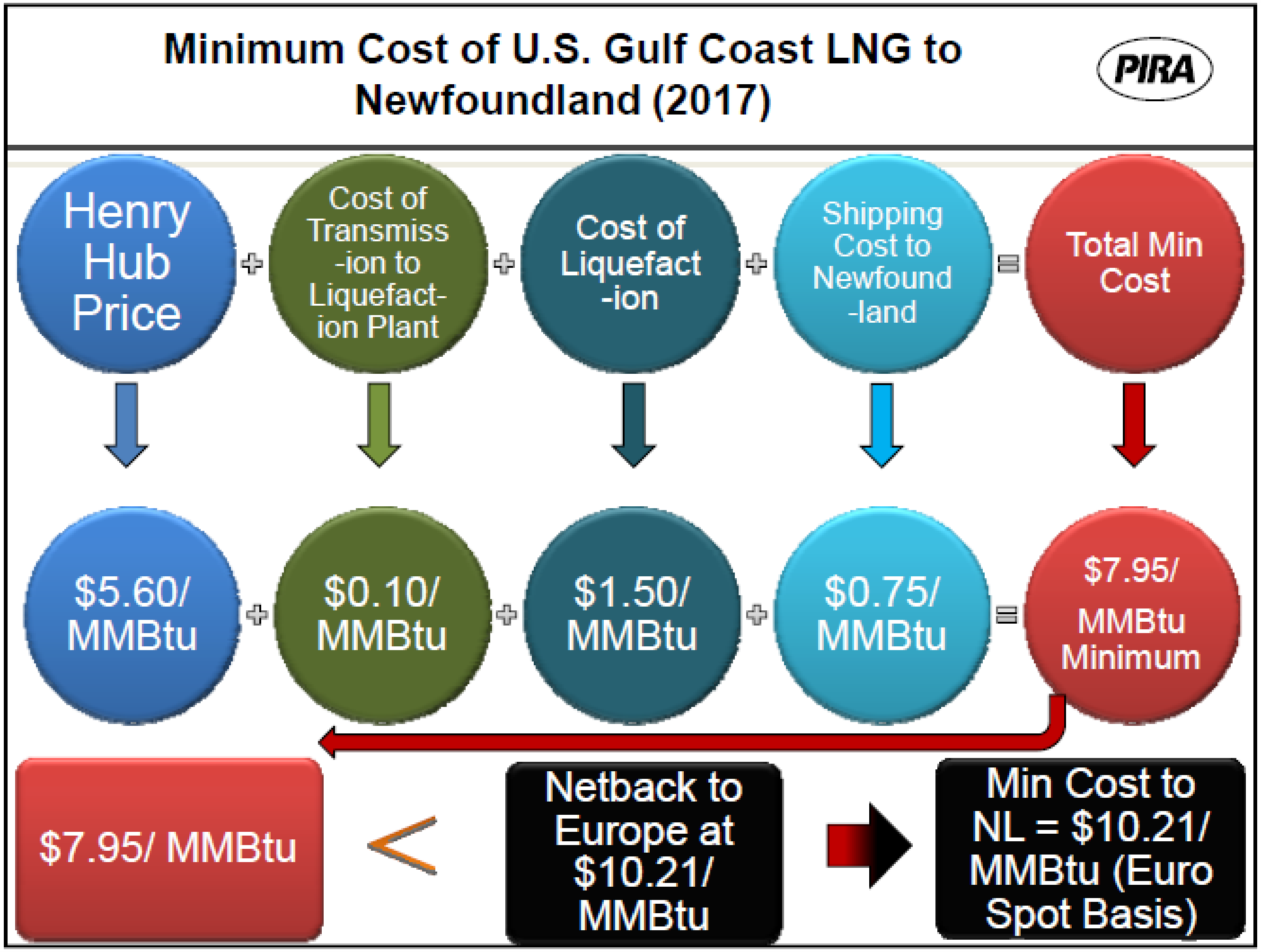
Analysts Advice



LNG LONG TERM CONTRACTS

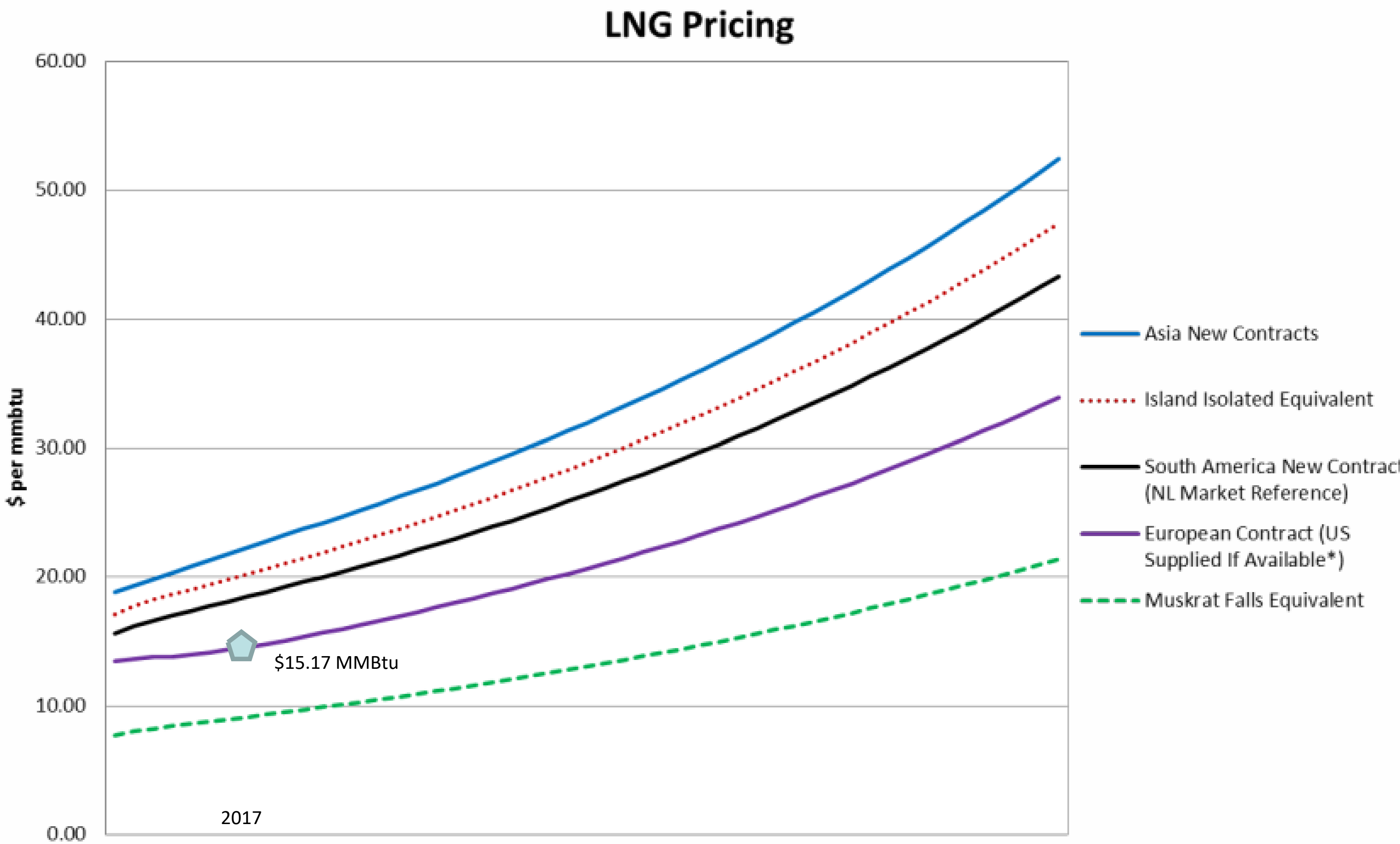
Analysts Advice

- Both PIRA and Ziff Energy believe that Nalcor's circumstances and requirements for security of supply under long term contracts indicate that the LNG offer price should more closely resemble European or South American prices.
- Buyers still prefer to buy within the region not only because to keep shipping costs at a minimum, but also because of the higher risks involved in bringing volumes from distant places.
- PIRA projects that South American buyers will offer rather attractive prices to sellers due to the relative economics in oil substitution. The difference between what South American and Asian buyers are willing to pay averages only about $3/MMBtu from 2017 onward. For an Atlantic Basin seller, the $3/MMBtu difference will be greatly diluted by the much higher transportation cost to Asia.

Analysts Advice

- Nalcor's LNG project is very small. It will only require up to 10 cargoes per year in its first 20 years of service. Today, even the smallest new LNG export plant produces the equivalent of at least 50 cargoes per year. The largest plant in existence, in Qatar, can easily deliver over 120 per year. We have little to no negotiation leverage.
- Even if Newfoundland and Labrador can contract for LNG that is indexed to the Henry Hub price, PIRA is confident that no LNG seller will accept a flat Henry Hub price today without first inflating it several times to keep them in line with what the LNG can be sold elsewhere including South America, Europe, and Asia.
- With 30-40 new regas facilities being developed, it is a sellers market for the foreseeable future. It is easier for a seller to find and supply a given buyer and conversely more difficulty for a buyer to find an alternative seller.
- Contract renewals will favour the seller as NL would have no alternatives.

Analysts Advice – South American



* No exports from the US exist as the gas is used domestically.

From	Transportation Difference between NL & South America	South American Price of $15.17/MM Btu
Norway	-0.81	14.90
Cove Point, Md	-1.08	14.63
Trinidad	+0.20	15.91
West Africa	+0.49	16.20
Sabine Pass, La	-0.80	14.90

PIRA Advised Pricing Expectations

Projected LNG Prices for Nalcor (2017)

($/MMBtu)

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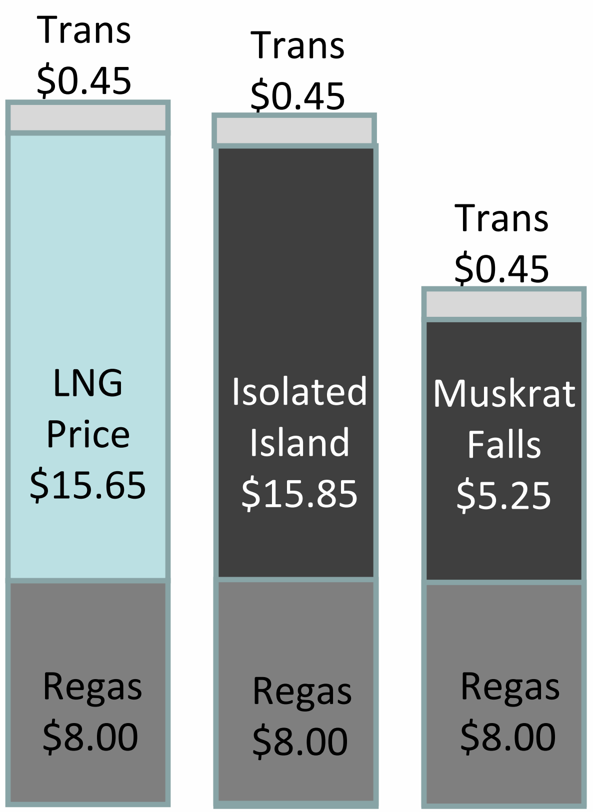
West Africa	+0.49	16.20
Sabine Pass, La	-0.80	14.90

LNG ANALYSIS - PRICE

LNG Conclusion

- US is not a source of LNG for NL.
- Long Term Contract with price references based on South America deliveries.
  - Cost of LNG is 80%-90% of cost of oil.
- Unit cost to convert LNG to natural gas is extremely high due to low volume requirements.



GRAND BANKS GAS

Landing Grand Banks Gas

- Associated gas produced at offshore oil fields is currently used by the developments:
  - Hibernia and Terra Nova produced gas is used for fuel to power each platform; the remaining gas is re-injected into the reservoir for pressure maintenance to maximize higher value oil production
  - White Rose gas is used for fuel and the surplus is currently being stored; Husky continues to evaluate opportunities to re-inject gas to maximize oil production
  - the Hebron proponents intend to use produced gas for fuel and any surplus would be re-injected for later use.
- The conclusion is that there is no low-cost Grand Banks natural gas available for transporting to shore for domestic use.
- Oil companies have seen the power generation alternatives – and concluded cannot compete.
  - Project economics will not meet required hurdle rates
- Field sizes not large enough (yet) to consider LNG export.

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Offshore Gas Development

- Facilities and pipeline sized to peak at 176 MMcfd for life of project.
  - Standalone wellhead platform costs of $1.5 -2.4B.
  - $875M pipeline routed 640km.
  - Three initial wells. Additional wells 3-5 years there after.

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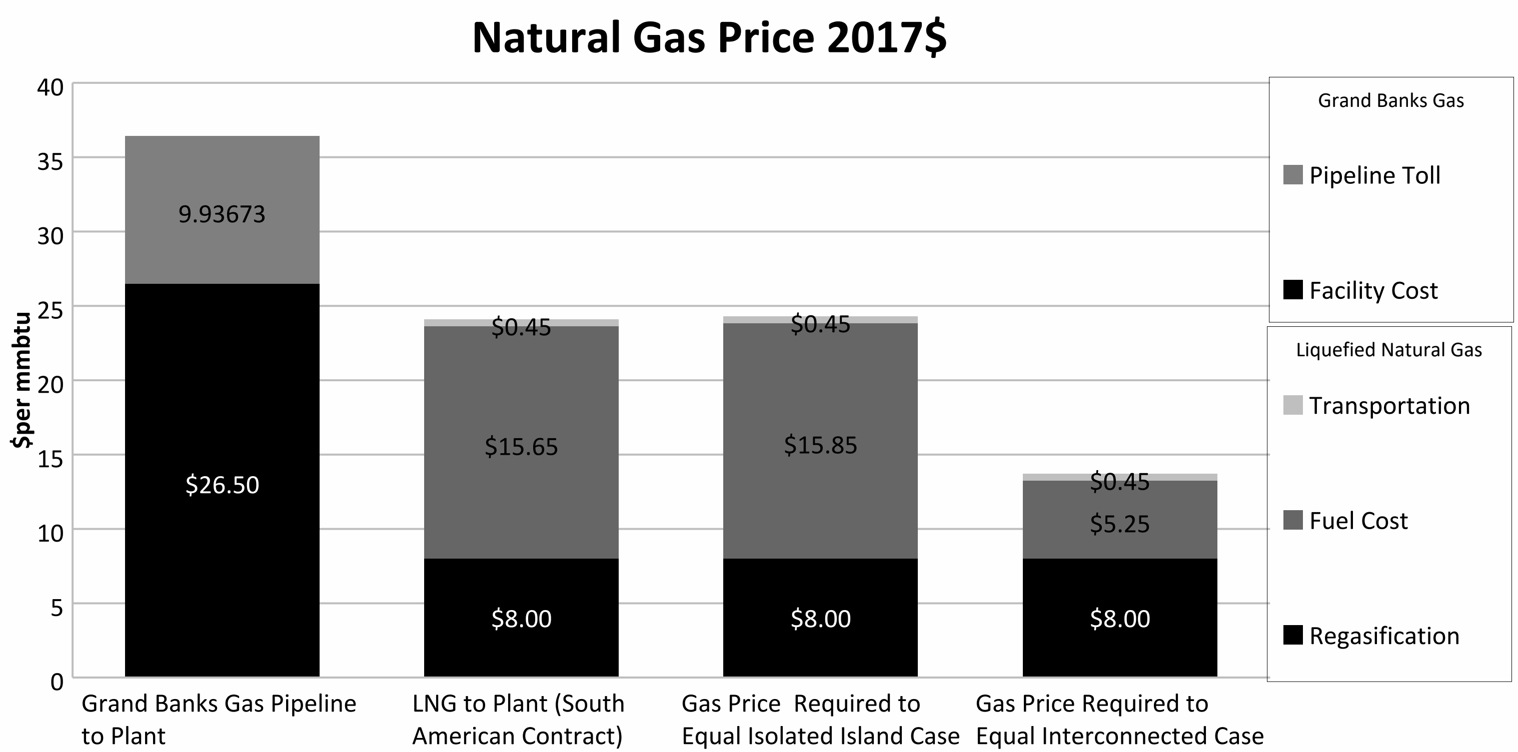
Offshore Gas Development

- Costs on the right are the cost of delivery alone. It does not include a price for the natural gas itself – assumed $0 MMBtu.
- Stand alone development required due to short oil field life and economic life of FPSO.
- Large initial investment would be need to be recovered in 6-10 year period over very small and seasonal volumes.
- Pipeline routing risks.
- Diesel will still compose 10-20% of fuel requirements do to uptime issues.
- Opportunity cost of other monetization options.

CONCLUSIONS

Comparisons



Screening Conclusions

Criteria	LNG Imports	Grand Banks Gas
Security of supply and reliability	• US ruled out • Long term contracts required – oil indexed	• Uptime required alternative fuel backup • Uncertainty after oil is depleted
Cost to ratepayers	• Near isolated island costs no clear advantage	• Significantly higher cost than isolated island
Environment	• Favourable to oil • Less favourable than hydro	• Favourable to oil • Less favourable to hydro
Risk and uncertainty	• Commercial risks on renewal – eliminate any possible price advantage	• Uptime risks need diesel back-up • Pipeline scour risks • Well bore risks
Financial viability of non-regulated elements	• No viability of non-regulated elements. No benefit to province.	• Potential loss of future gas export project • Potential deferred oil production