

MEMORANDUM

STATE OF ALASKA

Department of Natural Resources

Division of Oil & Gas

To: Antony Scott, Chief Commercial Section
From: William Nebesky, Commercial Analyst
RE: Briefing paper on Wood Mackenzie Long Term Outlook
Date: May 15, 2008

The attached briefing paper summarizes Wood Mackenzie's *Gas and Power Long Term Outlook*. The suite of publications contained in this *Outlook* service are available on a subscription basis only. However, Wood Mackenzie has allowed the State to provide a public summary of their pricing views, and the main drivers that determine those views. The following synopsis has been revised by Wood Mackenzie and accurately reflects the Wood Mackenzie January 2008 Base Case view.

Wood Mackenzie Gas and Power Long Term Outlook

Briefing Paper

Introduction

Wood Mackenzie has assembled a long-term forecast of the natural gas price in North America published in *Wood Mackenzie's Long Term View – January 2008 Update: Gas and Power Service*.¹ Wood Mackenzie's gas price outlook considers global economic and energy market fundamentals and is one of several gas price projections considered in the State's evaluation of stakeholder NPVs. This briefing note summarizes the key assumptions that underpin the Wood Mackenzie gas price outlook.

North American Gas Supply Outlook

Aggregate gas production from gas fields throughout North America (Canada, Mexico, and the US) is assumed to average approximately 73 billion cubic feet per day (Bcfd) through the 20-year forecast horizon (2008-27), varying within an approximate range of 70 – 75 Bcfd. US gas production accounts for about $\frac{3}{4}$ of this total and is expected to grow in the near term at between 3 and 4 Bcfd from 2007 through 2011. This near-term growth and subsequent production gains stem from follow-on, unconventional plays in the Arkoma basin (gas shale) and in the Rockies and ArkLaTex basins (tight gas).

Production in the Western Canadian Sedimentary Basin (WCSB) is expected to decline at a steady rate of -1.8% per year as a consequence of cost pressures from oil sands competition, compounded by relative strength in the Canadian dollar. The recent adjustment in Alberta royalty is assumed to lower producer expected returns and further discourage investment in gas exploration and development.

At an average annual rate of -3.2% per year, the sharpest gas production decline is assumed for the Gulf of Mexico (GoM), as shown in Table 1. Despite promising lease sale spending in the Central GoM Sale 205 (January 2008), the recent 134-mile, 24-inch Independence Trail pipeline that serves ten fields with additional tie-in capacity, and heightened interest in deep and ultra deep exploration, GoM production rates will nearly halve over the next 20 years from peak production at 8.1 Bcfd in 2008.

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Table 1. Average Annual Rate of Growth in US Production by Region

	<u>GoM</u>	<u>Gulf Coast</u>	<u>Rockies</u>	<u>San Juan</u>	<u>South - west</u>	<u>Mid-Cont</u>	<u>West Coast</u>	<u>North-east</u>	<u>Alaska^a</u>	<u>US Total</u>
AARG ^b (%/Yr)	-3.2%	-1.4%	1.2%	-1.3%	0.8%	-0.4%	-2.8%	1.4%		-0.5%
Max Year	<u>2008</u>	<u>2009</u>	<u>2020</u>	<u>2008</u>	<u>2023</u>	<u>2012</u>	<u>2008</u>	<u>2020</u>	<u>2023</u>	<u>2011</u>
Max Rate (Bcfd)	8,146	15,147	11,796	4,005	7,717	7,922	774	3,288	4,500	55,752

Table Notes:

^a Included in US Total.

^b Average Annual Rate of Growth

The steady decline in WCSB and GoM production will be partially offset with latter Arctic development from the Canadian McKenzie Valley, which would gradually ramp-up to 1.1 Bcfd beginning 2014. The Alaska Gas Pipeline is assumed to start up in 2021 with 4.5 Bcfd of Alaska North Slope gas delivered into the Alberta and Chicago markets. Arctic development is not expected to significantly impact North American prices, with price weakness after completion of the Alaskan pipeline expected to be temporary.

The composition of North American production will shift over the forecast horizon. The Lower-48 and Canada account for 95% of North American gas production through 2017. Production from these provinces will fall to 85% of a relatively constant total of 70 - 73 Bcfd. The difference will be made up of gas from the Alaska North Slope (6%), the Canadian McKenzie Valley (2%) and Mexican fields (7%).

LNG Import Assumptions

Wood Mackenzie has recently ratcheted down its projections for LNG deliveries into the North American market compared with its forecast estimates in prior years. This scale back is due in part to the delays and “industry struggles” (p 13) to maintain new-build development schedules.² Lower imported LNG volumes are due also to stronger expected US domestic supply in the near term and higher “oil-linked” (p 13 and 14) gas prices in markets that compete for LNG; especially in Asia and Europe, where LNG import demand is expected to remain high indefinitely.

The pace of liquefaction plant new builds in North America is also expected to slow. Only two of nine projects achieved investment decision timeline targets in 2007. Nevertheless, Wood Mackenzie assumes twelve new LNG receiving facilities with aggregate capacity of 12 billion cubic feet per day (Bcfd) for North American imports will be in service between 2008 and 2017. LNG imports are assumed to grow at a strong average annual rate of 13%, rising from 2.1 Bcfd in 2008 to 17.0 Bcfd or about 23% of total US Demand in 2025. By 2017, the four existing receiving facilities currently serving North American LNG imports will account for only about 35% of total imported LNG.

² Current global production level estimates for 2012 have been reduced by 100 million tons per annum (mmtpa) or about 25% of Wood Mackenzie’s own estimates prepared in 2005.

In sum, Wood Mackenzie characterizes Global LNG from 2010-2027 as a seller's market in which North American consumers would have increasing participation.

Core industrial and Power Demand

Total US demand for natural gas is assumed to grow from 64 to 73 Bcfd over the 20-year forecast horizon. This implies a medium average annual growth rate of 0.8%. The breakdown of expected growth by major consuming sector is summarized in Table 2. Residential and commercial demand will grow slightly. Industrial demand average annual growth is negative 0.4% due primarily to overseas competition from low-cost gas producing countries and expanding Middle East petrochemical capacity.

Table 2. Average Annual Rate of Growth in Total US Gas Demand by Sector

	<u>Residential</u>	<u>Commercial</u>	<u>Industrial</u>	<u>Power</u>	<u>Other</u>	<u>Total</u>
AARG ^a (%/Yr)	0.1%	0.2%	-0.4%	2.5%	0.1%	0.8%
Max Year	<u>2023</u>	<u>2023</u>	<u>2010</u>	<u>2024</u>	<u>2010</u>	<u>2024</u>
Max Rate (Bcfd)	13.45	8.74	18.85	28.68	4.92	72.88

Table Note:

^a Average Annual Rate of Growth

Growth in power demand is assumed to be positive and at an average annual rate of 2.5% per year and will dominate other sectors. Ethanol and oil sands are two key subsectors that, while relatively small, are expected to fuel gas demand growth. Wood Mackenzie assumes that, under the US Environmental Protection Agency's Renewable Fuel Standards (RFS) program, ethanol climbs to 10% of US gasoline consumption by 2015. Oil sands projects increase gas demand threefold from 1.0 to 3.0 Bcfd between 2007 and 2020.

Power generation capacity requirements are confounded by uncertainty over carbon legislation. Wood Mackenzie assumes that the market will absorb the combined cycle gas generation overbuild of the late 1990s and that new generation capacity will be required across all US regions over the next five years. Coal plant capacity is favored for baseload power in regions with lax emissions requirements but, in general, coal new build will be stymied by public opposition, cost escalation, and pending state and federal greenhouse gas (GHG) legislation.³

Gas is viewed by Wood Mackenzie as "virtually the only viable option" (p 17). Gas will account for about two-thirds of total new generation capacity installed between 2011 and 2017.⁴ Planned retirement of existing coal generation capacity will be stalled, in part as a result of reduced expectations for new coal build. Coal capacity new-build will account for 16% of total additions to incremental power generation capacity and be mostly in place by 2018. Wind (10%), nuclear (4%) and other (7%) will account for the balance to new generation capacity.

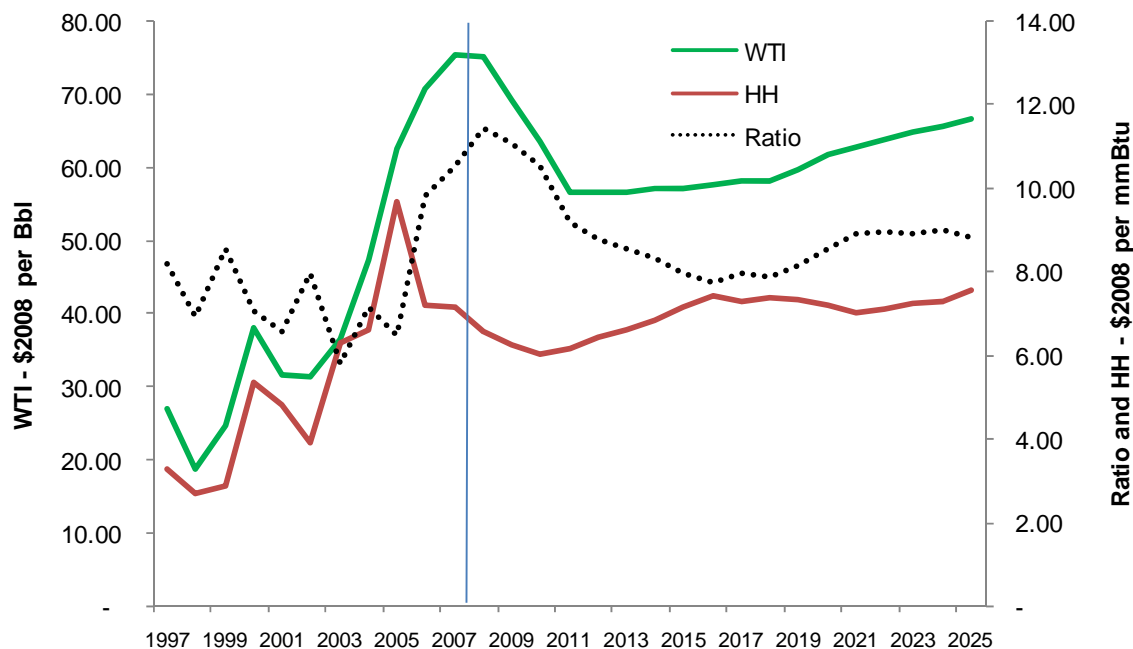
³ Wood Mackenzie assumes implementation of a Regional GHG Initiative with cap-and-trade emissions standards by 2009 in Eastern Seaboard states. But a US federal carbon tax would not be in effect before 2027.

⁴ Combined cycle to account for 41%; peaking 22%.

Oil Market and Gas Price Assumptions

Wood Mackenzie expects a period of diminishing price pressure in global markets during the period 2008-11 with a long-run, real WTI price of \$60 per barrel thereafter (see Figure 1). The primary drivers for the oil price forecast are global GDP growth and OPEC spare capacity. Several additional market and political factors are considered.

Figure 1. Wood Mackenzie North American Oil and Gas Price Forecast



Source: Wood Mackenzie, *Long Term Market View - January 2008*.

Global GDP growth is expected to increase at an average annual rate of 3.7 percent over the 20-year period 2005-25. The U.S. contribution to global GDP will decline from 21 to 18.5 percent, while China’s contribution is expected to increase sharply from 11 to 16 percent over the forecast period. This overall GDP growth translates into an increase of 23 million barrels per day (mmbpd) in world crude oil demand from about 85 mmbpd in 2007 to 109 mmbpd in 2025 – an average annual rate of 4.4 percent. China, alone, will account for about one third of this increase.⁵ The U.S. will account for less than ten percent of the increase. Developed Asian economies and OECD countries will play a modest role.⁶ Uncertainties related to the depth and timing of the U.S. recession, U.S. carbon emissions policy, and the degree that income and price effects matter are risk factors on the demand side.

⁵ China’s “car population” has increased by 20 percent per year since 2000 and now ranks second behind the US. (Wood Mackenzie, *Macro Oils: Long Term Outlook to 2025* (2008:p.3).

⁶ Corporate Average Fuel efficiency (CAFE) standards in the U.S. are expected to reach 35 miles per gallon by 2020. (Wood Mackenzie, 2008:p.3).

Global supply of crude is expected to “meet” future demand. Non-OPEC oil production growth, driven by Canadian oil sands and U.S. Gulf of Mexico deep water, as well as Central Asian developments, is expected to increase for about a decade then decline after 2020. Significant advances in unconventional oilfield development will help to offset this later-period non-OPEC decline.

The recent contraction in OPEC spare capacity to approximately 3 mmbpd is expected to reverse and widen to over 4.5 mmbpd during 2009-12. This is expected to be a major factor in downward price movement through 2016. Overall OPEC capacity is projected to increase by 31% from about 35 to 46 mmbpd over the forecast period. Mixed results with Saudi Arabia’s aggressive program for planned capacity expansion could weaken its role as OPEC swing producer and result in less capacity cushion in periods of supply tightness. Wood Mackenzie acknowledges this as an important supply-side risk factor. Other supply uncertainties include the effects of rising upstream costs on the economics of marginal supply⁷, the prospects for stability in Iraq⁸, and the ability of biofuels to compete with conventional oil in the future.

Other factors considered in Wood Mackenzie’s oil price forecast are: 1) investment in oil futures and U.S. dollar weakness and 2) refining capacity. Wood Mackenzie suggest that the marked recent growth in institutional investor participation in NYMEX oil futures trading was driven in part as an inflation hedge against U.S. dollar weakness. Wood Mackenzie expects the influence of these factors to diminish and possibly reverse after 2008 (Wood Mackenzie, 2008: p. 12).

Tightened global refinery capacity in recent years has played a part in strengthened oil prices. Going forward, refining capacity effects are not expected to continue because expanded refining margins attract investment and result in both 1) capacity new build, primary in Asia Pacific, Middle East, and Latin America), and 2) expansion of existing capacity, primarily in North America, Europe and the FSU (Wood Mackenzie, 2008: p. 16).

The US Henry Hub gas price “disconnect” with the oil, reflected in the widened gap between the oil and gas price lines in Figure 1, will continue until after 2011 as a result of several factors. They are: 1) growing North American gas production; 2) weak demand growth in the power sector due, in part, to weakness in the US economy; and 3) additions in generation capacity from wind and coal adequate to meet incremental demand without resorting to LNG cargos.

It is not until the period 2012-17 that US domestic gas production is assumed to stabilize and LNG imports begin to fill the emerging demand-supply gap. The “draw” on LNG imports, for which global pricing is highly competitive and “oil-linked”, is a key factor in the re-establishment of North American oil-gas real price parity at around 8-to-9 (ratio of oil price in \$ per barrel to gas price in \$ per mmBtu). Wood Mackenzie notes that if the long-term, real oil price stabilizes at a level higher than \$60 per barrel (say \$80), then they expect the pull on gas prices to rise

⁷ In recognition of continuing upstream cost increases, Wood Mackenzie revised upward its November 2007 estimate of the break-even Brent oil price for Canadian oil sands from \$55 to \$70. (Wood Mackenzie, 2008:p.13).

⁸ Wood Mackenzie assumes that political stability in Iraq emerges slowly after 2010 and estimates that Iraq capacity could reach 6 mmbpd by 2015. (Wood Mackenzie, 2008: Pp.25-31).

accordingly, indicating that long-term oil-gas price parity is expected to stabilize in the 8-to-9 range.

Over the long term (2018-2027) Wood Mackenzie views natural gas as the “fuel of choice”. The real HH gas price will stabilize at about \$7 per mmBtu as a result of continued decline in global energy intensity and long-term F&D cost stability. The North American gas price is expected to experience little if any interruption as a result of McKenzie Valley or North Slope production.

Summary

North American gas production stays level but the regional mix changes. Sharp declines in WCSB and the US GoM are partially offset by Arctic gas from both Canada (2014) and Alaska (2021).

Wood Mackenzie has scaled back its view of global LNG in both production and receiving capacity. By 2017, flexible LNG volumes will be tied to oil, strengthening the link between US gas prices and world oil prices. With the installation of 12 new receiving facilities in North America, LNG will eventually achieve a significant 23% share of the North American market.

Overall growth in North American total gas demand will be dominated by capacity gains in the power sector. Gas demand growth in power will offset decline in the industrial sector. Gas will be favored as the chief source of new power generation capacity. Coal development will occur but will be dogged by regional GHG legislation and the threat of eventual federal legislation.

The long term oil price stabilizes at about \$60 real by 2013. The Henry Hub real gas price gradually rises in step with North American LNG penetration and stabilizes at above \$7 per mmBtu. With the link between gas and oil reestablished, however, higher oil prices would pull North American natural gas prices higher as well.