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To: gbennett@nlh.nl.ca; dawndalley@nalcorenergy.com
Subject: Fw: Ziff Energy report on Natural Gas Viability and Analysis
Date: Monday, April 16, 2012 5:15:07 PM
Attachments: Newfoundland LNG Analysis April 13 2012.pdf

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----- Forwarded by Jim Keating/NLHydro on 16/04/2012 05:12 PM -----

From: "Bown, Charles W."
To:
Date: 16/04/2012 04:21 PM
Subject: FW: Ziff Energy report on Natural Gas Viability and Analysis

From: Foote, Wes
Sent: Monday, April 16, 2012 8:33 AM
To: Bown, Charles W.
Subject: FW: Ziff Energy report on Natural Gas Viability and Analysis

Charles

Here is the LNG piece. In summary, Ziff is saying that LNG for Holyrood would be competing with England NBP and not gas prices on mainland of North America which is Cabot Martin's story line. Let's discuss next steps.

Wes

From: Bill Gwozd [mailto:bill.gwozd@ziffenergy.com]
Sent: Friday, April 13, 2012 6:42 PM
To: Foote, Wes
Cc: Simon Mauger; Edward Kallio; Cameron Gingrich; Carmen Mah
Subject: Ziff Energy report on Natural Gas Viability and Analysis

Hi Wes,

As promised, please find attached our brief 10 page report addressing 10 Figures covering Newfoundland

and Labrador Natural Gas Viability and Analysis. We are sending this report as a PDF version; however, should you need access to the Figures in PowerPoint (or text in word), then we can send that.

We will update our internal timesheets with professional hours used to prepare the report and we will prepare an invoice. Ms. Carmen Mah will send the final invoice in 2 weeks (April 26).

Bill

William P. (Bill) Gwozd P.Eng. | Vice President, Gas Services

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NEWFOUNDLAND AND LABRADOR NATURAL GAS VIABILITY AND ANALYSIS

Prepared for:

Government of Newfoundland and Labrador

Calgary, Alberta

April 13, 2012

ziff ENERGY GROUP
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NEWFOUNDLAND AND LABRADOR
NATURAL GAS VIABILITY AND ANALYSIS

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INTRODUCTION

In February 2012, The Government of Newfoundland and Labrador consulted Ziff Energy Group regarding the viability of various natural gas supply options for power generation in Newfoundland. A preliminary meeting was held in Toronto and discussions led to commissioning of the following independent report.

Background

Low current natural gas prices in North America are an economic driver for many LNG liquefaction proposals from coastal regions of the U.S. and Westcoast of Canada. These projects are intended to arbitrage inexpensive North American gas into premium gas markets in Europe and Asia which are primarily linked to world oil prices. One U.S. LNG facility has received U.S. Department of Energy (DOE) approval to export domestic gas to offshore markets. LNG delivery contracts for the off-take from this proposed LNG facility are for firm quantities, large volumes, and long term. Interestingly, the DOE licence is not definite for the full term of the LNG contracts, and can be re-visited if the DOE deems continued LNG exports are not in the public interest.

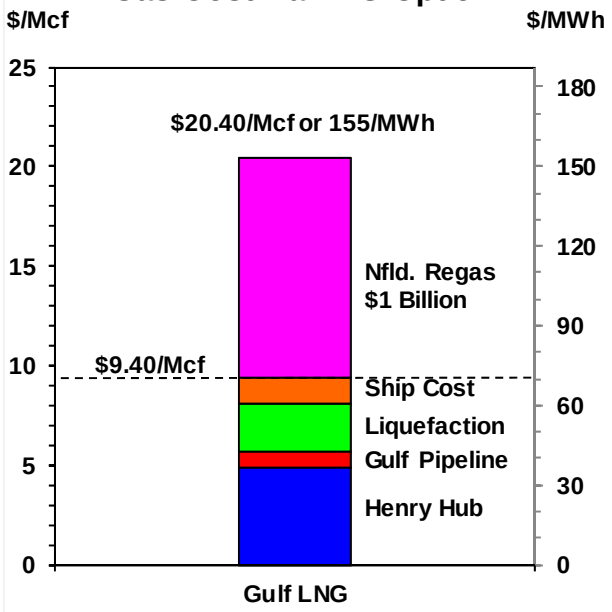
Oil produced several hundred miles offshore Newfoundland contains associated natural gas. Some of this gas is produced and burned to fuel facility operations and the balance of the gas is re-injected into oil reservoirs to maintain oil reservoir integrity and pressure. To date it has not been feasible to consider transport of associated natural gas to Newfoundland and Labrador or other markets.

CONCLUSIONS

Figure 1 shows use of LNG as a source of power generation in Newfoundland faces several key obstacles. Results of Ziff Energy's analysis show:

- LNG landed in Newfoundland would be prohibitively priced over the long term:
  - optimistic case, based on LNG source via Henry Hub price would result in $9.40/Mcf FOB Newfoundland and a $20.40/Mcf price at the regasification plant outlet
  - low load factors for this option would lead to reliance on unreliable spot cargoes and are likely referenced to world oil pricing in winter
- investment in regasification facilities and associated upstream contracts may turn into 'White Elephant' investments if Grand Banks gas were ever monetized through LNG.

Figure 1
Gas Cost via LNG Option



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HOLYROOD PROJECT

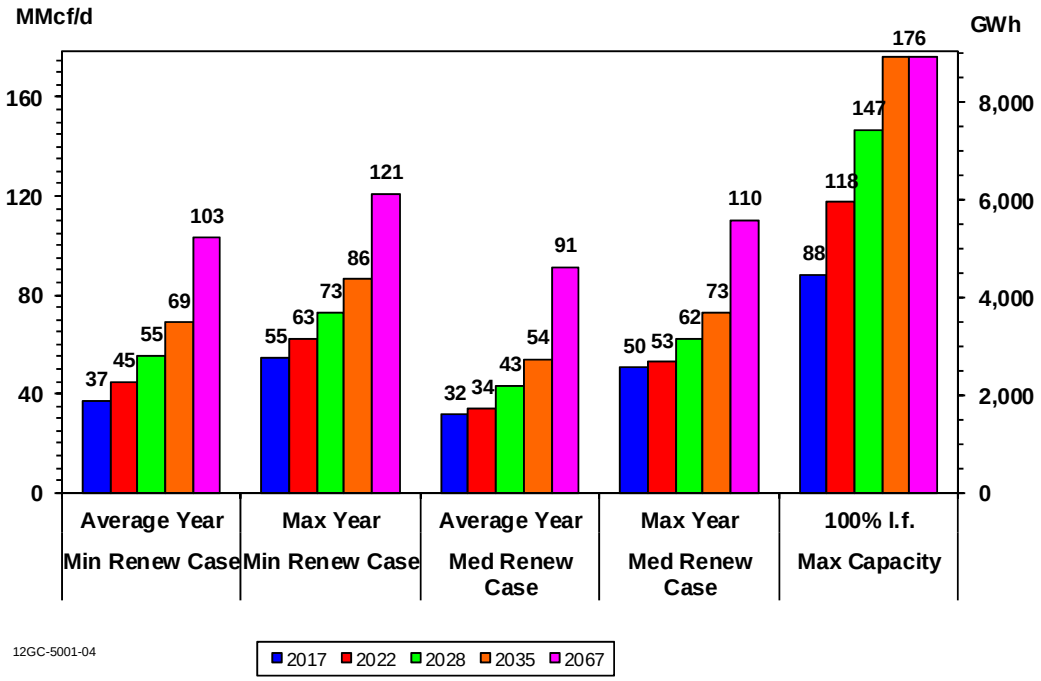
Holyrood Project Load Profile

Ziff Energy studied the forecast gas demand for the Holyrood power plant currently serving Newfoundland:

- average year loads vary from 37 MMcf/d in the Minimum Case in 2017 to 121 MMcf/d for the whole year in 2067
- average year load of 32 to 91 MMcf/d in the Medium Case will not incent development of natural gas as a primary feedstock for any development in Newfoundland.

Figure 2 provides a summary of the average year LNG requirements for Holyrood to 2067. The analysis considers 5 separate cases. As Holyrood would be relied on to meet peak-day requirements, infrastructure would have to be overbuilt to handle extreme days when the full output capacity at Holyrood is most required. As a consequence, large initial capital investments will be required and low utilization load factors will drive unit costs upward.

Figure 2
Holyrood LNG Requirements



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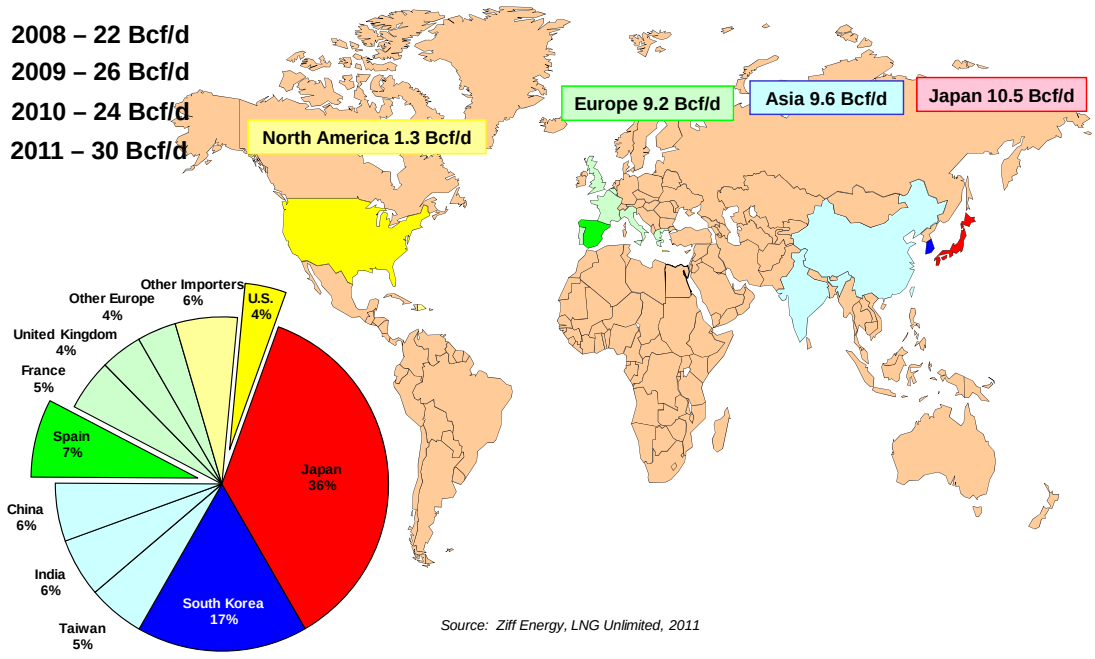
World LNG Market

LNG is transported to various countries in the world to supplement their fuel choices. Ziff Energy estimates that the world supply of LNG is 30 Bcf/d in 2011, twice the entire gas production of Canada and less than half U.S. gas production. Natural gas requirements for the Holyrood power plant of 0.037 Bcf/d (2011) to 0.176 Bcf/d (2076) would comprise a miniscule part of the World LNG market (from 0.12% to 0.59%).

Firm LNG off-take is contracted based on long term contracts with minimum take requirements. The low volumes of gas required to produce power at Holyrood would be a challenging economic barrier to securing long-term firm LNG supply. To underpin the proposed LNG facilities in the U.S., Ziff Energy believes that LNG operators will require contracts of much larger volumes of LNG for 20 years, based on Henry Hub pricing plus a locational differential premium, plus a facility toll for liquefaction.

Holyrood would be captive to LNG spot markets which are less reliable and are likely priced off oil indexes in winter. Ziff Energy does not foresee world LNG pricing deviating from the current linkage to oil prices. Figure 3 provides world perspective for LNG markets.

Figure 3
LNG Holyrood vs. World LNG Buyers



Source: Ziff Energy, LNG Unlimited, 2011

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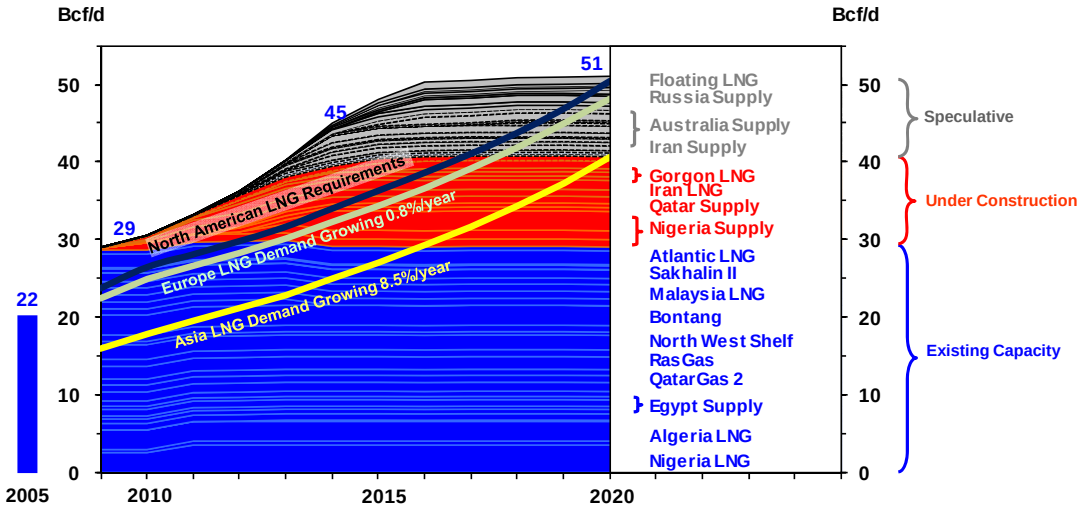
LNG Supply and Demand Forecast

World LNG Supply is growing. By 2020, Ziff Energy believes world LNG supply may exceed 50 Bcf/d, more than double the supply in the 2005 to 2010 era. LNG demand is increasing. Ziff Energy's analysis suggests that by 2015/2016 LNG demand could out-strip LNG available or the overall balance could become very tight. Even with new LNG export projects from Australia and Qatar, these projects may not be sufficient to satisfy growing LNG demand in Asia and Europe.

The next tranche of LNG projects may be viewed as speculative as they would originate from Iran, Russia, and Nigeria. There is a high degree of uncertainty that large investments in these jurisdictions will come to fruition. Potential for LNG supply shortages and price spikes for spot LNG during the winter could become the norm. Buyers relying on spot cargoes could face real supply risk.

Figure 4 provides a summary of world LNG supply and demand. The LNG shown at the bottom in **blue** is already built. **Red** projects are under construction. **Grey** projects are speculative, and Final Investment Decisions have not been made.

Figure 4
LNG Supply Outlook



Assumptions:
- Existing Capacity operating at 80% Load Factor (LF)
- Capacity Under Construction operating year one at LF = 20%, then 85%
- Proposed Capacity is assumed to be 50% successful and operating year one at LF = 20%, then 85%

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LNG Transportation Costs

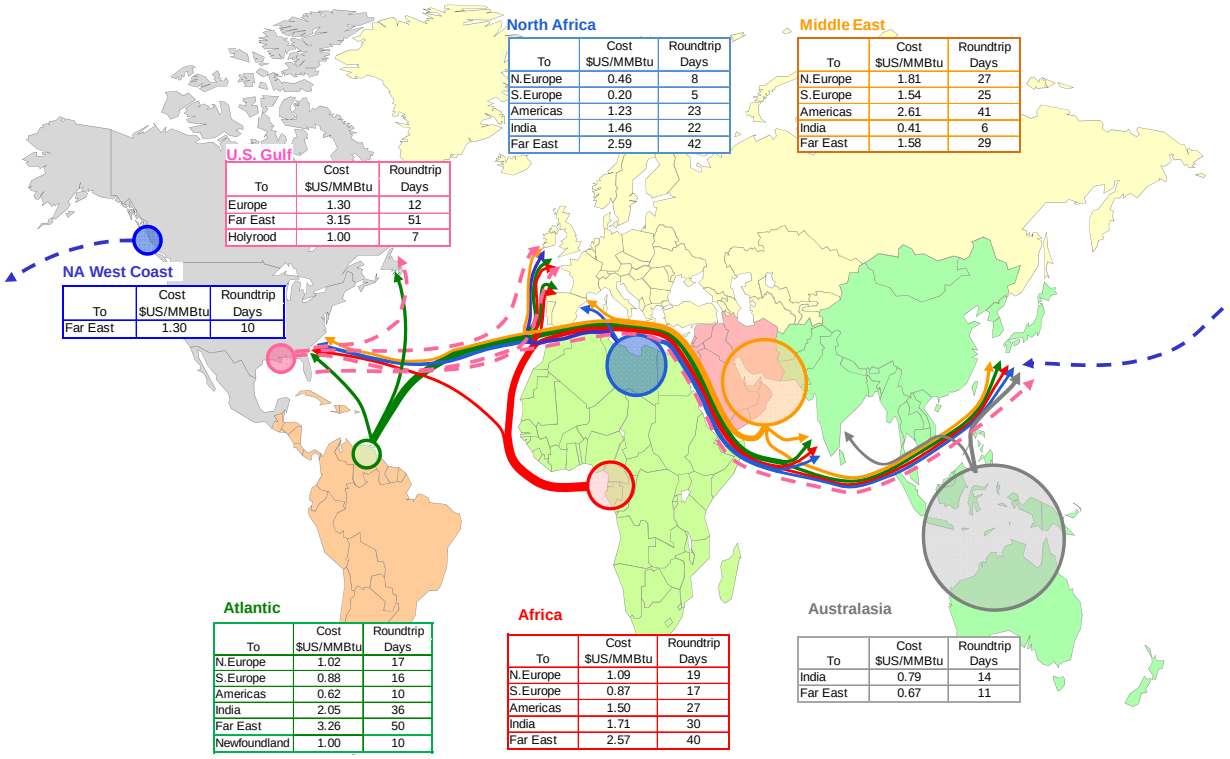
LNG has been safely transported for decades. There are hundreds of LNG tankers that transport LNG from a liquefier to a LNG receiving terminal. LNG tankers have increased in size thereby allowing users to transport ever increasing amounts of LNG. LNG transportation costs can be quickly calculated based on the route, repeatability, on-loading and off-loading time, along with frequency of the trip.

Ziff Energy estimates a toll to deliver LNG from the U.S. Gulf Coast to Holyrood would be about $1.00/Mcf and the LNG tanker round trip time could be 7 to 10 days depending on the location of the LNG source. Our estimate is based on two other quotations:

1. the LNG toll from Trinidad & Tobago to the U.S. Southeast cost is $0.62/Mcf
2. LNG transportation from the Gulf of Mexico to Europe would be $1.30/Mcf.

Figure 5 summarises world LNG tolls from 7 regions. The toll summary provides an estimate of the duration of time that the LNG cargo ship will require for a typical return trip. For example, a ship journey from the U.S. east coast to Europe and back is 10 days.

Figure 5
Typical Shipping Costs



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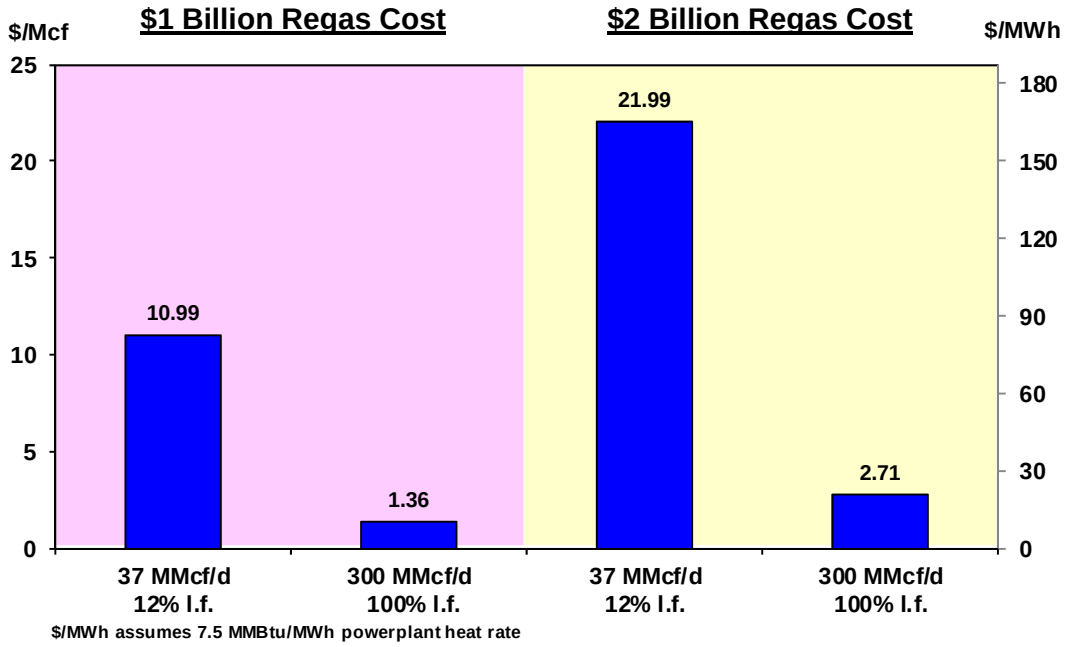
LNG Regasification Costs

Estimates of LNG regasification costs depend on many factors. Considerations are: size of the facility, ease of gaining a construction permit, and time (and effort) to gain regulatory approval. Typical costs of a regasifier are estimated at under Cdn$1 to up to $2 Billion for up to 2 Bcf/d. For a small regasification facility (0.3 Bcf/d) costs may be lower. Some regasifiers in the U.S. Northeast and U.S. Westcoast faced opposition so fierce that proponents abandoned the proposals altogether.

Ziff Energy estimates that a typical regasifier facility can be constructed within 3 to 5 years, though the exact timetable can become longer for many specific reasons. Regulatory and environmental delays can be onerous. LNG regasification facilities are relatively simple: the facility itself needs to be designed for a specific site, a deep port established, and various piping and low pressure storage tanks constructed. North America has 2 dozen such facilities. An initial life span may be 3 dozen years, perhaps longer.

Figure 6 illustrates how operating costs for a regasifier will depend on the annualised volume being delivered. More deliveries can lower the unit operating costs and facilities with larger throughputs benefit from economies of scale. North America regulated cost for a 100% load factor facility typically is in the $0.33[1] to $0.75[2]/Mcf range. Unit costs for a regasifier supplying gas to a small power plant such as Holyrood would be substantially higher reflecting much lower load factors and lesser scale. Ziff Energy has modeled the unit cost of a $1 or $2 Billion, 300 MMcf/d regasification facility operating at 37 MMcf/d[3] (12% load factor) and 300 MMcf/d (100% load factor).

Figure 6
Holyrood LNG Regasification Cost



[1] Cove Point LNG in Maryland 1.8 Bcf/d of send out capacity
[2] Southern LNG in Georgia 1.2 Bcf/d of send out capacity
[3] Min Renew Case in 2017

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NORTH AMERICAN GAS PRICE

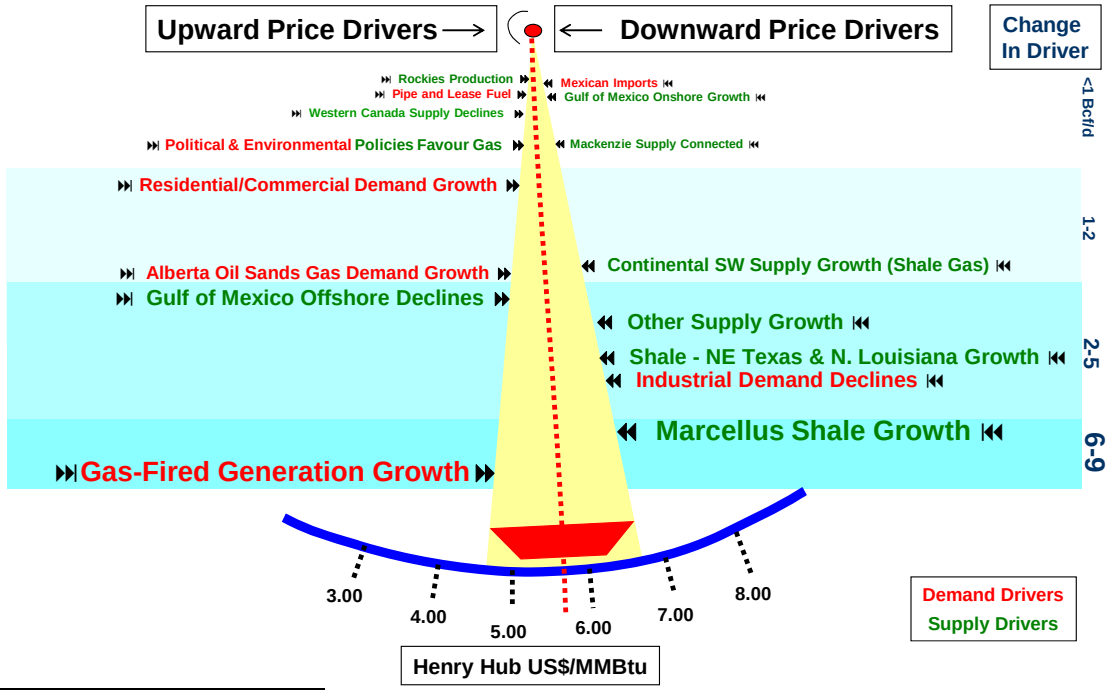
Influences to 2020

To assess long term gas prices, Ziff Energy uses its proprietary imbalance pendulum model. The model considers over a dozen primary long term gas supply and gas demand factors that could exert a significant influence on gas price during the period of time being analysed. Each driver/factor is ranked in terms of change to supply or demand. For example:

- incremental gas demand for power in North America is expected to grow by 9 Bcf/d by 2020. This factor exerts a large upward influence on the (price) pendulum
- conversely, strong downward pressure is exerted on the gas price pendulum by strong growth of gas supply from the Marcellus and other locations
- the cumulative influence of all factors results in the ultimate direction of gas prices.

Figure 7 summarises over a dozen factors that influence gas price. **Red** text denotes demand influences and **green** text refers to supply influences. The size of the font is important – **larger** text is more important and exerts a larger influence. The bottom of the pendulum suggests that the equilibrium price between 2012 and 2020 should fall in the high $4 to the mid-$6 range. Note that short term factors such as weather, gas storage levels, or outages are excluded for the long term forecast as short term factors are normalised[4] and thus do not exert any long term impact on gas price.

Figure 7
Holyrood LNG Price Influences Short Term 2012-2020



[4] example: what is the average temperature across a province in the year 2024? Ziff Energy assumes it is normal and not warmer and not colder, thus there is no influence of weather on long term price forecasts

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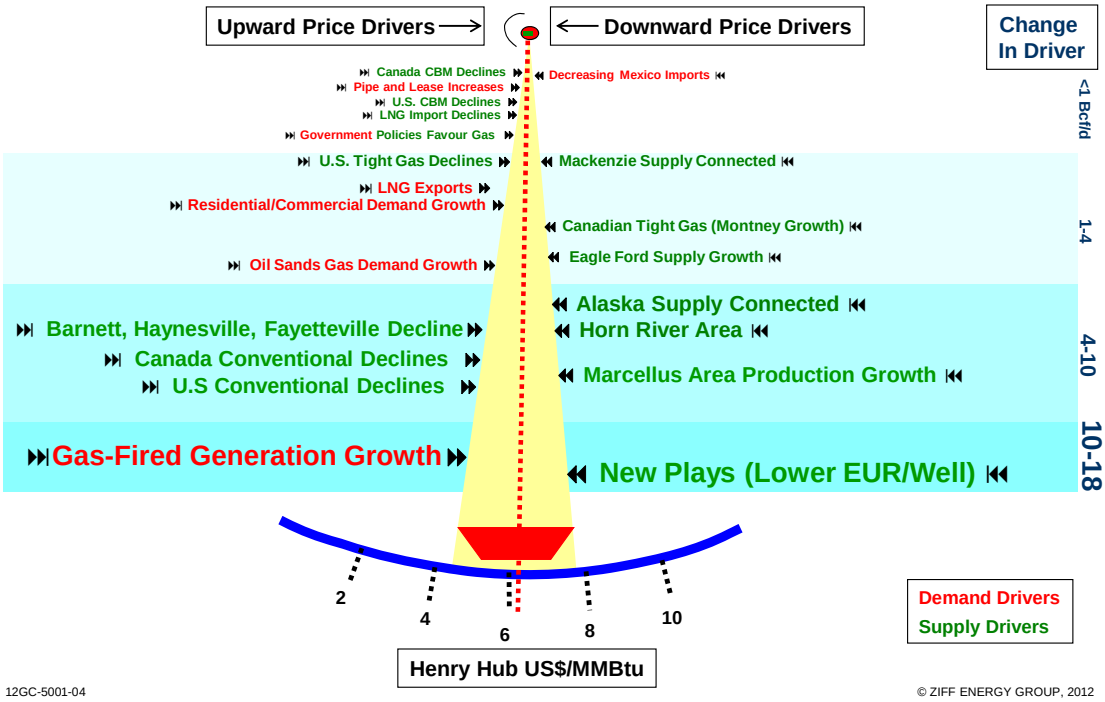
North American Gas Price Influences to 2035

The Ziff Energy gas price model has been extended to 2035 to determine how gas supply and demand factors will interact. Some items, such as long term policies to reduce the number of coal fired electrical generation plants by mothballing facilities over 45 years of age, can become a key factor or a potential sensitivity. The eventual commercialisation of Alaska and Mackenzie Delta gas supply may exert influences in specific years.

The major upward drivers on price will be gas fired electrical generation growth, declines in supply from mature gas plays, and demand growth for Oilsands and LNG exports. Continued supply growth from unconventional gas plays and connection of northern gas supply will push prices down. The result suggests that gas prices may range between over $4/Mcf to under $8/Mcf.

Figure 8 provides factors that in Ziff Energy's opinion will influence gas prices to 2035.

Figure 8
Holyrood LNG Price Influences to 2035



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Landed Cost of LNG

In addition to the commodity price of natural gas at the inlet to an LNG liquefaction facility, several additional fees are stacked before the gas is landed at a regasification terminal.

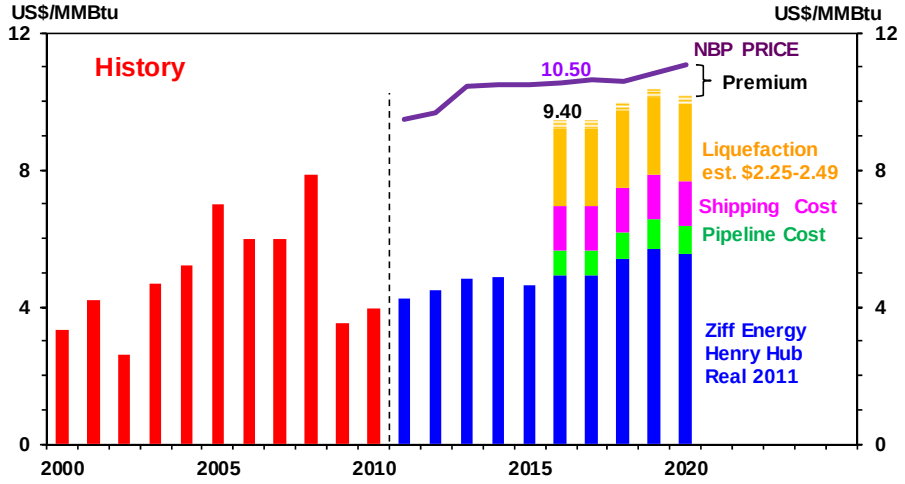
Long term LNG offtake deals from the U.S. Gulf Coast have been structured over the last 12 months for firm volumes of LNG. These deals are at Henry Hub gas price plus a 15% premium to reflect the location. Other costs to Holyrood would include:

- Cdn$2.50 liquefaction toll
- $1.00 shipping via tanker
- $1.20 regasification (high side of range at 50% L.F.).

Landed cost for U.S. Gulf Coast facilities is representative and would likely not be feasible for volumes required for the Holyrood plant. Long term firm deals for large annual take commitments may be negotiated on substantially similar terms to those represented below. Because of low take commitments, Holyrood requirements are more likely to be sourced from the world LNG Spot market. Such cargoes are likely to command World Price gas prices, and therefore roughly similar to current Holyrood feedstock on a heating equivalent basis.

Figure 9 illustrates that in 2016 to 2020, the full cycle cost of delivered LNG to Holyrood would be substantially similar to gas delivered to England.

Figure 9
Gulf of Mexico LNG Export to Holyrood (No Regasification)



- **2015-2020 Average:**
  - Henry Hub - $5.17/MMBtu
  - Estimated LNG Price based on NBP $10.68/MMBtu

→ **Arbitrage Opportunity $5.51/MMBtu**

  - Offset by $4.38 – 4.62/MMBtu of Pipeline (0.83), Maritime (1.30), and Liquefaction (2.25-2.49) Costs

12GC-5001-04

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DOMESTIC GAS OPTION

Additional Gas Market Potential

Due to the small gas requirements at Holyrood for electrical generation, additional markets would be required to justify large infrastructure investments in jetties, storage, and regasification facilities.

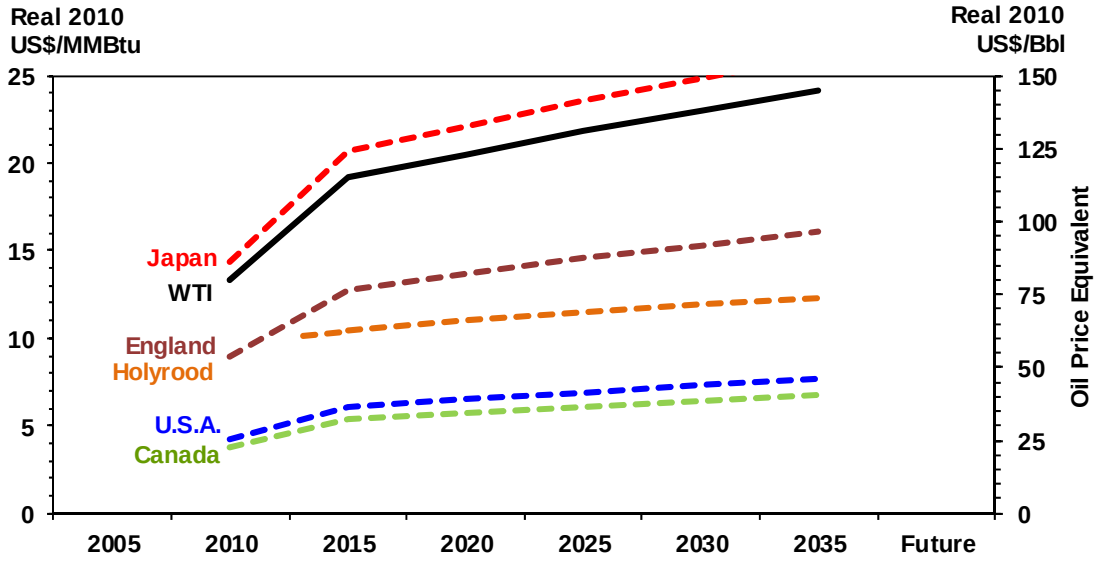
Ziff Energy estimates the residential market could add approximately 14 MMcf/d if all households convert to gas (conversion to gas would be partially or potentially wholly offset by decreased power requirements). The residential market would be subject to high winter peaks and very little summer demand, similar to Holyrood power loads. As such, this market would require would require gas storage to levelize the loads to make investment more attractive to producers. The conclusion is that these additional residential markets are not sufficient to generate economies of scale to reduce operating costs, or to leverage long term firm gas based on Henry Hub net forward pricing.

Long Term Energy Prices

From a world-wide perspective, the U.S. Energy Information Agency (EIA) provides some insight to the relative prices of energy in various countries. A conclusion is that energy prices will continue to rise. Ziff Energy believes that the on-going competition for LNG supply from Asia and Europe will continue. Further, it is our belief that the landed cost at Holyrood in winter will be reflective of the world oil price for spot LNG cargoes. Even if Henry Hub net-forward pricing were available, landed gas at Holyrood would be roughly equivalent to English gas prices, and not similar to gas prices realized on the mainland of North America.

Figure 10 provides EIA forecasts of Japan and WTI Oil prices, as well as gas prices in England, the U.S. and Canada. The Holyrood gas price is a derived figure which equals the EIA U.S. gas price, plus shipping, and liquefaction.

Figure 10
Global LNG Prices



Jan. 23, 2012 – early EIA spring 2012 outlook
*does not include regas

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