Natural Gas Market Dynamics

Georgia Tech – Clean Energy Series

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Agenda

- Chevron Highlights
- Global Energy Demand
- Natural Gas Supply Trends
- Why Gas? Why Now?
- Questions & Answers
Chevron’s Net Production
First Half 2011

762 MBOED
North America

634 MBOED
Europe, Eurasia and Middle East

670 MBOED
Africa & Latin America

662 MBOED
Asia Pacific

1H11 Net Production By Region

2.73 MMBOED

2010 Proved Reserves By Region

10.5 BBOE

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Chevron’s LNG Projects Underpin Long-Term Growth
Well positioned for growing Asia-Pacific demand

9 LNG projects

Chevron’s LNG Projects Underpin Long-Term Growth
Well positioned for growing Asia-Pacific demand

Equity LNG Production (MMTPA)

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Chevron’s Recent Portfolio Additions (>15 MM acres)

Unconventional Gas (>6MM acres)
Natural Gas Supply & Demand

- **Recent Events**
  - Supply: Shale Gas
  - Demand: Fukushima

- **Near Term Trends**
  - Continued Demand Growth in Emerging Markets
  - Shifting Mix in Power Generation … from Coal & Nuclear to Gas

- **Longer Term … Possible Game Changers?**
  - LNG: Liquefied Natural Gas … Imports and Exports
  - NGVs: Natural Gas Vehicles
  - GTL: Gas-to-Liquids
  - More “Unconventional” Gas … Shale, Coal Bed Methane, Gas Hydrates
Recent Events

US, Europe & Asia Natural Gas Prices

Brent
JCC (Oil Parity)
Japanese LNG (Ave)
UK NBP
US Henry Hub

$/MMBtu

Source: Wood Mackenzie
Global Energy Demand

The “World at Night” reveals areas with high energy demand

Global Energy Demand Growth

*Led by China, India, Brazil, and other Emerging Markets*

Source: DOE EIA International Energy Outlook, September 19, 2011
U.S. Total Energy Demand

Natural Gas forecast to become larger % of energy mix

Total U.S. Primary Energy By Type

U.S. Gas Demand By Sector

Source: Wood Mackenzie
Gas Supply Can Meet U.S. Demand

Natural Gas Reserves +22% (2006 to 2009) … and still growing

<table>
<thead>
<tr>
<th>2010 Natural Gas Supply</th>
<th>BCFD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore</td>
<td>59</td>
</tr>
<tr>
<td>Offshore</td>
<td>7</td>
</tr>
<tr>
<td>LNG</td>
<td>1.5</td>
</tr>
<tr>
<td>Imports</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77</strong></td>
</tr>
</tbody>
</table>

Source: EIA
Diversification Has Mitigated Gas Price Volatility

More Production, More Reserves, More Transportation & Storage

Sources: Nymex, Platts
Total World Gas Resources (2009) over 6,000 Tcf (~1 Trillion BOE)

- North America: 283 Tcf
- Latin America: 262 Tcf
- W. Europe: 167 Tcf
- Africa: 490 Tcf
- Middle East: >2,500 Tcf
- Former Soviet Union: 2,020 Tcf
- Asia Pacific: 415 Tcf

Source: EIA, 2009
Natural Gas Resources (EIA, 2011)

“Technically Recoverable” Shale Gas ... with many challenges

Total World Gas Resources (2009) over 6,000 Tcf
+ “Technically Recoverable” Shale Gas, over 6,000 Tcf
= Total over 12,000 Tcf (2011)

North America 283 Tcf
+1,250 Tcf

Latin America 262 Tcf
+1,906 Tcf

W. Europe 167 Tcf
+620 Tcf

Africa 490 Tcf
+1,042 Tcf

Middle East >2,500 Tcf

Former Soviet Union 2,020 Tcf

Asia Pacific 415 Tcf
+1,785 Tcf

Source: EIA, 2009 & 2011
Why Natural Gas? Why Now?

Economic Benefits of Natural Gas

- **Job creation:**
  - Over 600,000 Americans directly employed in the industry
  - Creating 2.2 million more jobs

- **Economic Contribution:**
  - $200 billion in labor income
  - $4.4 billion per year in gas royalty payments, 2005-2010
  - $3.5 billion in tax revenues

Sources:
U.S. Department of the Interior, Office of Natural Resources
U.S. Department of Energy, Energy Information Administration (EIA)
IHS Global Insight, 2010
Sustainable Development
A New, Cleaner Way to Power the World

Chevron’s Gorgon Project

- Natural Gas: Cleanest burning fossil fuel
- Supply for growing Asia market
- US$37 billion investment
- World leader in CO₂ injection technology
- First gas expected in 2014
- Creates 10,000 jobs
- Built on Class A Nature Reserve

Barrow Island, Western Australia
Bottom Line: Gas is Good

- Economic Benefits
  - Creates nearly 3 million jobs, directly & indirectly, in all 50 states
  - Contributes to the economy – tax revenues & royalties
  - Contributes to global competitiveness

- Environmental Benefits
  - Low emissions
  - Sustainable
  - Essential to complement renewable energy

- Energy Security
  - More than a 100-year supply and growing
  - Huge untapped gas resource, unleashed by innovation and technology
Thank You For Your Time
Happy to Answer Questions
Combined Cycle Gas Turbine (CCGT)
Least Expensive, Full-Cycle Power Generation Alternative

Source: Wood Mackenzie
Renewable sources & nuclear include a federal tax credit
Environmental Benefits of Natural Gas
(Example: 500 MW Power Plant)

**Sulfur Dioxide**
- NGCC: 7 Tons / Year
- Coal (Controlled): 8,043 Tons / Year

**Nitrogen Oxides**
- NGCC: 971 Tons / Year
- Coal (Controlled): 5,056 Tons / Year

**Carbon Dioxide**
- NGCC: 1,241,292 Tons / Year
- Coal (Controlled): 2,942,375 Tons / Year

**Ash**
- NGCC: 0 Tons / Year
- Coal (Controlled): 125,000 Tons / Year

**Sludge**
- NGCC: 0 Tons / Year
- Coal (Controlled): 350,000 Tons / Year

**Particulates**
- NGCC: 21 Tons / Year
- Coal (Controlled): 428 Tons / Year
Drilling technology improvements and efficiencies in shale have emerged:
- Longer horizontal laterals
- Multiple-stage hydraulic fractures
Small surface footprint for multiple, extended wells
Horizontal drilling & hydraulic fracturing result in gas wells with long stable production lives
Ground water is separated by thousands of feet & tons of impermeable rock, and protected by state & federal regulation
Significant amount of water is recycled
“Micro-seismic” technology is evolving, enabling even greater precision in fracturing wells
Chevron Wells Designed to Protect Groundwater

- Fresh water protected with **8 layers** of premium steel casing and cement
- Cement circulated to surface on all strings
- More than **1 mile** between Marcellus shale and freshwater aquifers
- Prevents methane migration

<table>
<thead>
<tr>
<th>Casing</th>
<th>Depth</th>
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<tbody>
<tr>
<td>16&quot; Casing</td>
<td>7500' to 8500' TVD</td>
</tr>
<tr>
<td>11-3/4&quot; Casing</td>
<td>&gt;7000' to groundwater</td>
</tr>
<tr>
<td>8-5/8&quot; Intermediate Casing</td>
<td>700'</td>
</tr>
<tr>
<td>5-1/2&quot; Premium Production Casing</td>
<td>350'</td>
</tr>
<tr>
<td>Max groundwater</td>
<td>350'</td>
</tr>
<tr>
<td>Max coal</td>
<td>700'</td>
</tr>
<tr>
<td>&gt;7000' to groundwater</td>
<td>2700'</td>
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