TEN-T Motorways of the Sea
The North Europe LNG Infrastructure Project - Martech LNG
Bornholm 19 September 2012

Mogens Schrøder Bech
Danish Maritime Authority
Outline

Introduction – the overall project
An LNG infrastructure
A shipowners economic perspective
An infrastructure economic perspective
Recommendations
Elements in the way ahead
Sum up
The full project: An infrastructure of filling stations and deployment in ships

**AN EU TEN-T Motorways of the Sea project**
- LNG as fuel for international short sea shipping
- Total costs 26 mill. euro

**A pilot project – Fjord Line Danmark A/S**
- 9.0 mill. euro from TEN-T

**An LNG infrastructure project**
- 0.6 mill. euro from TEN-T

**A combined top-down and bottom-up approach**
The full-scale pilot project

Supporting and developing a transport corridor

- From the South Western part of Norway
- ... to the Northern part of Jutland
- ... and further to the Continent

Ports

- Hirtshals base port
- Bergen, Stavanger, Langesund

The project

- Two new cruise ferries with LNG propulsion – 2013 deliveries
- A full-scale pilot project
- Deployment in international short sea shipping
- An extensive measuring programme
- A maritime LNG infrastructure is needed!
The infrastructure project

The new sulphur regulation in North Europe
  • Competitiveness of shipping and regions

Distribution, storage and use as fuel of natural gas - LNG

From the LNG import terminal to LNG used as fuel in ships

The LNG supply chain
  • "Hard" on maritime filling stations/infrastructures
  • "Soft" on regulations, industry standards, etc.

The business case as a horizontal issue

How can we create this infrastructure?
  • Recommendations to central stakeholders
Partners – the infrastructure project

**States:** Belgium, Denmark (the Danish Maritime Fund), Finland, Norway and Sweden

**Regional:** Council of Nordic Ministers

**Ports:** Port of Hirtshals (DK), Port of Zeebrugge (BE), Szczecin and Swinoujscie Seaports Authority (PL) and Port of Rotterdam

**LNG terminals and gas distribution companies:** Fluxys (BE), Gasum (FI), Gasunie (NL), Energinet.dk (DK), Energigas Sverige (SE), Gasnor (NO) and GazpromLNG (RUS)

**The maritime cluster:** Germanischer Lloyd (DE), Bureau Veritas (DK), MAN Diesel and Turbo (DK), Lauritzen Kosan A/S (DK)
LNG infrastructure outlay

Large LNG terminal
- Truck
- Bunker/feeder vessel

Intermediary LNG Terminal
- Onshore, e.g.
  - Tank
  - Container
- Bunker/feeder vessel
- Offshore, e.g.
  - Vessel
  - Barge
- Truck

Small-scale liquefaction plant
- Pipeline/direct filling

End users
- SHIPS
  - Trucks
  - Cars
  - Industry/power generation
  - Gas grid
  - Etc.

Gas pipeline
- Liquefaction plant

End users
- SHIPS
  - Trucks
  - Cars
  - Industry/power generation
  - Gas grid
  - Etc.
LNG infrastructure essentials

Migration strategies must be chosen
• E.g. from floating to fixed

Cost components for LNG as fuel
• The price of fuel at major European import hubs
• The costs of storage
• The cost of transhipment between hubs and local port facilities and further to the end user

Availability of LNG at a competitive price
### Generic "LNG infrastructure" port cases

<table>
<thead>
<tr>
<th></th>
<th>Large scale import terminal</th>
<th>Medium scale port</th>
<th>Small scale port</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Storage</strong></td>
<td>An import terminal</td>
<td>A 50,000 m³ tank</td>
<td>Two 700 m³ tanks</td>
</tr>
<tr>
<td><strong>Bunkering</strong></td>
<td>Ship to Ship Direct filling Tank Truck</td>
<td>Ship to Ship Direct filling Tank Truck</td>
<td>Direct filling Tank Truck</td>
</tr>
<tr>
<td><strong>Annual throughput</strong></td>
<td>300,000 m³</td>
<td>400,000 m³</td>
<td>19,000 m³</td>
</tr>
<tr>
<td><strong>Total investment costs – m EURO</strong></td>
<td>69</td>
<td>137</td>
<td>15</td>
</tr>
<tr>
<td><strong>Infrastructure costs from a pay back perspective (EURO pr tonnes) 8 years</strong></td>
<td>136</td>
<td>157</td>
<td>211</td>
</tr>
<tr>
<td><strong>12 years</strong></td>
<td>95</td>
<td>112</td>
<td>172</td>
</tr>
<tr>
<td><strong>OUR BASELINE</strong></td>
<td>170 + 440 = 610</td>
<td>170 + 440 = 610</td>
<td>170 + 440 = 610</td>
</tr>
</tbody>
</table>
Small and medium scale LNG

- Large scale regulations and standards not applicable
- Safety must not be jeopardized

<table>
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<th>Large scale</th>
<th>Medium scale</th>
<th>Small scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal storage capacity</td>
<td>+ 100,000 m³</td>
<td>10–100,000 m³</td>
<td>- 10,000 m³</td>
</tr>
<tr>
<td>Ship seize</td>
<td>+ 100,000 m³</td>
<td>10–100,000 m³</td>
<td>1,0–10,000 m³</td>
</tr>
<tr>
<td>Tank trucks</td>
<td></td>
<td></td>
<td>40–80 m³</td>
</tr>
<tr>
<td>Pipe dimension</td>
<td>+16 inches</td>
<td>8–15 inches</td>
<td>2–7 inches</td>
</tr>
</tbody>
</table>
A shipowners economic perspective

The overall conclusion

• LNG a viable compliance strategy
• 1 – 3 years pay back time for newbuilts
• 2 – 4 years for retrofit
• Different picture for different shiptypes

Only viable because of the 2015 sulphur regulation

Financing a big issue for the shipowners’

• The LNG propulsion technology is mature
An infrastructure economic perspective

Big investment costs

Uncertainty with regard to demand

The price of LNG from a shipowner point of view?

Shipowners’ wait and see strategy (MGO)

Possible business models
  • Public, e.g. a public utility
  • Contractual
  • Incremental
  • Merchanting
Recommendations

Aim: To establish a cost efficient LNG infrastructure

• What are the problems
• What are the solutions
• Who must take the initiative
• The time schedule

Grouping of recommendations

• Bunkering solutions
• Economic and financial aspects
• Safety
• Technical and operational aspects
• The permit process
Bunkering solutions (+ fuel tank containers)
Economic and financial aspects - 1/3

Max 12% Internal Rate of Return for making LNG competitive with MGO

Development of business cases on infrastructure and operation

- Demand analysis
- Integration with land-based LNG
- Co-operation needed to reach a marked potential
  - Within and between ports
- International/regional dimension
- Rough financial and economic calculations

Port clusters or similar as drivers for infrastructure development

- Port authorities

Business models with flexible partner participation
Economic and financial aspects - 2/3

The need for floating infrastructures

• Create funding incentives for construction and operation of bunker vessels/barges in the early stages

Supplementary EU/ Member State funds/guarantees for fixed infrastructure

Accumulated investment need – central scenario

• 2015: 1,2 billion EURO
• 2020: 1,5 billion EURO

Central demand scenario in mill. tonnes

• 2 in 2015 and 4,2 in 2020 as maritime demand
• Demand from non maritime users needed
Economic and financial aspects - 3/3

Create a "minimal infrastructure and secured marked"

• Wider regional scope
  ➢ North Europe and/or the EU?

• Co-operation instead of rivalry needed for development of
  ➢ Transparency
  ➢ Framework conditions

• Stakeholders in the LNG supply chain
Safety

Define small scale LNG, e.g.
- Ship seizes
- Tank capacities
- Bunkering pipe hose dimensions

Guidelines for risk modelling
- For bunkering concepts and facilities

Routines for accident and incident reporting

Harmonisation of land- and sea-based regulation
- Consistent safety level

Avoid specific regulations for traffic with LNG feeder and LNG bunker vessels
Technical and operational aspects

Guidelines and standards for LNG bunkering
- ISO TC 67/WG10
- National administrations

Emergency Shut Down Systems and Communication

Emergency Release Systems

Training of crew onboard small- and medium-scale vessels
- Carrying LNG as cargo

Training of personnel on board LNG fuelled vessels and bunkering facilities

Minimising of methane slip in the LNG supply chain
The permit process

Communication during the public consultation process
- Early good co-operation
- Define the project
- Adequate safety analysis
- Demystify LNG
- LNG has advantages as fuel
- Target group specific information

Guidelines for siting of small and medium scale LNG terminals
- Large scale siting guidelines are not applicable

A coordinated permit process
- Close co-operation within the public sector
Elements in the way ahead, e.g.

**EU/EMSA dialogue with central stakeholders**
- Technical, operational and safety issues
- Ongoing GAB analysis - will be finalized this year
- Policy initiatives?

**EU financial instruments**
- TEN-T MoS calls
- Marco Polo calls
- EIB

**LNG in the Baltic Sea**
- Pre investment analyses for 8 ports
- TEN-T MoS financing

**COSTA**
- Mediterranean, Atlantic and Black Sea areas/TEN-T
- Framework Conditions for the use of LNG ships
- TEN-T MoS financing

**PRIVATE INVESTMENTS**
- Gearing possibilities!
SUM UP: Infrastructure and commercial requirements for an effective LNG network

”Soft ” infrastructure
• Missing regulation, standardization, best practice, etc. must be worked out
• Regulation, etc. must be appropriate (no overregulation)
• Recommendations to the ”problem owner” on what must be done?

Hard infrastructure
• Possible components and investment cost indications
• Migration thinking/increasing demand
• Business opportunities outlined

Recommendation validated through industrial partners and port authorities

Scenarios for LNG investment costs in the ECA area

Business case thinking and first movers needed
Thank you for your attendance

Further information on

www.dma.dk

“In focus”

North European LNG Infrastructure Project