LNG market development in Baltic Ports
SSPA’s experience

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Outline

• Brief introduction to SSPA

• LNG experiences

• LNG in Baltic Sea Ports I and II

• Future outlook
SSPA Sweden AB

- Providing maritime consultancy services and ship design on a worldwide basis

- Independent Consulting Company, fully owned by the Foundation Chalmers University of Technology

- Main clients; Maritime operators and ship yard industry, energy companies, industry, ports, authorities, EU, OECD, IMO, EMSA

- 20% internationally funded research

- 115 employees, 14 Million Euros
Maritime Operations

- Infrastructure Development
  *Port design, bunkering facilities, fairways, multimodal transport systems*

- Sustainable development
  *Decision support, multidisciplinary approaches*

- Alternative fuels
  *LNG, Methanol, Hazid, energy logistics*

- Risk assessments
  *FSA, ship-bridge collisions, navigational risk analysis, Hazids, quantitative and qualitative risk assessments*

- Seaman simulations
  *Full mission, Monte Carlo & desktop, manoeuvring & port design*

- Research and Development
SSPA and LNG

- Ship design
- Market analyses
- Feasibility studies
- Bunker Logistics
- Terminal design, layout and operation
- Risk assessment & QRA
- Maritime simulations
- Training
Some references on LNG bunkering...

- Location criteria for LNG in Swedish ports for *Energigas*
- North European LNG Infrastructure Project for *European Commission and DMA* and following *BPO studies*
- Bunkering of LNG fuelled ships in South Korea for *KOGAS*
- Terminal locations and safety - *LNGGOT*, Gothenburg, *VOPAK*, *KLASCO*, Klaipeda, Malmö-Copenhagen, Aarhus, Stockholm, Mombasa etc
- Maritime LNG Strategies for Gas providers in Europe and Korea
- LNG Study for Wider Caribbean region (IMO)
- Ship-to-ship bunkering of Viking Line in Stockholm
- Risk analysis of shore-to-ship bunkering of Ro-Pax
LNG in Baltic Sea Ports I

• Focused on feasibility, risk assessment, early stages in the planning process

• SSPA assisted in
  – Stockholm
  – Aarhus
  – Copenhagen-Malmö
  – LNG Handbook I
Main issues in LNG in Baltic Sea Ports I

- Feasibility of LNG as marine fuel
- Market analysis
- Business models in a port perspective
- Supply chain development
- Localization
- Risk assessments
Choosing type of supply and terminal

- Import of LNG
- Storage system
- Distribution system
LNG storage and bunkering

Alternative solutions
• No terminal – truck-to-ship bunkering of LNG
• No terminal – bunkering vessel ship-to-ship bunkering
• Small storage tank - pipelines or trucks for bunkering
• Larger storage tank - pipelines or trucks for bunkering
• Floating storage - pipelines or trucks for bunkering
LNG bunkering supply to Stockholm
Safety manual and strategic planning for infrastructure in Stockholm

Safety manual
• Recommendations for safety management
  Guidelines
  Training
  Check lists
  Procedures

Strategic planning
• Future demand
• Distribution of LNG in all parts of Port of Stockholm
LNG in Baltic Sea Ports II

- Focused on design and the permit process
- SSPA assisted in
  - Trelleborg
  - Sundsvall
  - LNG Handbook II
Main issues in LNG in Baltic Sea Ports II

- Choices and decisions to be made during the design process:
  - Location of the terminal
  - Size of the terminal or supply
  - Type of tank/supply
  - Volumes of the tank
  - Distribution system for LNG supply;
    - bunkering
    - truck filling stations
    - pipelines
  - Financial aspects and investment costs
  - Safety measures and security aspects
LNG terminal location

Requirements for location of an LNG terminal for marine purposes:

• Located remote from any existing commercial marine operations
• Safe distance from centres of population
• Provide safe marine access to berth(s)
• Located in sheltered water
LNG bunkering alternatives

- **Truck-to-ship**
  - Dominating method today

- **Shore-to-ship**
  - Via pipeline from terminal, intermediate or mobile tank

- **Ship-to-ship**
  - From bunker vessel or bunker barge
  - In harbour or offshore
Pros and cons from a logistical and an operational perspective

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<th>Ship to ship STS</th>
<th>Tank truck to ship TTS</th>
<th>Tank to ship via pipeline TPS</th>
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<tr>
<td><strong>Advantages</strong></td>
<td>Flexibility</td>
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<td>Availability</td>
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<td>High loading rate</td>
<td>Low costs (investment and operation)</td>
<td>Large bunkering volumes possible</td>
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<td>Bunkering at sea (enlarged market)</td>
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<td><strong>Disadvantages</strong></td>
<td>Manoeuvrability in port basin</td>
<td>Small quantity</td>
<td>Fixed to certain quay</td>
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<td></td>
<td>High costs (investment and operation)</td>
<td>Low loading rate</td>
<td>Occupy terminal space</td>
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<td>Sunk costs</td>
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Conclusions from LNG in Baltic Sea Ports I and II

**Recommended steps**

- Technical feasibility study
  
  *Market potential for LNG, needed volumes, alternative set-ups for LNG storage and sources, determination of optimal storage types and suitable bunkering techniques*

- Financial overview
  
  *Determination of maturity of the project*

- Inventory of all relevant stakeholders and applicable regulations

- Design process
  
  *Determine the needed installations, volumes etc.*

- Initiate permit process
  
  *Identify relevant laws and regulation for applying of permit*

- Dialogue with the relevant authorities

- Involve stakeholders
Current market and future outlook

- Slow development of LNG market
- Low oil prices -> lower demand of LNG
- Low impact of SECA
- Local liquefaction plant
- Bunkering infrastructure under development in Europe
- Larger vessels - ship-to-ship bunkering
Moving on from truck-to-ship...

• 2000: First LNG fuelled vessel in operation; Glutra, Norwegian ferry
• Ferries and offshore vessels
• Truck-to-ship bunkering of small vessels
• Small storage tank
• 2013: M/S Stavangerfjord and Bergensfjord (Fjord Line)
  – 2015: Shore-to-ship Risavika
• 2013: Viking Grace
  – Ship-to-ship Seagas
• 2013: Buquebus Fransico
  – HSC, Argentina, Cryobox nano, truck-to-ship
• 2015: Samsø Ferry
  – Shore-to-ship from movable tank
• 2017: Umeå – Vaasa ferry
  – Truck-to-ship
• 2017: Tallink Shuttle Megastar
  – Shore-to-ship or ship-to-ship?
• 2017: Destination Gotland
  – Shore-to-ship or ship-to-ship?
Moving on towards STS...

Ship-to-ship bunkering projects
- Zeebrugge - 2016
- Rotterdam - 2017
- Coralius - 2017
- Klaipeda

• Preferable with respect to flexibility
• Long experience of STS-operations
• When correctly performed, an efficient and safe method
JIP STS LNG bunkering

Background

• Inadequate knowledge of the hydrodynamical behaviour of two ships moored along each other
  – Limiting the possibilities to use simulations tools
• Different characteristics of LNG compared to traditional fuels affecting risk and safety aspects
• Simulations to support risk assessments
Objective

- Investigate and evaluate relative motion between two ships moored alongside each other
- Quantify the motions in different conditions
- Develop reliable hydrodynamical models to be used in simulation which can serve as a tool for risk analysis

*Ensure safe, efficient and flexible STS bunkering operations under varying conditions, both at berth and at an offshore location*
Invitation

Total budget estimated to SEK 4-8 million (0.4 – 0.8 million EUR)
Funding from industry partners, public research funding and other public funding

As a participating partner, you will profit from:

• Exclusive access to the knowledge generated during the JIP
• More efficient and flexible establishment and performance of STS operations with high safety standards
• Reduced impact on other activities in the area of the STS operation due to precautionary measures
• Relevant design criteria for STS LNG bunkering equipment and its performance
• Relevant groundwork for policymakers
• Cost-sharing benefits
Thank you for your attention

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