United States Natural Gas Prices to 2015: Update and Views from International Natural Gas and LNG Developments*

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Search and Discovery Article #70054 (2008)
Posted October 30, 2008

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*Oral presentation at AAPG Annual Convention, San Antonio, TX, April 20-23, 2008
U.S. Nat Gas Prices to 2015

Update and Views on International, LNG Developments, AAPG 2008 Forum
# Natural Gas Price Drivers Pre-2015

<table>
<thead>
<tr>
<th>Pressures Toward Lower Prices</th>
<th>Pressures Toward Higher Prices</th>
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<tbody>
<tr>
<td>• No major hurricane disruptions</td>
<td>• Adverse conditions (Henry Hub during winter 2005-06 approx. $6-15)</td>
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<tr>
<td>• Persistent inventory overhang</td>
<td>• Persistent inventory uncertainty</td>
</tr>
<tr>
<td>• Oil prices fall with demand</td>
<td>• High oil prices, inflationary pressure</td>
</tr>
<tr>
<td>• Success in tight gas plays</td>
<td>• Moderate/low supply development</td>
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<tr>
<td>• Rockies deliveries</td>
<td>• Moderate/low supply development</td>
</tr>
<tr>
<td>• Surplus LNG cargoes available at Henry Hub prices with new regas</td>
<td>• LNG market remains tight, new regas terminals delayed</td>
</tr>
<tr>
<td>• Demand erosion in key industrial applications does not reverse</td>
<td>• Business as usual demand increases</td>
</tr>
<tr>
<td>• No/little success on climate</td>
<td>• Climate initiatives begin to bite</td>
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## Natural Gas Price Drivers Post-2015

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<tr>
<td>• Permanent loss in key demand sectors (industrial); flat demand in core (residential, commercial)</td>
<td>• Demand increases (despite high prices) due to climate measures and other factors</td>
</tr>
<tr>
<td>• Sustained decline in oil prices</td>
<td>• Extreme volatility; critical resource, infrastructure improvements not achieved</td>
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<tr>
<td>• Entry of new, major infrastructure projects (Alaskan pipe)</td>
<td>• Alaska (and Canadian Arctic) delays continue</td>
</tr>
<tr>
<td>• Mexico exports to US, result of LNG imports and excess capacity</td>
<td>• Mexican demand surges, no surplus for US</td>
</tr>
<tr>
<td>• Henry Hub basis detaches with expanding LNG shipments</td>
<td>• Euro, Pacific competition for LNG supply; idle US regas capacity</td>
</tr>
<tr>
<td>• Coal takes majority of new power demand (fears of gas price spikes)</td>
<td>• State, Federal climate measures become serious; gas benefits.</td>
</tr>
</tbody>
</table>
A Line in the Sand

Ali al-Naimi, who controls the world's biggest oil exports, said crude prices are unlikely to fall below $60 a barrel because of rising costs to develop tar sands and alternative fuels. *Producing oil from...alternatives costs about $60 to $70 a barrel, "and, therefore, a line has been drawn below which the price cannot fall,"* al-Naimi said in an interview published in Petrostrategies, a Paris-based industry newsletter.

First Enercast, March 3, 2008
Determining the Price of Oil (2006)

RESULT: Crude oil is overpriced

- Plus financial speculation ($15-20)
- Plus "artificial" demand (10-20%)
- Plus growth in demand
- Plus political premium
- Finding and lifting cost (role of marginal producer)

* Oil for economic development
Fun with China

China Current Account
$\text{in} > \text{out}$

US Current Account
$\text{out} > \text{in}$

$\text{energy} < \text{market}$

$\text{energy} = \text{market}$

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Oil Production and Consumption

- World Production
- World Consumption
- WTI ($/bbl)

Sources: BP Statistical Review; USEIA
Growth in Oil Consumption

Impact of “Managed Prices” in China

Sources: BP Statistical Review; USEIA
US Oil Consumption vs. Price

January 1982-July 2006

Composite RAC, $/bbl

US Petroleum Consumption, 1000 b/d
Chakib, We Hardly Knew Ye

The decision to stand pat reflects the view of [OPEC] that there is little it can do to bring down oil prices. Citing higher U.S. inventories of crude, ministers said the weak dollar was driving oil's rally...Chakib Khelil, OPEC's president, said crude stocks were above their five-year average and that soaring crude prices were caused by a weak dollar, the credit crisis in the U.S. and "speculative activity in petroleum markets." "It's due to the mismanagement of the U.S. economy that's affecting... economies in the rest of the world," he said...Wednesday's meeting came with OPEC in a new position. Once its decisions were the chief driver of crude prices. But factors such as U.S. interest-rate policy and bond- and equity-market movements are increasingly important.

“OPEC Keeps Output Level Steady”, WSJ, 3/5/2008
Oil and Money, I

Intended Federal Funds Rate (%)

Cushing, OK WTI Spot Price FOB (Dollars per Barrel)

Sources: Federal Reserve Bank System; New York Mercantile; US Energy Information Administration; Center for Energy Economics, University of Texas-Austin
Oil and Money, II

- Cushing, OK WTI Spot Price FOB (Dollars per Barrel)
- Trade Weighted Exchange Index: Major Currencies

Sources: St. Louis Federal Reserve Bank; New York Mercantile; US Energy Information Administration; Center for Energy Economics, University of Texas-Austin

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Commodities have been one of the best performing asset classes over the past five years and have been widely accepted by institutional investors as an asset class in their own right, suitable for absolute returns and portfolio diversification purposes.

DB Global Markets Research, 2/8/2008

"Money is pouring into commodities as an asset class and the instruments we trade might not be up to it".

Comment from DB GMR, February 08

Source: DB Global Markets Research, Bloomberg
Natural Gas Competitiveness

Sources: U.S. EIA; NYMEX
Power Generation Has Surpassed Industrial Load

Source: U.S. EIA
Pricing Natural Gas for Power Gen


Natural Gas Deliveries for Electric Power (MMcf)

Henry Hub Price ($/MMBtu)

Source: U.S. EIA
The Future of Coal?
*$4,000,000/MW!

*Based on estimated total cost for Future Gen low or zero IGCC/CCS, if fully funded, built, and operated (250MW).

Planned nameplate additions, 2006-2010, 94 GW (shares do not add to 100% because of omitted categories)

Source: U.S. EIA, Platts and other
LNG Cargo Receipts and Natural Gas Pricing

Sources: NYMEX, World Gas Intelligence; USEIA ©CEE-UT, 18
LNG Value Chain Cost Estimates (Excludes Feedstock)

- Total, 1980s: $2.5/MMBtu
- Liquefaction: $0.5/MMBtu
- Shipping: $0.1/MMBtu
- Regas and Storage: $0.1/MMBtu
- Total, 2000s: $1.8/MMBtu
- Liquefaction: $0.3/MMBtu
- Shipping: $0.28/MMBtu
- Regas and Storage: $0.2/MMBtu
- Total, 2006: $2.58/MMBtu

Sources: CEE Fall 2007
Sample Projects in Same Region

What caused the differences?
Onshore vs. Offshore?
Developer posture?
Early dialogue?

Unlicensed Onshore Project

Licensed Offshore Project

Sources: CEE, Community and Economic Benefits of LNG, 2008
Sample Projects in Different Regions

What caused the differences?
Onshore vs. Offshore?
Developer posture?
Early dialogue?

Unlicensed Onshore Project

Licensed Onshore Project

Sources: CEE, Community and Economic Benefits of LNG, 2008
Opportunities for Northeast Projects

• Onshore projects are unlikely due to inland waterways can become problematic.
• A permanent offshore FSRU will likely face opposition unless considerably remote.
• Remote offshore projects seem possible without a permanent visible structure from the coast.
• A visible FSRU may be possible if it is only present only for continuous supply during peak demand
• Promotion of the use of LNG in marine operations (fishing, tug boats) as well as for home heating by the community would help provide tangible benefits.

Sources: CEE, Community and Economic Benefits of LNG, 2008
Pacific Northwest Projects

- Small storage and regasification facilities
- Facilities that serve local markets in areas where electricity will need to be generated thermally due to dam decommissioning
- Excess volumes could eventually target other markets (via pipeline or wire).

Sources: CEE, Community and Economic Benefits of LNG, 2008
Central/Western Gulf Coast Projects

- Preference for onshore projects; potential overbuilding in the region.
- Possible constraint associated with limits to tolerance for further, intense coastal industrial development.
- Regasification facilities with associated storage (LNG or underground natural gas) near existing pipeline takeaway infrastructure or rights of way.

Sources: CEE, Community and Economic Benefits of LNG, 2008
Florida Projects

- Offshore projects face environmental challenges due to pipeline construction impacts.
- Novel pipeline construction techniques (tunnels), if economically viable, may help reduce footprint.
- Onshore projects near busy and congested ports might be supported as State shifts toward more natural gas power generation.
- Extension to greater Southeast as mid-term coal projects are displaced by natural gas.

Sources: CEE, Community and Economic Benefits of LNG, 2008
California Projects

• Offshore projects face ever more complex demands which are being solved “technologically”.
  – No seawater use – move to used closed loop vaporization.
  – No emissions allowed – thermal integration with shore facilities or air vaporizers to avoid onsite combustion.
  – Minimize coastal impact – pipelines in large tunnels.
  – Minimize visual impact – move further offshore.
  – Minimize security concerns – move even further offshore.

• Onshore projects unlikely unless in existing port but still face similar issues.

Sources: CEE, Community and Economic Benefits of LNG, 2008
CEE “Commodity Cycle” Forecast of Russian Natural Gas Consumption

What Nat Gas Will be Monetized?

• Stiffer terms for upstream, HH pricing eliminates cost advantage for industrials
• Desire among NOCs to participate in LNG VC components, but can they pay up?
• Desire among host governments to use nat gas for domestic economic development
• Strategies of big players – will Russia pursue market share?