

February 29, 2012

Ms. Cheryl Blundon  
Director of Corporate Services and Board Secretary  
Suite E210, Prince Charles Building  
120 Torbay Road, St. John's  
P.O. Box 21040  
St. John's, NL  
A1A 5B2

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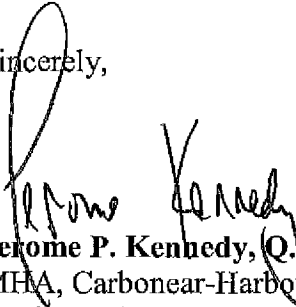
FEB 29 2012

ST. JOHN'S, NL

Dear Ms. Blundon:

I am filing the attached document as additional information for consideration during the Board's review of Muskrat Falls. The impact of the oil price forecast on the project analysis and Nalcor's use of PIRA's reference case has been raised during the Hearings. In addition to Nalcor using PIRA's oil price forecasting services as an input to their analysis, the Province also has a subscription service with PIRA. We regularly use PIRA forecasts for revenue estimates and project assessments. The attached report provides an overview of PIRA, their forecasting methodology as well as their long term view of the forecast and risk factors. I thought it would be helpful to provide this additional information on PIRA given the discussion and issues raised during the hearings.

Sincerely,

  
**Jerome P. Kennedy, Q.C.**  
MHA, Carbonear-Harbour Grace  
Minister of Natural Resources

Attach.

# **PIRA's Forecast Methodology and Assessment of Future Oil Price Trends**

**Prepared for Government of Newfoundland & Labrador  
Department of Natural Resources**

**Submitted by**

**PIRA ENERGY GROUP**

**February 28, 2012**

### Overview

PIRA Energy Group is an international consulting firm founded in 1976 known for its comprehensive and detailed research and market analysis of energy markets. "PIRA" was originally an acronym for Petroleum Industry Research Associates, but PIRA's practice has evolved beyond petroleum and now also includes coverage of natural gas, LNG, coal, power, emissions, and biofuels. We also have groups dedicated to the important macroeconomics, country political risk, energy policy, and shipping assumptions, which underpin our fundamentals-based forecasts.

PIRA is retained by more than 500 companies in over 60 countries. Our clientele includes all of the world's major private integrated oil companies, nearly all of the largest state-owned national oil companies, and over 80% of both the oil producers and oil refiners in North America. Outside of the oil business, we also provide services to over 80% of the U.S. gas and electric companies and over 90% of the gas and power marketers. Our clients are not limited to the energy industry, as we provide consulting to two-thirds of the world's top commercial banks, several proprietary traders and hedge funds, and many industrial end-users, ranging from airlines to automobile companies to chemical manufacturers. This wide-ranging, international clientele is indicative of PIRA's global, balanced view, in which no particular constituency is catered to.

Our approach to market analysis is highly quantitative and highly detailed with databases and models that build up supply and demand at the most disaggregated level possible in order to build up to country, regional and global totals. We begin all of market assessments with a sound understanding of the fundamental forces driving markets (supply/demand/inventory), but we also closely monitor and incorporate the impacts of political risk, financial market investment, and any other relevant "non-fundamentals" factors.

PIRA is staffed by approximately 80 professionals, with the majority of senior consultants holding advanced degrees in economics and engineering. Historically, we have hired staff with extensive experience in industry (particularly the major oil companies) to direct our analytical work.

### Methodology — Long Term Oil Price Outlook

PIRA begins its analysis of the long-term crude price by developing detailed, bottom-up outlooks for liquids demand and liquids supply based on a first-pass price assumption. The demand outlook is developed as part of a full energy balance for each country of the world for each end-use sector (i.e. transportation, industry including petrochemicals, residential/commercial, electric power generation). Historical data are assembled using data from the IEA, country sources and PIRA's own estimates. Assumptions are made for each of 140 countries about economic and population growth, the pace of overall energy efficiency improvement, the prospects for new technology, likely government policy developments, and fuel substitution trends. Assumptions on the availability of non-oil fuels, particularly natural gas, are also made on a country-by-country basis. Projections are made for the demand for each major oil product, including LPG and ethane. The country totals are then aggregated to provide us with regional and global results.

On the supply side, PIRA independently develops an outlook for non-OPEC supply at the country, or in some cases, at the field or basin level, depending on data availability. This outlook will be based on our estimates of the original and remaining resource base, expected rate and location of new discoveries,

decline rates in existing fields, specific development plans of companies (private and state), the prospects for technology improvement (e.g. shale liquids), and policy assumptions that could impact supply availability such as environmental or acreage access limits. We also make an assessment of the supplies likely to come from non-crude sources, including natural gas liquids (OPEC and non-OPEC), biofuels such as ethanol and biodiesel, oil sands, and conversion of gas- or coal-to-liquids.

Once we aggregate the supply data into a global total we calculate the difference between the demand and the total non-OPEC outlook in order to develop a requirement for the amount of OPEC crude to balance the market. We then develop an outlook for production capacity for each of the OPEC countries, taking into account their resource base, investment plans, and a reasonable estimate for the risks of supply loss. (Historically, supply disruptions have limited net OPEC capacity growth and we therefore build in a very conservative outlook for future capacity expansion given the continued risks in many of the OPEC countries.) If there is sufficient OPEC capacity to balance global supply and demand (and allowing for some desired volume of spare capacity), we assemble a balanced Reference Case price outlook. If the supply is insufficient, we would adjust (raise) the assumed starting price and recycle through our demand and non-OPEC supply balances until we reach a balance.

This outlook is tested for reasonableness in several ways. For instance, we check to see:

- If the burden imposed by oil expenditures in the oil importing countries is consistent with our economic growth assumptions by looking at trends in oil expenditures as a share of GDP.
- If the price allows for sufficient growth in OPEC production. For instance, we would not judge an outlook as sustainable if it required persistent cuts by Saudi Arabia to maintain the price.
- If the price is sufficiently high to cover the likely costs of the marginal source of oil supply, such as Canadian oil sands, shale liquids and new deepwater discoveries.
- If the price/production profiles provide OPEC with the revenue needed to meet budget requirements. This may not be possible in all cases since a country like Iran with declining oil exports may need an impossibly high price in the future for budget balance. But it still provides a useful check for countries such as Saudi Arabia.
- If it is consistent with likely changes in the value of the U.S. dollar. A declining dollar, all else equal, would tend to increase the dollar-denominated price of crude oil since it is our view that the price is set in the global market and simply denominated in U.S. dollars.

Ultimately, the key question is whether the price is high enough to incentivize producers to bring forth sufficient liquids supply to meet the expected demand growth at that price.

If the outlook balances, and passes all of the above mentioned reasonableness tests, it is considered to be our Reference Case. We characterize this as our "most likely" case and consistent with our most likely assumptions on all of the key inputs to the balances. It is not just one of many plausible scenarios but one that we put forward as a most likely basis for decision-making.

### Scenario Price Determination — Methodology

Even though the Reference Case may reflect our assumptions on most likely economic growth, technology, government policy and Middle East politics, history has shown us that many of these assumptions carry a wide range of uncertainty. PIRA develops its High and Low Price scenarios by

combining an internally consistent, plausible set of alternative assumptions that give a range of prices around the Reference Case. For instance, in developing the High Price scenario we may reduce our assumption on OPEC supply availability — perhaps in a world in which Middle East unrest prevents any supply growth from the region. Once such an assumption is changed, we would no longer have a balance between supply and demand at our Reference Case prices. Therefore, we would raise the price in our long-term supply and demand models until demand was reduced, and non-OPEC supply was increased sufficiently to bring total supply and demand back into balance — but in a world with less OPEC supply and higher prices.

To develop the Low Price case we might assume a lower rate of economic growth and, in turn, lower oil demand growth. In this case, we would be forced to lower our price outlook until supply and demand rebalanced. Alternatively, we could develop the Low Price case based on increased non-OPEC supply (say from a significant increase in North American and global shale liquids production) that would also create an oversupply situation that would require a decline in price to balance. Again, as in the Reference Case, we would test the price in each of our scenarios against a series of reasonableness checks. For instance, in this latter case, driven by higher shale liquids production, we would have to ensure that the scenario price was still high enough to provide a return on investment to shale liquids investors.

## Current Reference Case — Key Assumptions

PIRA's latest Reference Case outlook is based on the following assumptions:

### Demand

- PIRA estimates that the individual country growth assumptions we make will result in global economic growth that will average 3.5% per year between 2011 and 2025. This projection is in line with the consensus economic forecast of others (IEA, OPEC, BP) that develop long-term forecasts. Energy efficiency improvements will proceed at a slightly faster rate in the future than they have over the past decade, driven by a combination of higher price, environmental pressures, and growing supply security concerns and policies to slow consumption growth. New, more efficient automobile technology including (but not limited to) hybrids and all-electrics will be brought to market and slowly increase its share of new car sales with the help of government subsidies and regulations. This is assumed to be the case in both the OECD and China. (We note that while there is a tendency to focus on policy developments in the OECD, the most important policy developments may in fact be those taking place in China, where the oil growth potential is the largest.)

While there will be continued steady progress in energy end-use technology, disruptive technological breakthroughs, such as extremely low cost batteries or economic hydrogen vehicles, are not anticipated. Given the expected low cost of natural gas relative to oil, we have assumed some penetration of natural gas in the commercial transportation sector in the developed world and in personal transport in select developing countries, but the global impact will still remain small. Significant oil price subsidies will steadily disappear, with the exception of the major oil exporting countries where they will be politically difficult to remove in most cases. PIRA estimates that overall oil demand will grow by between 1 and 1.5% per year over the entire 2011-2025 period with all of the net growth in the developing world, particularly China, India, and the oil exporting nations. From just under 90 MMB/D today, oil demand will reach between 105 and 110 MMB/D by 2025.

## Non-OPEC Supply

- Conventional non-OPEC crude supply will resume its growth after years of stagnation with the net growth coming primarily from liquids from shale source rock. These shale liquids will initially be developed in North America however post-2020, a growing contribution is expected from other global shale resources around the world. Most of the growth in non-OPEC liquids supply will come from OPEC Natural Gas Liquids (NGLs) and condensates (typically counted with non-OPEC) and non-conventional supplies. Canadian bitumen projects account for the largest single source of growth followed by biofuels and small volumes of gas-to-liquids. In total, non-OPEC liquids production from all these sources will grow at an average rate of around 1 MMB/D per year.

## OPEC Crude Supply

- Reconstruction in **Iraq** is assumed to proceed slowly given the remaining uncertainties, particularly the renewed threat of sectarian conflict. We project growth toward just over 5 MMB/D in 2025. This is still well below Iraqi targets and resource base potential.
- **Saudi Arabia** will add only modest net amounts of new capacity as their required production should average just above current levels longer term.
- **Iran** and the West will avoid a serious confrontation that impacts long-run capacity or production. This is looking to be a greater risk, and to reflect this we have put in a conservative outlook for capacity growth that has Iran declining gradually due to a lack of foreign investment.
- **Venezuela's** capacity will eventually recover slowly as new investors are found for additional heavy oil projects in a post-Chavez regime.
- The current unrest spreading through **North Africa and the Middle East** will result in periodic short-term losses but no significant, extended losses.
- OPEC will follow the price guidance of the market in the longer term. There is no particular price target that is relevant for the longer term, but the price required to meet the group's revenue needs will continue to climb; this process has been accelerated due to the increased social spending driven by recent protests. At some point, the growth in OPEC spending will have to slow since the market is unlikely to permit the group to achieve an ever rising price — at least not in inflation-adjusted terms.
- OPEC crude production in total will climb from today's level of 30 MMB/D and plateau at just under 36. This is lower than our prior outlooks and more consistent with historical experience, where net growth in OPEC capacity has proved to be difficult to achieve due to periodic disruptions.
- Under these assumptions the Brent crude price will average approximately \$118/Bbl (2010\$) and WTI will average several dollars lower over the period from 2009-2025 with much of the increase occurring over the initial 5 years followed by an extended plateau.

We believe that this Reference Case price path:

- Appears to be broadly consistent with OPEC capacity expansion objectives (appropriately discounted) and post-Arab Spring higher revenue requirements. OPEC production and capacity will grow slowly under these assumptions and revenues will consistently rise.

- Is consistent with long-term expected trends in the costs of non-conventional supplies (although these tend to follow prices for extended periods).
- Appears sustainable from a demand and economic growth standpoint.
- Overall, will bring forth sufficient liquids supplies (on average) to meet anticipated demand growth at this price.

Compared to our past forecasts, upward price pressures in this year's outlook have again been accelerated due to the aftermath of the Arab Spring and the associated supply losses and higher OPEC revenue requirements. It is assumed that less price pressure will be observed post-2015 as non-OPEC liquids growth expands and the impact of transportation efficiency improvements spreads leading to a flattening of required OPEC production. We attach a probability of 45% that the average Brent price will fall within the \$100 to \$140/Bbl range (2010\$) over the 2009-2025 period, with the upside and downside risks about equal. (This has not always been the case. In past outlooks we have normally seen the risks as skewed to the upside.)

### Potential for a Low Price Scenario

The principal drivers for a sustained average price significantly lower than our Reference Case price would be:

- Persistently weaker North American and global economic growth and associated weaker oil demand growth.
- Significantly higher OPEC crude oil production — with Iraq being the country with the most upside if it is able to carry out its plans without disruption.
- Upside surprises to non-OPEC production. This could include, but would not be limited to, much higher shale liquids production in both North America and abroad than assumed under our Reference Case. Note, however, that not only would the shale liquids volumes have to be higher but they would have to be economically attractive at the lower prices of this case. Current estimates suggest that a price of between \$50 and \$60/Bbl (WTI 2010\$) is required to provide an acceptable return on shale liquids wells. That breakeven cost could drift down with improved technology or drift up with increased activity and scarcity of resources, as oil sands costs have done in Alberta.

Under these assumptions, we define a representative low case with an average WTI price of around \$66/Bbl over the 2009-2025 period. This average price would be about 43% lower than our Reference Case price — similar to the differential assumed back in November of 2009 between our Reference and Low cases.

### Comparison with November 2009 Outlook

Both the Reference Case and Low Price Case that were developed in November of 2009 were lower than our current view. Comparing the forecasts in the same constant 2010\$, our average Reference Case WTI price then was \$100/barrel and the current price for the same 2009-2025 period would be \$115/barrel. The comparable numbers for the Low Case were \$46 (2010\$) then and \$66 now. We did note at the time that the risks were skewed to the upside. The single principal reason for the increase in the Reference Case price since 2009 was the increase in the uncertainty over supply out of the Middle East and North Africa. The Arab Spring uprisings were part of the story, but the potential for losses in

Iran due to conflict with the West and in Iraq due to renewed sectarian conflict all have combined to reduce our assessment of the likely volumes to come from OPEC. In addition, the threats to existing Middle East regimes have caused the OPEC countries (Saudi Arabia in particular) to increase social spending, which has increased the oil price they require to balance their budgets. While they may not be able to achieve their desired price, this is a directionally bullish development.

We also note that the growth in global oil demand since 2009 has been nearly 3.6 MMB/D. This was stronger than expected under our growth projection at the time and occurred during a period when oil prices have remained high and global economic growth has been relatively weak, suggesting that oil demand may be even more resilient to demand destruction steps than typically assumed.