Implications of Abundant Natural Gas

Workshop on Abundant Natural Gas
Global Energy Technology Strategy Project
April 16, 2013 | Cambridge, MD

By
Howard Gruenspecht, Deputy Administrator
Supply Factors
EIA is updating its recent global shale gas assessment and identifying prospective tight oil formations

Resources are necessary but not sufficient for shale gas/tight oil development: above-the-ground factors matter a lot

- Ownership of subsurface rights affects the incentive for development
- Availability of many independent operators and supporting contractors with critical expertise and suitable drill rigs
- Pre-existing gathering and pipeline infrastructure in key areas, and
- Availability of water resources for use in hydraulic fracturing
World oil prices move together due to arbitrage

Global crude oil prices
Nominal dollars per barrel, monthly average

Sources: Bloomberg, Thomson Reuters

Howard Gruenspecht, GTSP Workshop
April 16, 2013
Spot natural gas prices vary significantly across global markets since 2008, with many markets far below oil-related benchmarks.

Global spot natural gas, crude oil, and LNG prices
U.S. dollars per million British thermal unit

Source: Derived from Bloomberg, L.P.
Supply-side wild cards

• Quality and extent of shale gas resources outside North America

• Success (or not) in addressing above-the-ground issues in key areas with resources outside North America

• Importance of economic and physical links between natural gas and tight oil production

• Speed of global natural gas market convergence

• Relative strength of gas-on-gas or gas-on-oil pricing models in key regions
Demand – Power generation
Coal regains some competitive advantage relative to natural gas in the United States over time on a national average basis.

Energy prices to the electric power sector

- **History**
- **Projections**

*2011 dollars per Btu*

**Coal**

**Natural gas**

Competitive parity

Source: EIA, Annual Energy Outlook 2013 Early Release

Howard Gruenspecht, GTSP Workshop
April 16, 2013
The average delivered price of coal to electricity generators varies widely across U.S. regions – transport costs are a key reason.

2011 Delivered coal prices, $ per million Btu

Source: EIA, Annual Energy Outlook 2013 Early Release

<table>
<thead>
<tr>
<th>National Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2.38</td>
<td>$1.65</td>
<td>$4.07</td>
</tr>
</tbody>
</table>

Howard Gruenspecht, GTSP Workshop
April 16, 2013
Growth in electricity use slows, but still increases by 28% from 2012 to 2040

U.S. electricity use
percent growth (3-year rolling average)

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950s</td>
<td>9.8</td>
</tr>
<tr>
<td>1960s</td>
<td>7.3</td>
</tr>
<tr>
<td>1970s</td>
<td>4.7</td>
</tr>
<tr>
<td>1980s</td>
<td>2.9</td>
</tr>
<tr>
<td>1990s</td>
<td>2.4</td>
</tr>
<tr>
<td>2000-2011</td>
<td>0.9</td>
</tr>
<tr>
<td>2012-2040</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Source: EIA, Annual Energy Outlook 2013 Early Release
Operating costs: existing plants with and without a value on carbon

The “crossover point” for least-cost dispatch of coal and natural gas capacity depends on both fuel prices and the carbon value. At lower natural gas prices, the “crossover” occurs at a lower carbon value.

Environmental operating costs and retrofit costs for pollution controls at existing coal-fired plants can “raise the bar” for their continued operation.

For retrofit decisions, the unit’s perceived “useful life,” which plays a critical role, can be affected by views regarding future climate policies.
Dispatch competitiveness of natural gas relative to coal in the United States depends on both resource and cost/technology futures.

Ratio of average fuel costs (natural gas CCGT to coal-fired steam turbine) per megawatthour in five cases, 2008-2040.
Both resource realizations and policy decisions affect the projected use of natural gas for U.S. electricity generation.

U.S. natural gas electricity generation
billon kWh
Projected U.S. coal production is also sensitive to natural gas resource levels and GHG policy decisions

U.S. total coal production, 2011, 2020, and 2040 (quadrillion Btu)
Demand -- Transportation
The ratio of oil to natural gas prices in the United States remains high through 2040 in EIA’s *AEO2013* Reference case projection.

**ratio of oil price to natural gas price**

<table>
<thead>
<tr>
<th>History</th>
<th>2011</th>
<th>Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1995</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2000</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2005</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2010</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

**Source:** EIA, Annual Energy Outlook 2013
Natural gas producers would LOVE to compete with oil in transport rather than with coal in electricity generation.

- In EIA’s Reference case, which assumes no policy actions to spur natural gas use in transport, natural gas still makes real inroads as a fuel for heavy duty vehicles.

- Methanol, either neat or blended, has real potential as a natural-gas based fuel for light-duty vehicles. Less relevant in markets that have already focused on ethanol as a blending component for LDV fuels, such as U.S., and Brazil.

- Natural gas as a feedstock for GTL fuels

- Opportunities for natural gas in rail and marine transport applications.
Demand-side wild cards

- Extent to which future climate policies hit the “sweet spot” for natural gas use for electricity generation – carbon prices need to be just right for natural gas to do well

- Other environmental policies affecting the economics of generation from existing coal-fired power plants

- Role of natural gas in transportation sector applications, which depends on
  - Future price of natural gas relative to oil, which is linked to the capability of major oil producers to manage supply to maintain high oil prices
  - Tradeoff between fuel cost advantage of natural gas and higher upfront/inconvenience costs of natural gas fueled vehicles/infrastructure
  - Technology progress to reduce costs and increase convenience of gas fueling
For more information


Short-Term Energy Outlook | www.eia.gov/steo

Annual Energy Outlook | www.eia.gov/aeo

International Energy Outlook | www.eia.gov/ieo

Monthly Energy Review | www.eia.gov/mer

EIA Information Center
(202) 586-8800  |  email: InfoCtr@eia.gov