The golden era of natural gas

Sammy Hulpiau
Tobias Svensson
Energy & Environment
Natural gas – the future energy source

Long-term drivers:
- Cleanest fossil fuel
- 250 years of proven reserves

World primary energy demand by fuel

Source: OECD/EIA, WEO 2011
Growth drivers

Short-term drivers:
- Temporary or permanent shutdown of nuclear powerstation
- China 5-year plan
  - From 3.8% in 2010 to 8.3% in 2015 of the energy mix
- Low gas price
Growth drivers – price

Natural gas prices in major markets, July 2007 to April 2011

- Japan
- Germany
- United Kingdom
- United States

<table>
<thead>
<tr>
<th>Year</th>
<th>Oil prices</th>
<th>Gas Prices MMBTU in US</th>
<th>Gas/Oil ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>99.57</td>
<td>9.12</td>
<td>11</td>
</tr>
<tr>
<td>2011</td>
<td>87</td>
<td>3.8</td>
<td>23</td>
</tr>
</tbody>
</table>

Gas/oil price ratio
- Normally = 6
- 23 in US
- 9 in Europe

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Conventional & unconventional gas

Natural gas production by type – WEO 2011

- Shale
- Coalbed methane
- Tight
- Conventional

Share of unconventional (right axis)

- 2008: 3,000 Bcm (12%)
- 2015: 3,250 Bcm (16%)
- 2020: 3,750 Bcm (20%)
- 2025: 4,500 Bcm (24%)
- 2030: 5,250 Bcm (28%)
- 2035: 6,000 Bcm (32%)

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### Largest gas producers – Projection 2035

#### Largest gas producers by type in 2035, WEO 2011

<table>
<thead>
<tr>
<th>Country</th>
<th>Conventional</th>
<th>Unconventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>800 bcm</td>
<td>200 bcm</td>
</tr>
<tr>
<td>United States</td>
<td>600 bcm</td>
<td>200 bcm</td>
</tr>
<tr>
<td>China</td>
<td>400 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Iran</td>
<td>300 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Qatar</td>
<td>300 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Canada</td>
<td>200 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Algeria</td>
<td>100 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Australia</td>
<td>100 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>100 bcm</td>
<td>100 bcm</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>100 bcm</td>
<td>100 bcm</td>
</tr>
</tbody>
</table>

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Gas demand vs production

Natural gas net imports by major region WEO 2011

Top 3 – biggest importers

* OECD Europe
* China
* OECD Asia

Natural gas net exports by major region WEO 2011

Top 3 – biggest exporters

* Eastern Europe / Eurasia
* Middle East
* Africa

Need for transportation

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World cumulative investment (2008-2035) in gas-supply infrastructure

WEO 2011
Total = $7,978 billion

- Exploration and development: 5,124
- Transmission and distribution: 2,137
- LNG*: 717

* Total include an additional $86 billion of investment in LNG carriers
The natural gas chain
– and Alfa Laval opportunities

Gas drilling

Gas processing

Gas transportation

Gas usage

Gas-fired boilers

Gas-fired power stations
Gas drilling

- Drilling mud cleaning, cooling and mixing
- Offshore fresh water generation
- Wastewater treatment
Gas drilling
– Mud treatment

Drilling mud decanters
Drilling mud coolers

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Acquisition of Vortex Systems
– Expanded product offering into drilling industry

- Patented equipment with clear operator values
- Increased end-user presence
- Mud mixers and dust recovery systems

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The natural gas chain
– and Alfa Laval opportunities

- Gas drilling
- Gas processing
- Gas transportation
- Gas usage
- Gas fired boilers
- Gas fired power stations

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Gas processing

- Gas treatment
- Liquefaction & regasification
- FLNG – Floating production of LNG
Gas processing
– Gas treatment

- Removal of water and impurities
- Central cooling plate heat exchangers
- Wastewater treatment
Many critical heat exchangers positions

Sweet gas

Stripping column

Sour gas

Interchanger

Reboiler

Alfa Laval wins SEK 80 million natural gas order in Saudi Arabia

Alfa Laval – a world leader in heat transfer, centrifugal separation and fluid handling – has won an order from a Korean engineering company to supply heat exchangers for a natural gas project in Saudi Arabia. The order value is approximately SEK 80 million and delivery is scheduled for 2013.
Gas processing
– Liquefaction & regasification

Liquefaction
★ Reduce volume by factor 600
★ Cooling down the gas to -162°
★ Central cooling system PHE + Filter

Regasification
★ Regasification by heating the LNG
★ Central heating system PHE + Filter
Gas processing – new trend
FLNG – Floating LNG plant

Expenditure ($ billion)

Liquefaction
Import


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FLNG
– Alfa Laval offerings

Amine heat exchangers
Central cooling incl filters
Desalination units
Fuel oil separators
Utility heat exchangers
MEG separators
MEG heat exchangers
MEG heat exchangers
Alfa Laval wins order to supply equipment for the world’s first FLNG facility

Alfa Laval – a world leader in heat transfer, centrifugal separation and fluid handling – has won an order from a Technip Samsung Consortium (TSC) to supply Alfa Laval equipment to Shell’s Prelude FLNG (floating liquefied natural gas) facility. Alfa Laval is unable to disclose the exact value of the order due to a confidentiality agreement.
The natural gas chain
– and Alfa Laval opportunities

Gas drilling

Gas processing

Gas transportation

Gas fired boilers

Gas usage

Gas fired power stations

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Pipeline transportation
– Gas transportation by compression

1st stage compressor

2nd stage compressor

3rd stage compressor

30 bar
85 bar
250 bar

Condensate
Gas cooler
Gas cooler
Gas cooler

Scrubber
Scrubber
Scrubber
Scrubber

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Pipeline transportation
– Gas pipeline protection

★ MEG – mono ethylene glycol treatment
Pipeline transportation
– Gas pipeline protection

* MEG – Mono Ethylene Glycol – to avoid hydrate formation
Gas pipeline protection
– Alfa Laval offer to the MEG regeneration process
Transportation via LNG carriers
– Alfa Laval offerings
Transportation via LNG carriers

- Alfa Laval’s traditional product portfolio + Specific heat exchangers like AlfaNova and Alfarex
- Inert gas systems added through the acquisition of Aalborg Industries
The natural gas chain
– and Alfa Laval opportunities
Primary use of natural gas

World primary natural gas demand by sector and scenario

- Power generation
- Buildings & agriculture
- Industry
- Transport
- Other

Est. 2035 WEO - 2011
2008

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Gas usage – gas-fired power stations

Waste Heat Recovery Unit (WHRU)
Gas usage – gas boilers

Industry & agriculture
- For heating and hot water/steam production
- Industrial market
- Aalborg gas fired boilers

Housing & buildings
- For heating and hot water production
- OEM supply to boiler manufacturers or distributors
- Copper brazed and plate heat exchangers

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Gas usage – petrochemicals

Petrochemical processing
- Fertilizers
- Consumer goods
Conclusions

- The golden era of natural gas has started
- Alfa Laval has opportunities in all steps of the natural gas chain
- Alfa Laval has the products, the presence and the know-how to capture this great opportunity