Prospects for gas and LNG in Europe

November 14th-15th, 2018

Jörg Blaurock ([email protected])
Agenda

1. Team Consult – short introduction
2. Prospects for gas and LNG in Europe
TEAM CONSULT – Expert for the energy sector

Reliability through expertise

• Consulting for the energy sector for 30 years.
• Founded in Hamburg, office in Berlin since 2004
• Experts with background of the energy sector
• International and national projects
• Cooperative partnership with the industry on eye-level
# Our fields of expertise

<table>
<thead>
<tr>
<th>Business Unit</th>
<th>Focus</th>
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<tbody>
<tr>
<td>NATURAL GAS</td>
<td>Natural gas business along its pipeline-based value chain, incl. procurement, transport, storage, gas-to-power, gas sales and trading</td>
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<tr>
<td>LNG</td>
<td>Importance of liquefied natural gas as global supply source, incl. new and small-scale applications (e.g. LNG as fuel in the transport sector)</td>
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<tr>
<td>ENERGY TRANSITION</td>
<td>Transition of the energy sector and design of the future energy system, in particular role of renewable and conventional power generation.</td>
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<tr>
<td>ENERGY STORAGE</td>
<td>Role of new energy storage solutions (such as batteries and Power-to-X technologies) as missing element in order to reach goals of the energy transition (“Energiewende”)</td>
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Our client base covers international energy majors, regional and national suppliers as well as local utilities

Clients of TEAM CONSULT (excerpt)

<table>
<thead>
<tr>
<th>Client</th>
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<td>Wingas</td>
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2 Prospects for gas and LNG in Europe

a. European gas demand - Mid-term prospects and drivers of gas demand in Europe

b. European gas supply situation

c. European gas price fundamentals

d. Europe as an LNG outlet?

e. Requirements for future LNG and pipeline gas import contracts
The IEA’s outlook for Europe indicates declining gas demand. IEA predicts a drop in demand from power generation, ...

Gas demand in EU 28 (bcm)

<table>
<thead>
<tr>
<th>Year</th>
<th>Power generation</th>
<th>Industry</th>
<th>Residential and commercial</th>
<th>Losses/other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>484</td>
<td>-</td>
<td>9</td>
<td>0</td>
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<tr>
<td>2023</td>
<td>475</td>
<td>1</td>
<td>-9</td>
<td>0</td>
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</table>

Change in gas demand in EU 28 by sectors (bcm)*

- Residential and commercial: 0
- Industry: 1
- Power generation: -9

Source: IEA, Team Consult analysis

*Differences are due to rounding
… however additional gas demand in the power sector will arise if a fuel switch from coal to gas occurs on a larger scale.

**Power production in EU 28 from coal in 2016 in TWh<sub>el</sub>**

- CHP plants:
  - Hard coal: 380 TWh<sub>el</sub>
  - Lignite: 311 TWh<sub>el</sub>
  - Total Power-only: 445 TWh<sub>el</sub>

- Power-only plants:
  - Hard coal: 243 TWh<sub>el</sub>
  - Lignite: 202 TWh<sub>el</sub>
  - Total Power-only: 109 TWh<sub>el</sub>

**Additional gas demand of coal to gas switch in EU 28 in TWh<sub>th</sub>**

- Total Power-only: ~990 TWh<sub>th</sub>
- Potential for realization by existing gas power plants: ~600 TWh<sub>th</sub>

45% efficiency

100% substitution of coal power with gas power

**Source:** Eurostat, Entsoe, Team Consult analysis

*Electricity produced in power plants with CHP-ability, but not necessarily in cogeneration mode

**Assumption:** Availability and operation of 65% of installed gas capacity (205 GW), average efficiency of 45% of gas power plants, increase of average load factor from 4.480 to 6.500h
In the future LNG can play a role outside the traditional gas market

- Aside from the traditional gas market so small scale LNG opens new business models
- Especially in the freight transport sector LNG offers a environmentally acceptable alternative
- Also industrial and off grid applications offer an expansion of sales channels
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Gas production in the EU 28 will steadily decline. This is caused mainly by Dutch gas production cuts in the Groningen field.

### Domestic gas production in EU 28 (in bcm)

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (bcm)</th>
</tr>
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<tbody>
<tr>
<td>2017</td>
<td>155</td>
</tr>
<tr>
<td>2019</td>
<td>135</td>
</tr>
<tr>
<td>2021</td>
<td>115</td>
</tr>
<tr>
<td>2023</td>
<td>95</td>
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</table>

### Change of gas production in EU 28 from 2017 to 2023 (in bcm)

- **Total change 2017-2023**: -46 bcm
- **Netherlands**: -35 bcm
- **UK**: -8 bcm
- **Other EU 28**: -3 bcm

**Source:** IEA, Team Consult analysis
Russia supplies 32% and Norway 24% of the gas demand in EU 28. The domestic production amounts to just 27%.

European gas balance 2017: Supply by source and consumption

Source: IEA, Gazexport, Norwegian Petroleum Directorate, GIIGNL, Team Consult analysis

* Net-LNG-imports (minus re-exports); Conversion: 1 mtpa = 1.3 bcm
** includes exports, stock changes, statistical difference
The decline in domestic production in the EU 28 will cause an increased demand for supply from outside the EU of about 37 bcm

Supply* and consumption in EU 28 (in bcm)

Source: IEA, Team Consult analysis

*Imports from outside EU 28 held constant from 2017 to 2023
Russia is the supplier country which has the most spare capacities available for additional pipeline gas supplies to Europe

European pipeline gas imports in 2017 (in bcm/a)

- **Russia**: 235 bcm/a
- **Norway**: 116 bcm/a
- **Algeria**: 138 bcm/a
- **Libya**: 59 bcm/a
- **Available import capacity (in bcm/a)**
- **Total imports (bcm/a)**

Source: IEA, Gazexport, Norwegian Petroleum Directorate, GIE, Team Consult analysis
European regasification capacities were under-utilized in recent years and thus have import capacities available.

**Terminal Utilization Southern Europe**

- **Spain, Greece, France, Italy, Portugal**

**Terminal Utilization Northern Europe**

- **Lithuania, Poland, Belgium, Netherlands, U.K.**

*Sources: GIIGNL, IGU, GLE LNG, TEAM CONSULT analysis*

**Operational regas capacity (mtpa)**

**Total imports (mtpa)**

**Capacity utilisation (%)**
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Will gas from Russia outcompete LNG especially from the US although the supply situation in Europe is tightening?

US LNG marginal costs as global price floor in relation to European & Asian prices

**Henry Hub**
(average Month-Ahead, $/mmBTU)

**US LNG Marginal Costs**
(schematic, $/mmBTU)

**European Gas & Asian LNG Import Prices**
($/mmBTU)

Liquefaction fee (Tolling):
Sabine Pass = 2.5 – 3 $/mmBTU
Corpus Christi = 3.5 $/mmBTU

Transport:
Depending on distance and type of tanker, charter rates exploded in 2018

Regasification:
Varying throughout Europe, mostly below 0.5 $/mmBTU for regulated terminals

Source: ICIS Heren, Japan Customs, EIA, BAFA, ECB, Cheniere Energy, European Terminal Operator websites, TEAM CONSULT Analysis

*schematic example for deliveries to Belgium
*LNG Import Price Japan ** AGIP = Average German Import Price *** TTF-MA per delivery month
Mergers of hubs in Europe will facilitate suppliers’ access to more customers

**Chances:**
- The merging of market areas will facilitate access to more suppliers and customers
- LNG suppliers can deliver to more customers without transport restrictions

**Risks:**
- Congestions of highly used transport infrastructure possible due to changes in supply patterns
- This in turn can lead to higher use of balancing services, additional infrastructure investments and ultimately rising costs

**Traded volumes 2017**
- > 15,000 TWh/a
- 200 – 2,000 TWh/a
- < 200 TWh/a

**LNG Terminals**
* only LNG Terminals in market areas to be merged shown

Source: EU DG Energy quarterly reports, TEAM CONSULT analysis
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Regulated terminals with TPA had ample free capacity in 2017

Development of European regasification capacities

Source: Terminal Operator Websites, Team Consult Analysis
Regulated LNG terminals have quite different technical constraints especially for send-out and storage.

### Send-out

- **User Determined**
  - Negotiable by user
  - Upper limit fixed once settled
  - Flexible nominations

- **Fixed**
  - Fixed baseline
  - Almost linear send-out
  - Additional purchase possible

- **Flexible**
  - Imposed by technical constraints
  - Dynamic allocation to users

- **Operator Determined**
  - Decided by operator
  - Fully flexible

### Storage

- **User Determined**
  - Fixed Baseline
  - Large dedicated storage
  - Additional purchase possible

- **Flexible**
  - Dynamic adjustment to delivery volume

- **Fixed**
  - Small baseline dedicated storage for user
  - Additional purchase possible
  - Terminal inventory mostly decided by Operator

- **Flexible**
  - Imposed by technical constraints
  - Dynamic according to cargo size but small

- **Operator Determined**
  - Terminal inventory mostly decided by Operator

Source: Terminal Operators, Team Consult Analysis
Small-scale LNG services and infrastructure in Europe have been built quickly in recent years

Small-scale LNG infrastructure in Europe increase from 2015 to 2018

Increase of services provided at LNG terminals*

<table>
<thead>
<tr>
<th>Year</th>
<th>Operational</th>
<th>Under construction</th>
<th>Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>46</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>129</td>
<td>66</td>
<td></td>
</tr>
</tbody>
</table>

Increase of bunkering and fuel loading ships

<table>
<thead>
<tr>
<th>Year</th>
<th>Operational</th>
<th>Under construction</th>
<th>Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>31</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>80</td>
<td>12</td>
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</table>

Increase of LNG filling stations

<table>
<thead>
<tr>
<th>Year</th>
<th>Operational</th>
<th>Under construction</th>
<th>Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>70</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>167</td>
<td>63</td>
<td>8</td>
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</tbody>
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*Services include: Reloading, Transshipment, Rail loading, Truck loading

Source: GIE, Team Consult analysis
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We observe a trend towards smaller volumes and shorter durations of LNG contracts.

Duration and volume of contracts signed over the last years

Source: IGU, GIIGNL, Team Consult Analysis
The share of spot trading steadily increases since 2013

Long-Term contracts and spot trading in Europe

Source. GIGNL, Team Consult analysis
Requirements for future LNG and pipeline import contracts

- **Seasonal flexibility**
  - Due to the loss of seasonal domestic flexibility importers will have to compensate the missing flexibility with other sources (e.g. storages, flexible supplies). Pipeline and LNG contracts will have to reflect such flexibility.

- **Contracts with shorter duration**
  - Higher liquidity of the LNG market, more market actors and possible oversupply will make the gas and LNG market a buyers market and will allow importers to demand for shorter duration of contracts

- **Standardisation of LNG spot contracts**
  - There are initiatives to standardise spot LNG contracts, which will facilitate (exchange) trading and swaps. New contracts might need to adhere to such standardisations.

- **Destination flexibility**
  - As importers want to take advantage of price differences between regions and better hedge their portfolios, they will increasingly demand flexibility provisions for the destination of the LNG deliveries.
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