The Business model of LNG and LBG
The Samsø Case

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Content

• The Samsø case – From Field to Ferry
  – The process towards biogas on Samsø
  – Biogas liquefaction challenge
  – Present status: Business and politics

• Lessons learnt
  – Steps ahead, refleksions
    • LBG og LNG?
    • Single Fuel/ Duel fuel /hybrid?
  – Other coastal communities
Samsø - The island of gathering

- 3700 inhabitants, 7x30 kms
- Independent municipality
- Agriculture, grain, pigs and milk
- Vegetables – intensive cultures
  - potatoes, onions, cabbage
- Tourism, green energy, gastronomy
Connections and cooperation

Liquid Natural Gas ferry 2015
Liquid Bio Methane 2020

New harbour in 2014

Prestudy proposed
Biogas and ferries

- Biogas is impossible without the ferry as customer
- Municipal decision in 2013: We make our own shipping company!
- New ferry since 2015, good business case!
- Now we need the biogas 😊
600 pax
160 cars
1 hour trip
Dual fuel engines

27 million euro

7,000 euro per islander
Biogas Liquefaction

- Workshop held at Samsø in 2017
- Challenge of scale and economy
  - Technically possible
    - Wärtsilä, Kosan Crisplant, StirLNG/Pentair, Air Liquide, Cryopur, Nærenergi/Cryobox, Biofrigas
  - Island delimitations
- Liquefaction of biogas report
Status for Samsø business case

- Environmental permissions OK
  - Samsø Municipality is the gas costumer
  - The biogas plant should be private

- The business plan is the challenge
  - World market LNG price is very low
    - Tax exemption for ships, lower subsidies, more restrictions

- Renewable Energy Directive agreement
  - 3,5% Advanced Biofuels for land transport by 2030
  - Bioticket value of biogas on EU market
Next steps at Samsø

• Political agreement – hopefully
• Procurement of biogas for ferry for 10 years
  – Green certificates
  – Private investors
• How to ensure local biogas production and job creation?
Next steps for LBG

• Steps forward, reflections
  – LBG or LNG?
    • LBG May not not the complete answer
  • Challenges described,
    • how much can we cover?
  – have less CH₄ emissions
Next steps for LBG

- Blending is realistic in some cases
- Single Fuel/ Dual fuel /Battery-hybrid/ Fuel cells?
  - Hybrid solutions upcoming
    - Not economically feasible with the Samsø Ferry
    - Future ferry energy needs
  - Pure single fuel engines
  - Methane emissions

<table>
<thead>
<tr>
<th>Energy (PJ)</th>
<th>Emission (Mt CO₂/yr)</th>
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</thead>
<tbody>
<tr>
<td>Danish ships within DK (Energistyrelsen 2015)</td>
<td>6</td>
</tr>
<tr>
<td>Danish ships (Danmarks Statistik)</td>
<td>10</td>
</tr>
<tr>
<td>Incl. half voyages from/to Denmark</td>
<td>280</td>
</tr>
<tr>
<td>Ships run by a large Danish company (Mærsk 2016)</td>
<td>445</td>
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Emission Reduction Measures: up to 75% by existing technologies

Source: Boumann et al. 2017
Liquid Biogas Business Concept

• Other coastal communities
  – Dialogue between biogas and maritime sector is challenging
  – LBG can be realistic for medium sized ferries, where biogas production/gas grid is available

• The Samsø *Field to Ferry* business concept is perhaps a one-of-a-kind case
  – a conceptual model for other coastal communities
  – RED II blends can increase the opportunities
  – We now ask for the realistic price
Questions, comments, discussion