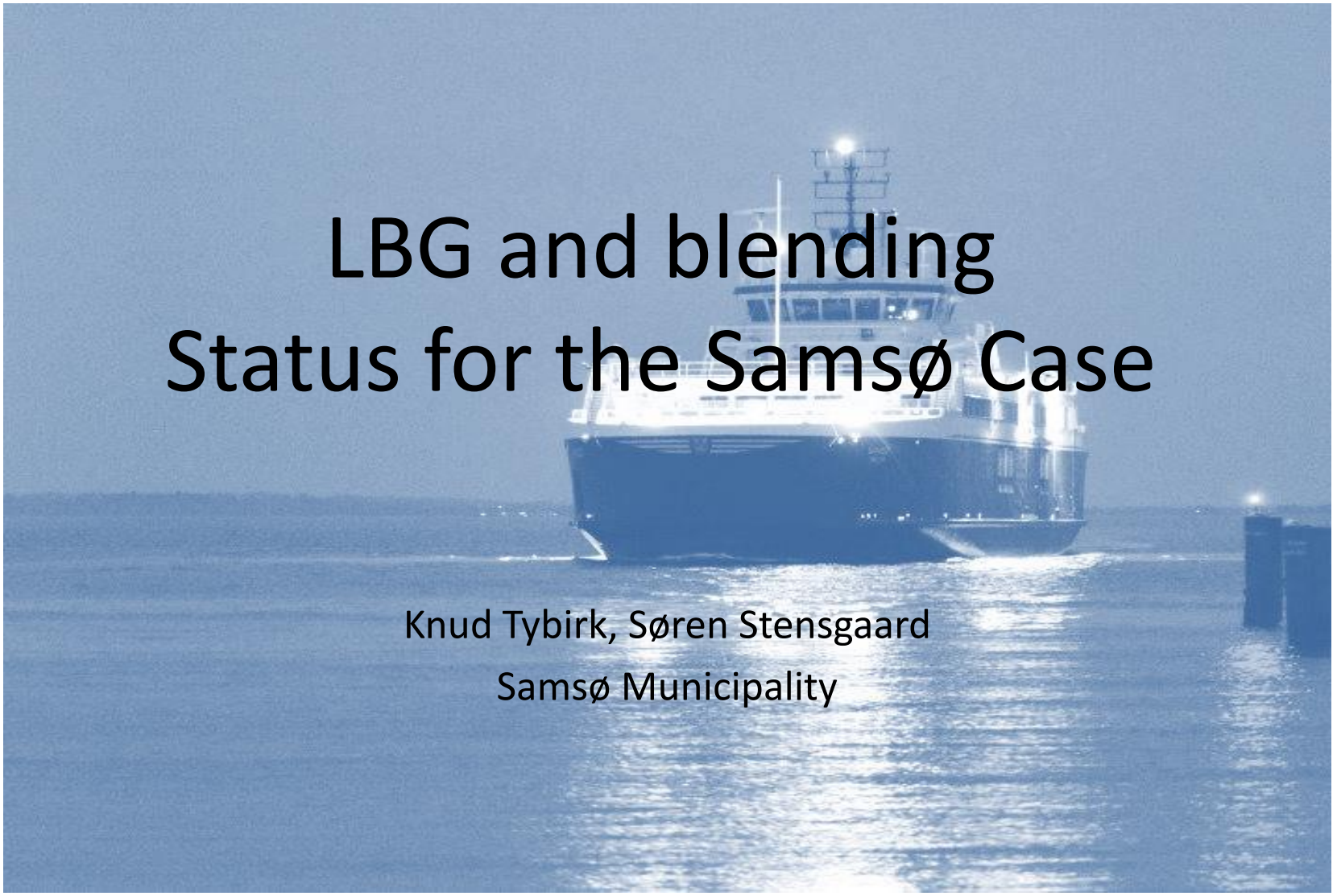

LBG and blending
Status for the Samsø Case

Knud Tybirk, Søren Stensgaard

Samsø Municipality

GoLNG

SAMSØ KOMMUNE

EUSBSR EU STRATEGY FOR THE BALTIC SEA REGION

Interreg Baltic Sea Region

Content

- The Samsø case – From Field to Ferry
  - Why Field to Ferry biogas on Samsø?
  - Biogas liquefaction challenge
  - Present status: Business and politics
- Lessons learnt
  - Steps ahead, refleksions
    - LBG og LNG? No talk about GTL!
    - Single Fuel/ Duel fuel /hybrid?
  - Other coastal communities

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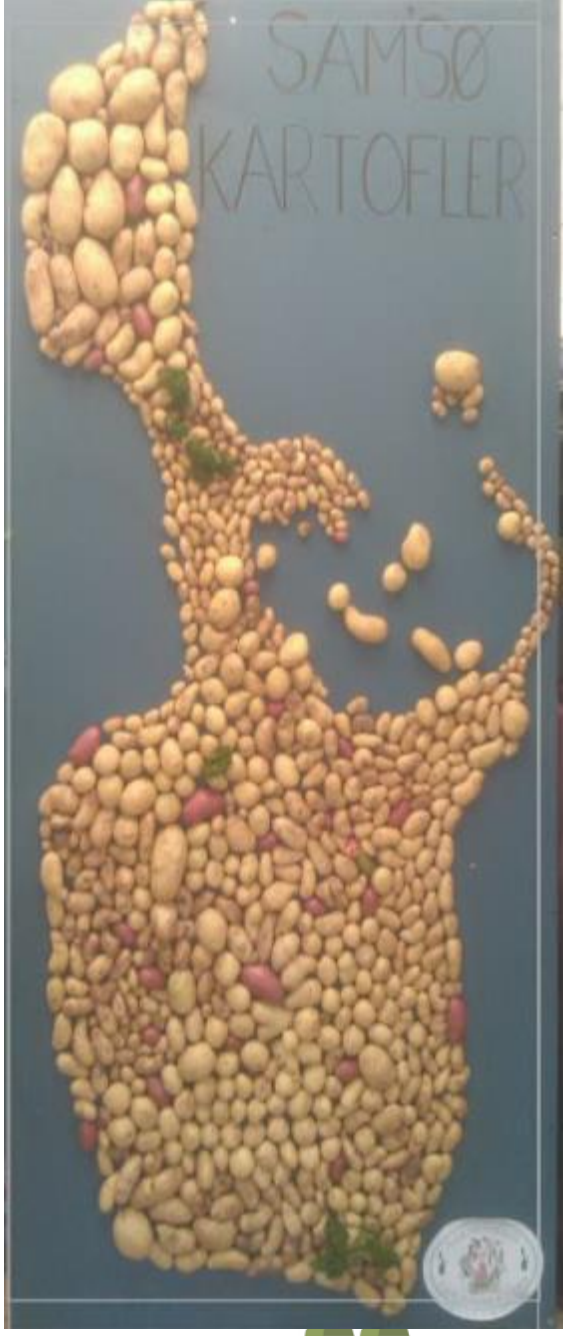
Samsø - The island of gathering

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



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Connections and cooperation

Liquid Natural Gas ferry 2015
Liquid Bio Methane 2020

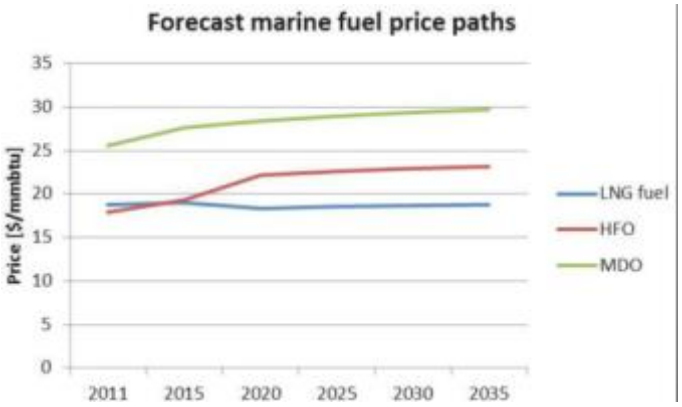
New harbour in 2014

GoLNG




Biogas from the fields to the ferry

- Renewable energy Island since 2007
- Biogas is impossible without the ferry as customer
- Municipal decision in 2013: We make our own shipping company!
- New ferry since 2015
- Now we need the biogas ☺



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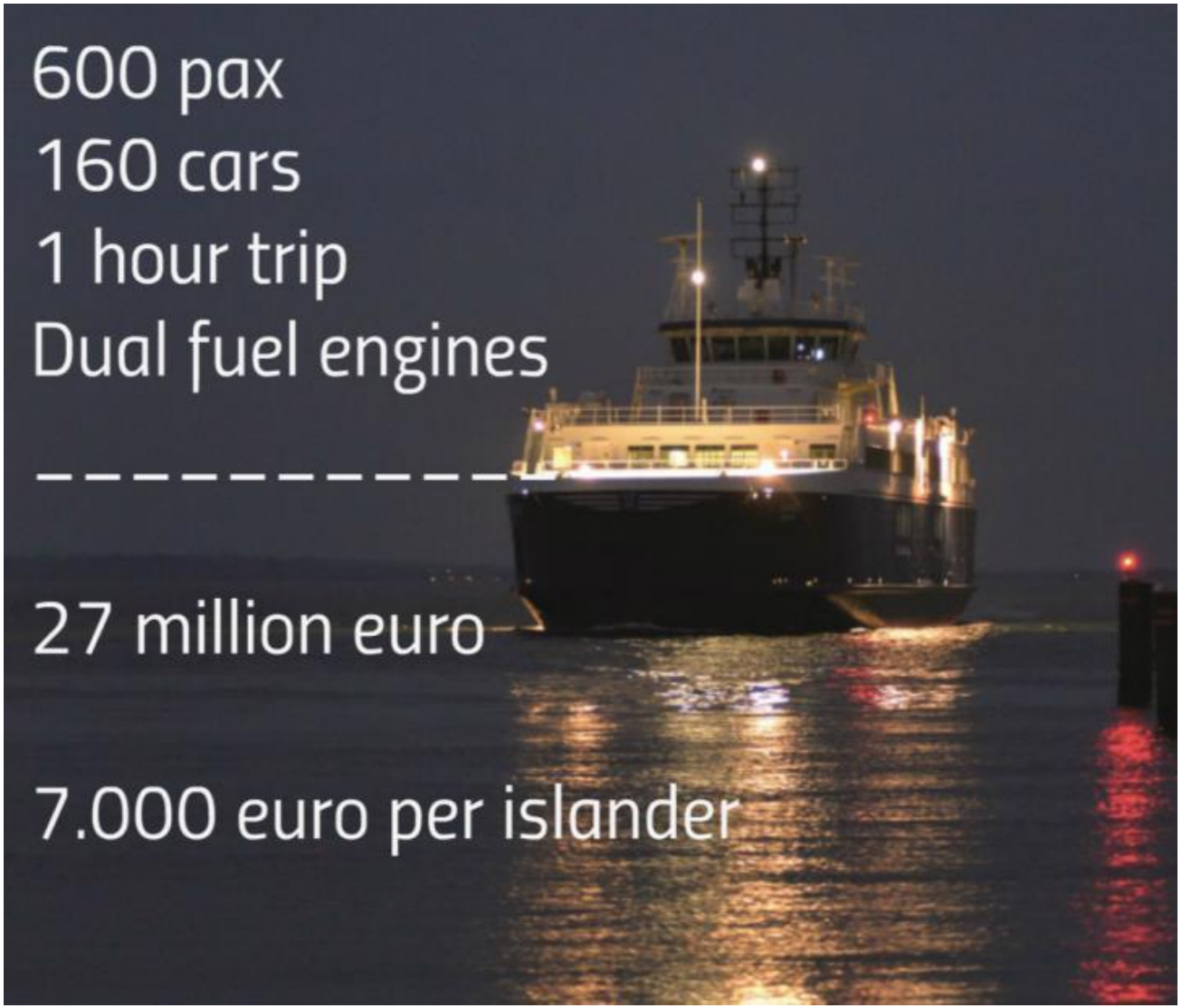
600 pax
160 cars
1 hour trip
Dual fuel engines
27 million euro
7.000 euro per islander

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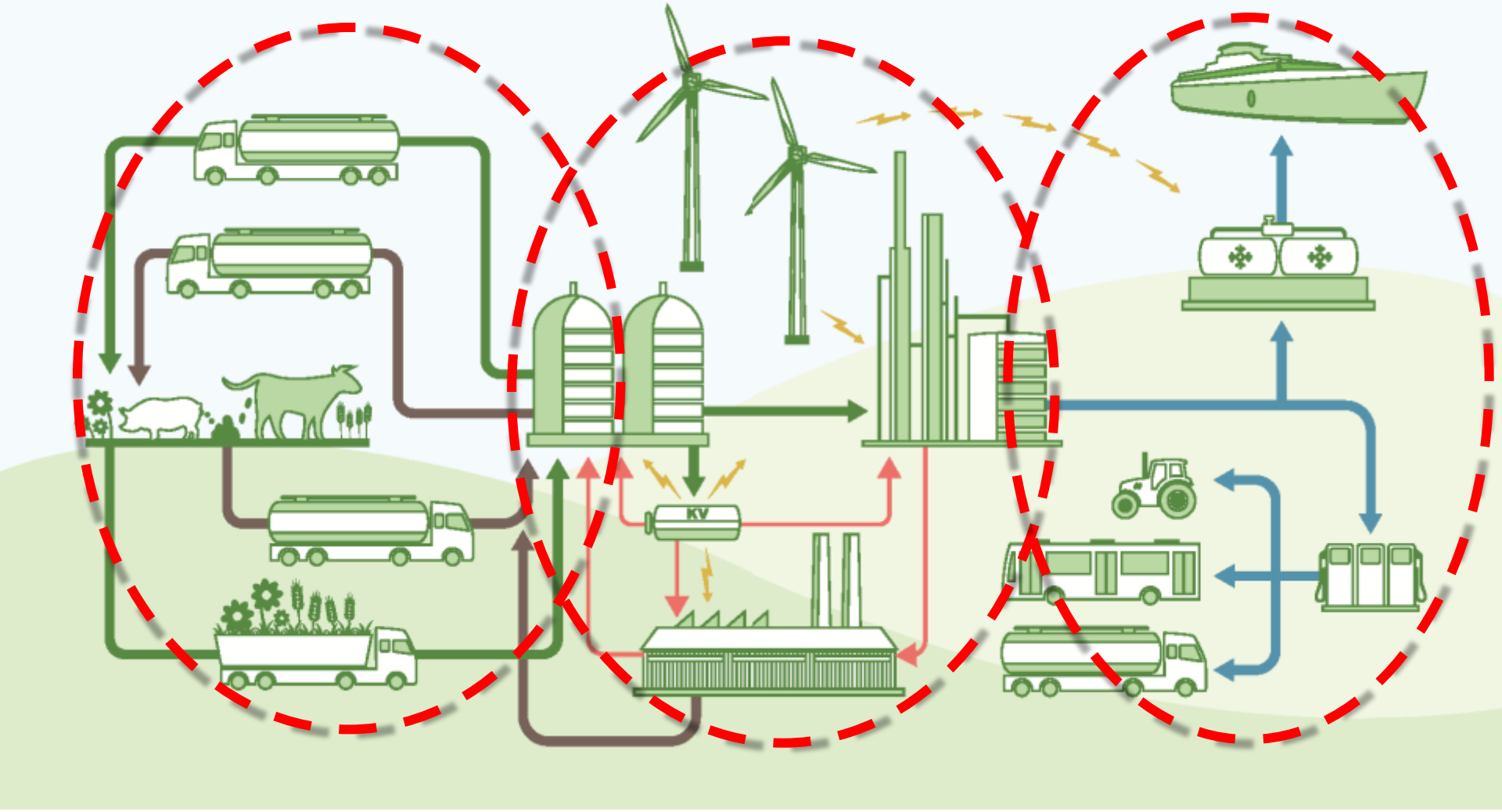
GoLNG

EUDP Feasibility

Energiteknologisk Udviklings- og Demonstrationsprogram

BioGas2020



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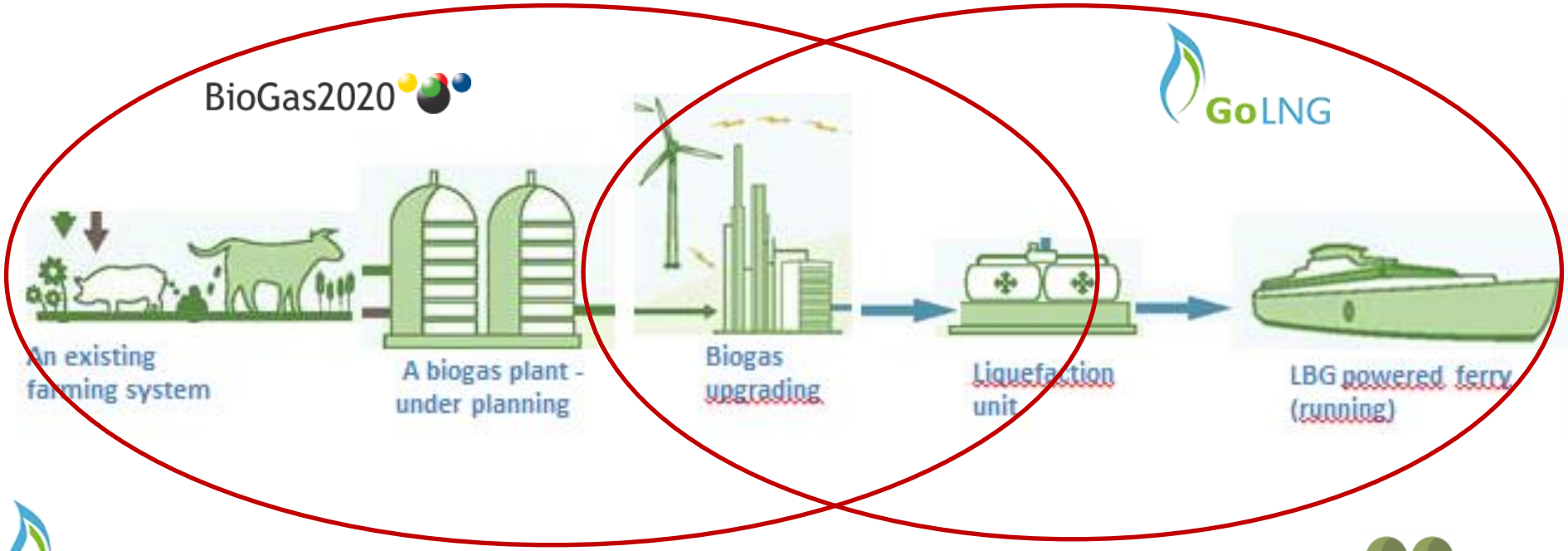
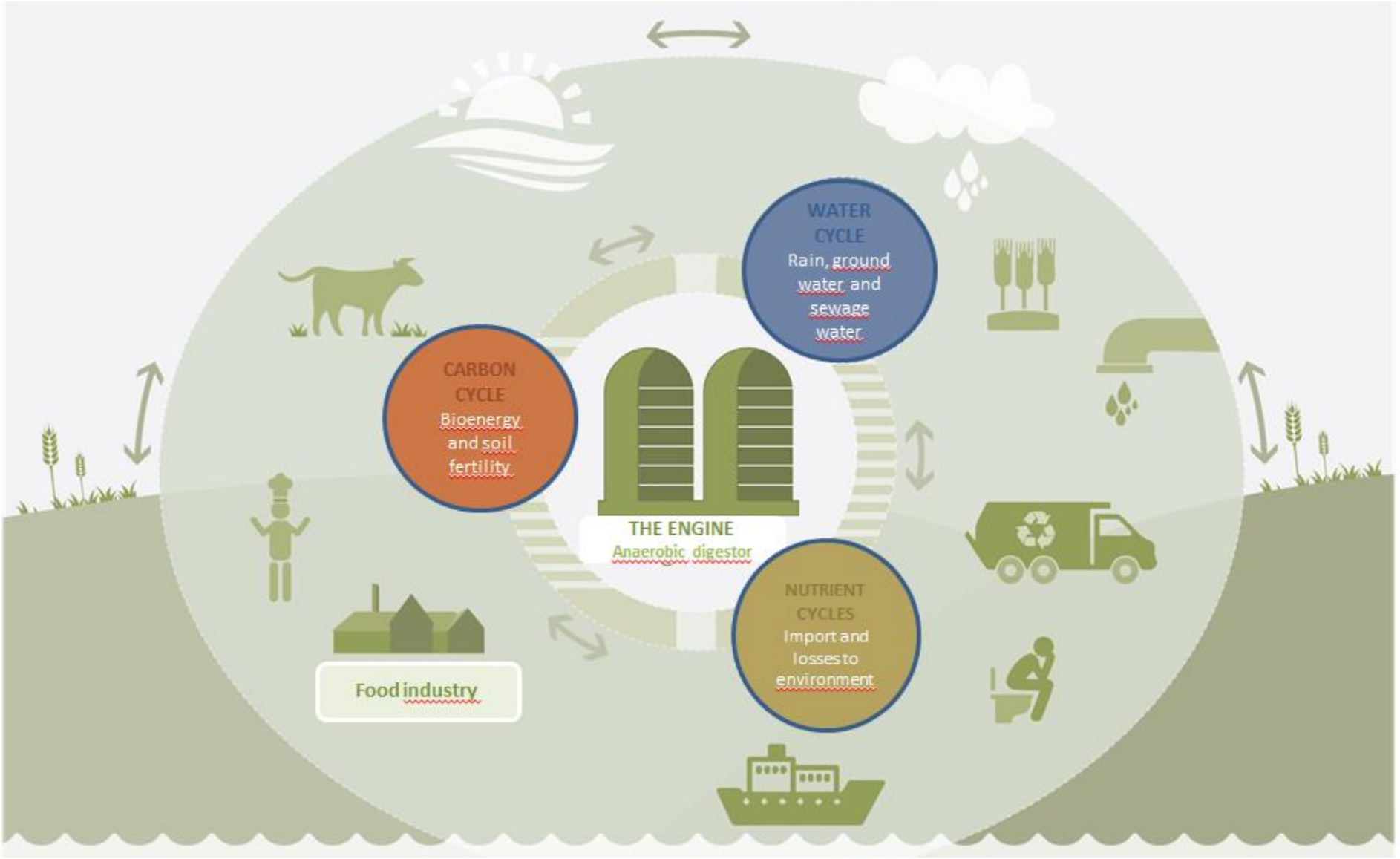
The Samsoe Case

- Field to ferry concept
  - Biogas 2020 value chain permissions
  - GOLNG technical & economic feasibility





Job creation and waste reource handling
Vision, Plan: Free of fossil fuels by 2030

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
- Coastal communities business model challenges and opportunities with GO-LNG

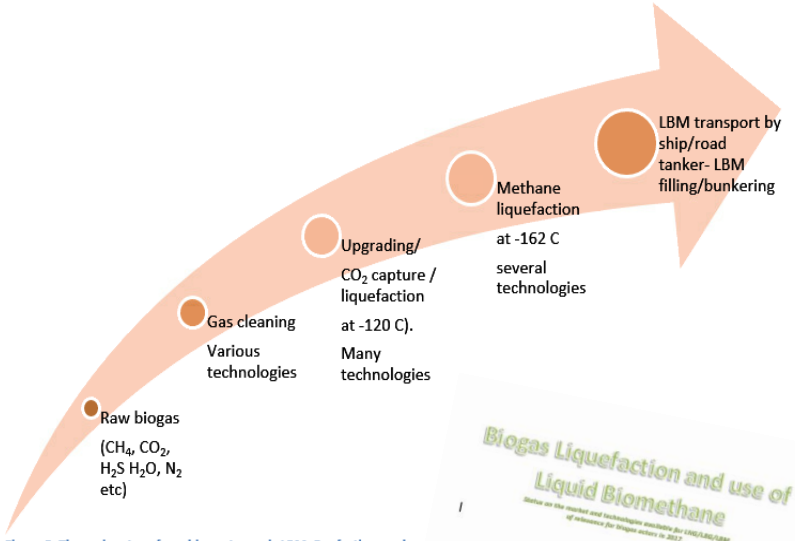
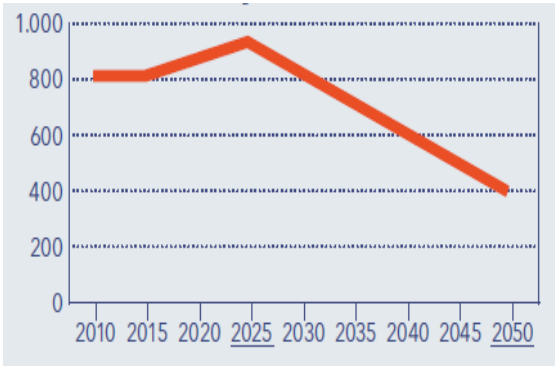


Figure 5. The major steps from biogas towards LBM. For further explana

Status for Samsø Field to Ferry

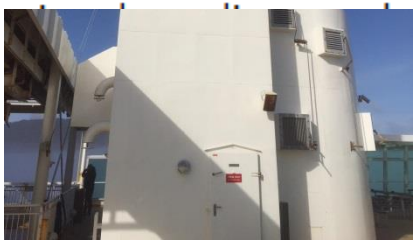
- Environmental permissions OK (Biogas 2020)
  - Samsø Municipality is the gas costumer
  - The biogas plant should be private
- The business plan is the challenge
  - World market LNG price is very low
  - Tax exemption for ships, lower subsidies, more restrictions
  - Renewable Energy Directive negotiations
    - Will determine the potential Bioticket value of Biogas on EU market
  - Municipal Board should procure Biogas for the ferry
    - 10 years to be delivered at Samsø

Lessons learnt – way ahead



- LBG or LNG?
  - LBG is not the complete answer.
  - Challenges described, how much can we cover?
  - GTL- synthetic diesel from LNG?
- Blending is inter
  - This very ship c
- Single Fuel/ Dua cells?
  - Hybrid solutions upcoming
    - Not economically feasible with the Samsø Ferry
    - Future ferry energy needs
  - Pure single fuel engines have less CH_4 emissions

	Energy (PJ)	Emission (Mt CO_2/yr)
Danish ships within DK (Energistyrelsen 2015)	6	0.4
Danish ships (Danmarks Statistik)	10	0.8
Incl. half voyages from/to Denmark	280	21.6
Ships run by a large Danish company (Mærsk 2016)	445	34.3



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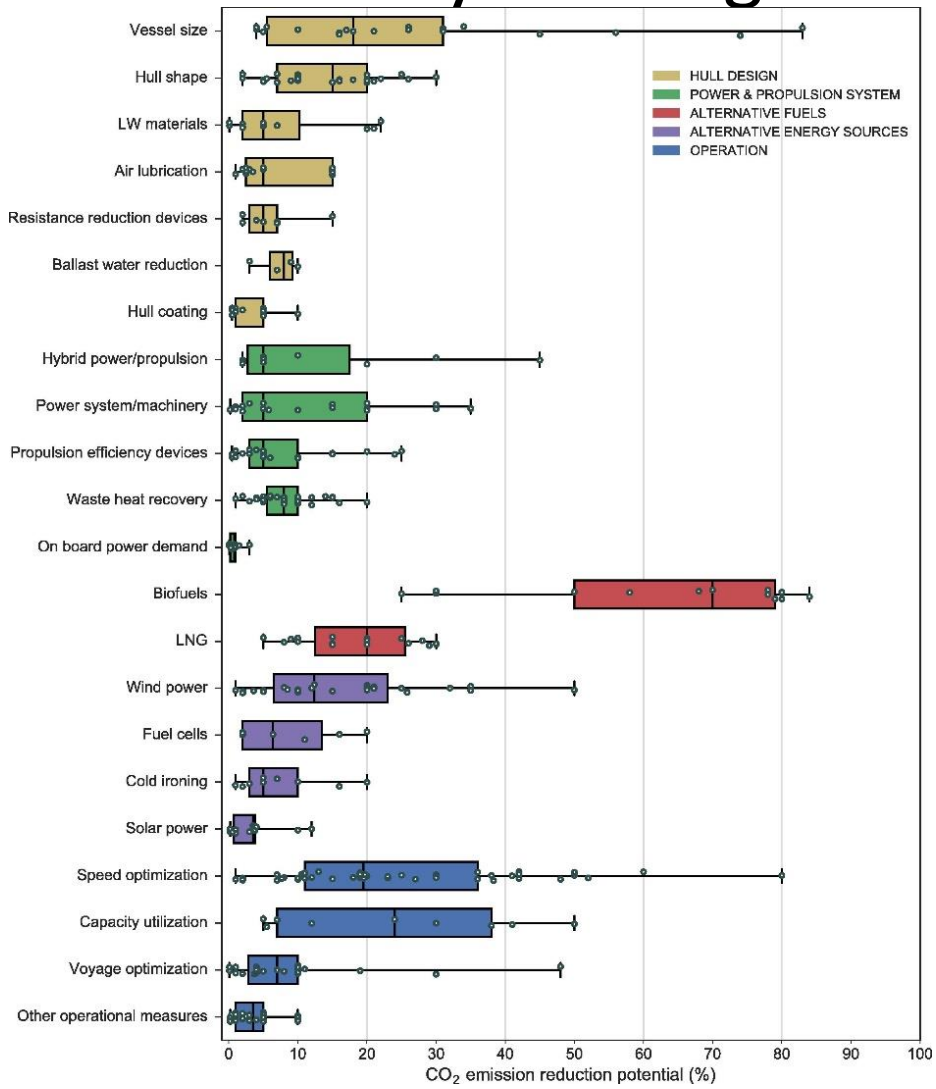
Emission Reduction Measures: up to 75% by existing technologies



HULL DESIGN

POWER & PROPULSION SYSTEM

ALTERNATIVE FUELS

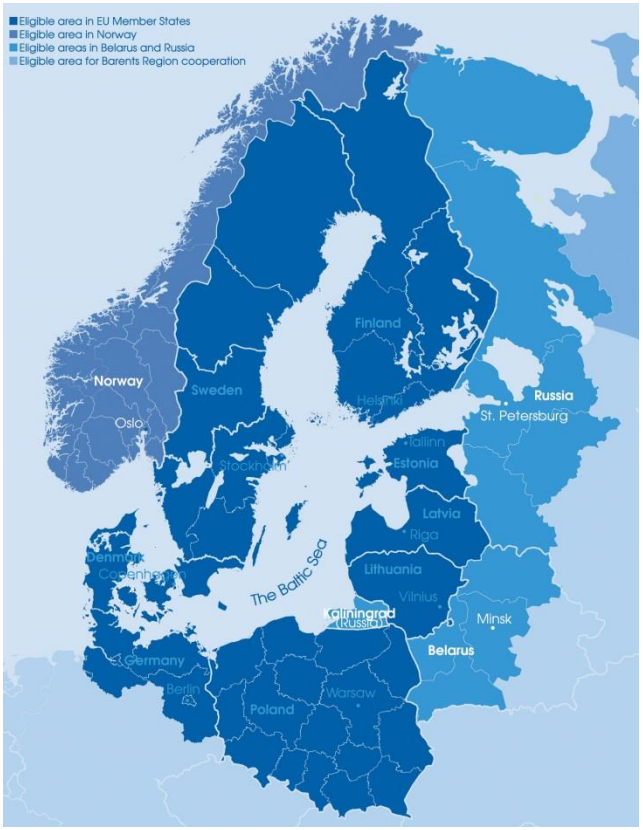
ALTERNATIVE ENERGY SOURCES

OPERATION

Source: Boumann et al. 2017

Future in Baltic Sea Region

- Other coastal communities
  - Dialogue between biogas and maritime sector is challenging
    - Planning for biogas
    - Planning for new ferry
  - Matching scale for business
  - LBG can be realistic for medium sized ferries, where biogas production/ gas grid is available
  - Bumble bees do fly, but against odds!



Questions, comments, discussion