Global Energy Outlook & Prospects for the LNG Sector

Steve Robertson
LNG Fuel Forum
20th September 2011

Our Business

• Established 1990
• Aberdeen, London, Canterbury, New York & Singapore

Activity & Service Lines
• Business strategy & advisory
• Commercial due-diligence
• Market research & analysis
• Published market studies

Large, Diversified Client Base
• 700 projects, 400 clients, 70 countries
• Leading global corporates
• Energy majors and their suppliers
• Investment banks & PE firms
• Government agencies

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Energy Sector Outlook
LNG Market Review
Risk Factors
Conclusions

What will happen as developing economies grow?
What will be the impact on energy demand & prices?

Developing economies will increasingly ‘bid away’ the OECD’s energy supplies

Data sources: BP Statistical Review and the United Nations

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Global energy sources

- **Nuclear 5%**
  - NIMBY concerns
  - Long plant build time
  - 5x gas plant Capex?

- **Renewables 7%**
  - Hydro – environmental concerns over large dams
  - Wind, solar etc – high costs

- **Oil 35%**
  - Preferred transportation fuel
  - Supply concerns
  - Emissions concerns

- **Coal 29%**
  - Abundant supplies
  - Highly polluting
  - CCS very expensive and unproven at scale

- **Gas 24%**
  - Abundant – but local shortages
  - Expensive to transport
  - ‘Off-the-shelf’ powergen plant
  - Emits half CO2 of coal

• No energy source is ideal

Source: BP

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Gas Will Play A Key Role in Meeting Energy Demand

- Energy demand growth outpaces population growth (95% v 55%)
- Recently driven by growth in China and India
- Gas supply is dominated by E Europe & FSU but others to see significant growth
- All areas to see growth in consumption, particularly Asian markets
- Gas is abundant, clean and efficient choice relative to oil, nuclear, coal, etc.

Global Primary Energy Consumption (Source: BP)

Global Natural Gas Production & Consumption (BP 2011)
There is an increasing reliance on offshore and deepwater production:

- Offshore oil: 25% of global production in 1990, 31% in 2000, 33% in 2010 and 34% by 2020.
- Deepwater: 0% in 1990, 2% in 2000, 9% in 2010, 13% by 2020

**Oil supply: 8 out of 10 oil majors passed peak production?**

<table>
<thead>
<tr>
<th>Production (mmbld)</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<td>2,516</td>
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<td>2,616</td>
<td>2,405</td>
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<td>BP</td>
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<td>2,531</td>
<td>2,562</td>
<td>2,475</td>
<td>2,414</td>
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<td>2,380</td>
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<td>2,379</td>
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<td>2,093</td>
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<td>1,899</td>
<td>1,771</td>
<td>1,680</td>
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<td>Petrobras</td>
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<td>1,847</td>
<td>1,920</td>
<td>1,918</td>
<td>1,978</td>
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<td>Chevron</td>
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<td>1,823</td>
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<td>1,701</td>
<td>1,759</td>
<td>1,783</td>
<td>1,876</td>
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<tr>
<td>Total</td>
<td>1,589</td>
<td>1,661</td>
<td>1,655</td>
<td>1,621</td>
<td>1,506</td>
<td>1,509</td>
<td>1,456</td>
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<td>ConocoPhillips</td>
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<td>953</td>
<td>924</td>
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<td>1,032</td>
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<td>Statoil</td>
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<td>Eni</td>
<td>921</td>
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<td>1,020</td>
<td>1,026</td>
<td>1,007</td>
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</table>

Data: Petroleum Review, May 2010

- Peak oil is a reality, not just for the majority of the producing countries but perhaps for the majority of the top producers
- Gas has a role to play as a substitute

“The failure of governments and the International Energy Agency to promote transparency over key data and analysis about oil production and supply is leading the world blindly into a looming energy crisis.”
- The Missing Chapter - Global Witness 16th July 2011
Recent stock market falls, ‘Eurozone crisis’ and worries over economic growth

Spring 08 – Spring 09 dramatic drop in consumption of 5 mbpd from 88 mbpd to 82.75 mbpd in May 2009

Recovery to the same level took only 1 year!

Jan 2011 up 1.2 mbpd compared to Jan. 2010 forecast

Aug 2011 demand up 0.78 mbpd on Jan 2011 expectations

Global consumption up 6.2 mbpd (to 89 mbpd) since lows of the recession and 2.25 mbpd in the first 8 months of this year. China up 22% to 10 mbpd since May 2009.

**Natural gas production and use to soar**

- Large resource but costly to transport
- Deepwater gas, LNG & FLNG to be of growing importance
- But local supply issues e.g. EU to import >73% by 2020?
- Increased Japanese demand?
- Impact of unconventional gas on North America (& other markets)
• Gas shales have revolutionized US outlook
• 100 years’ supply in US resources: 2 quadrillion cf resources on 23 tcf consumption
• Some questions about economics, but $7-8 mmbtu gas looks plausible indefinitely
• Other shale initiatives beginning (BP in China)
• Major LNG projects continue to come on line
• Right now, the world looks to have plenty of natural gas

Proved Gas Reserves: 6,300 trillion cubic feet (60 years)
Source: EIA

Gas – lowest Capex for power plants

Source: EIA-Nov 2010
New Approaches To Developing Stranded Gas - FLNG

- World’s largest offshore floating structure
- Will produce
  - 3.6 mmtpa of LNG
  - 1.3 mmtpa of LPG
  - 0.4 mmtpa of condensate
- Storage Capacity 220,000 m³

- Shell has awarded a contract to Samsung and Technip to design, construct and install multiple FLNG vessels over a 15 year period
- Each vessel is expected to cost approximately $3 bn
- The first will be used on the Prelude field in Australia

2011 – E&P Spend Sensitivity to Oil Prices

- E&P companies prepared budgets assuming $77 oil on average, up from $70 last year
- Expect capex to materially decrease in the industry if oil prices fall much below $60
- Expect capex to increase materially if oil prices sustain above $90, up from $85 last year
• Oil prices nearly double between Jan 2009 and Jan 2010
• Recovery in spend 2010, up 10% to $442 bn
• Continued growth in 2011 to $490 bn, up 11%, a new peak
• 82% of future spend is outside N America
• Big focus on offshore

• Recovery is evident – 71 rigs ordered in 2011
• Deepwater push: 36 Semis & Drillships ordered – best-ever year
• Backlog - 52 Drillships and 18 Semi-submersibles under construction at present 4th Sept 11
• Fleet renewal and expectations of strong utilisation driving orders
• Fleet to grow to over 950 rigs???
LNG Demand

7.4% demand growth in 2010 (BP)

- Highest growth rate in 40 years!

LNG Demand is difficult to forecast

- Based on
  - Gas demand
  - Availability of alternative sources of gas
  - Politics
  - LNG prices – no global pricing structure
  - Unforeseen events – Japanese earthquake

LNG Supply

- Recent years growth driven by Middle East – Qatar and Yemen
- Few additions expected 2011-2014
- 2014/2015 first Australian trains expected to commence production

Potential future supply from
- Arctic Russia
- US Shale
- West & East Africa
Carrier Deliveries

- Units by year of delivery
  - 2007-2009 – Massive increase in deliveries – Qatari fleet
    driven by Australian LNG terminals & Asian demand

LNG Carrier Trends

- Carrier size has dramatically increased in recent years
- Flexibility of use – addition of regasification topsides
- Spot trading – chartering by companies such as Morgan Stanley
- Growth in Chinese shipbuilders – Hudong has 5 units on order
- Future entry from Russian shipyards?
- Speculative builds – new orders with no contracts
- New orders from
  - Awilco
  - Chevron
  - Dynagas
  - GasLog
  - Golar
  - Höegh
  - Maran Gas Maritime
  - Sovcomflot
Outlook for FLNG

Floating regasification – several in service, becoming increasingly popular
- Why?
  - Relatively cheap compared to onshore
  - Short lead times (18 months)
  - Ease of construction
  - Seasonal/temporary fix

Key regions – Asia, Latin America, Western Europe

Floating Liquefaction – emerging industry
- Why?
  - Enables production from stranded gas fields – no long pipelines to shore
  - Combined production & liquefaction
  - Possible cost advantages compared to onshore plants?

Key regions – Australia & Papua New Guinea, to a lesser extent SE Asia, Brazil, Canada & W. Africa

- Still considered a niche technology for specific applications
- Prelude only one in build – backed by supermajor – can smaller operators handle these projects?

FLNG Focus Areas

- British Colombia – Unconventional gas production
- Western Europe and the Mediterranean Rim – Diversification of supply away from Russian piped gas
- South East Asia – Stranded gas and rapidly growing consumption in cities
- Latin American Cities – Rapidly growing seasonal consumption
- West Africa – Stranded gas and gas flaring
- Parts of the Middle East – Rapidly growing seasonal consumption
- Timor Sea – Stranded gas
LNG Industry Capex by Segment

- Capex for facility only – no upstream facilities
- $93bn forecast over 2011-2015 period
- Liquefaction (export) terminals are more expensive than other LNG facilities
- 45% Capex Liquefaction (export), 40% Import, 15% Carriers

LNG Industry Capex by Region

- Asia largest region with 40% mostly import terminals
- Australasia to rival towards the end of the period
- Australasia driven by Australian & Papua New Guinean projects
  - Offshore fields – Gorgon, Wheatstone, Browse
  - CBM – centred round Gladstone, Queensland
  - FLNG – Prelude
  - Papua New Guinea – PNG LNG, Gulf LNG
Risk Considerations

• What could de-rail the LNG business?
  • Significant risk of widespread recession and associated fall in gas demand and prices.
  • Political instability and discontinuity
  • Competing sources of natural gas
  • Growth constrained by bottlenecks in the supply chain
On July 1, 2011

Without incremental supply, oil prices spiked

Historically, when crude oil expenditure has reached 4% of GDP, the US has fallen into recession

Equals $85-90 oil

WTI today: $95

Brent: $111

“Oil: What Price can America Afford?”

Unconventional Gas Production & LNG

Two key areas

- Unconventional gas production as competing gas supply source
  - Currently – North America
  - Future – China, Europe?

- Unconventional gas as potential feed source for LNG terminals
  - Onshore terminals
  - FLNG
Global Unconventional Resource Base Is Staggering

World Total: 33,000 TCF
(Source: Kawata & Fujita)

Unconventional Gas vs. LNG

Massive growth in unconventional gas production in North America

Impact on LNG –
- LNG imports diverted elsewhere
- Utilization of existing import terminals has dropped to 8%
- Many LNG import terminal projects have been scrapped
- Operators considering adding liquefaction trains

Future Outlook
- Lots of uncertainty on future unconventional production outside North America
  - Current – North America, Australia
  - 5-10 years – China
  - 10 years+ - Europe, India, SEA
  - ? – Latin America, Africa.
### Unconventional gas as feed source for LNG

<table>
<thead>
<tr>
<th>Plant Name/Location</th>
<th>Country</th>
<th>Source</th>
<th>mtpa</th>
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<tbody>
<tr>
<td>Queensland Curtis LNG</td>
<td>Australia</td>
<td>CBM</td>
<td>8.5</td>
</tr>
<tr>
<td>GLNG</td>
<td>Australia</td>
<td>CBM</td>
<td>7.6</td>
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<td>APLNG</td>
<td>Australia</td>
<td>CBM</td>
<td>9.0</td>
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<td>Curtis Landing LNG</td>
<td>Australia</td>
<td>CBM</td>
<td>7.5</td>
</tr>
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<td>Gladstone LNG</td>
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<td>CBM</td>
<td>1.5</td>
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<td>CBM</td>
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<td>CBM</td>
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<td>Kitimat LNG</td>
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<td>Shale</td>
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<td>BC LNG - Douglas Channel</td>
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<tr>
<td>Lake Charles LNG</td>
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<td>Shale</td>
<td>15.0</td>
</tr>
</tbody>
</table>

- **Three main areas** —
  - Queensland, Australia
  - British Colombia, Canada
  - Gulf Coast, USA
- 16.3 mtpa already under construction
- A further 14 mtpa approved
- Predominantly targeting Asia & Europe

### Politics & LNG

- Bolivia
- USA
- Papua New Guinea
A massive global problem is developing worldwide as the ‘baby boomer’ generation retires. Investment in attracting, training and retaining skilled people will be money well spent. Knowledge-based companies with highly skilled people are key elements of long-term success.
Conclusions

- Current macro economic situation is troubling but any downside likely to be short-lived. At present, overall energy industry activity is buoyant.
- Long-term industry fundamentals are sound. Fundamental push to develop offshore hydrocarbons has not changed. Gas has a major role to play in power generation and as a substitute for oil.
- FLNG is becoming an increasingly adopted regas option and liquefaction is on the way.
- LNG spend to increase substantially over the next five years - $93 billion spend forecast.
- Unconventional gas is both a competing and complementary source
- Industry needs to consider supply-side constraints and plan accordingly

Thank you

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