LNG as a driver for innovation
Norwegian experience in LNG

Study visit to Stavanger, Norway to explore LNG
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Source: Gasnor
We contribute to

• Innovation in Norwegian trade and industry

• Making Norwegian businesses competitive domestically and internationally

• Promoting the reputation of Norwegian businesses

Photo: Siv Nærø/ Innovation Norway
“Snøhvit” Sales

“Melkøya” - The world’s most northerly, and Europe’s first LNG export facility

4.2 million tonnes a year LNG processing

Deliveries to 9 countries

Longest commercial LNG journey; 32 days to Tokyo Bay
Small scale receiving terminals in Norway (2009)

Receiving LNG terminals
LNG receiving terminals in operation
Total number of 30 terminals
Wide span in size
100m³ - 3500m³ LNG

Source of LNG
Local production (marked P)
Karmøy 20000 ton/year
Kollsnes1 40000 ton/year
Kollsnes2 80000 ton/year
Tjelbergodden 10000 ton/year
Tanager (2010) 300000 ton/year
Total 450000 ton/year
Norwegian LNG-related companies are distributed across the LNG value chain

**Transport and distribution of LNG**
- Golar
- Hoegh LNG
- Gasnor

**Terminals/FSRU**
- Norwegian Shipowners’ Association
- Knutsen OAS Shipping
- Moss Maritime
- BW Gas
- DSD AS

**Building & design**
- I.M. Skauge
- Hoegh LNG
- Gasnor

**Transport**
- Gasnor

**Other LNG stakeholders**
- DnB NOR
- Eksportfinans
- GIEK
- NORAD
- INTSOK
- Innovation Norge
- Sjøfartsdirektoratet
- NHO
- Intertank
- Norwegian Maritime Exporters

**LNG bunkering**
- Hamworthy
  - Land facilities
    - Hoegh LNG
    - Golar
    - TORP LNG
  - Offshore facilities

**LNG storage**
- Stolt Nielsen
- NLI
- Aker Solutions
  - Storage tanks

**LNG as marine fuel**
- Rolls-Royce
- Marintek
- I.M. Skauge
- Wärtsilä

**Engineering Activities & Management**
- Kvaerner
- Grendland
- Skipsteknisk AS

**Equipment, Services & Consultancy**
- Gravifloat
- DNV
- Stolt Nielsen
- Knutsen OAS

**Management (Safety, Risk, Energy Efficiency)**
- Wilhelmsen Technical Solutions
- TTS Group
- Hamworthy
- FRAMO
- Aker Solutions (onshore)
- Dresser Rand
- Kongsberg Maritime
Small scale distribution of LNG

Covering the coast of Norway

- LNG source - base load LNG or receiving terminals or small scale LNG production
- LNG could be further distributed by truck or rail way or distributed by locale pipeline.
Advanced LNG chain

Ocean LNG carrier

Pipeline

Receiving terminal

Rail car

Small liquefier
stranded gas, biogas
or from pipeline

Vehicle fueling station

Loading LNG on tanker and truck

LNG-tanker running on natural gas
Small receiving terminal at an aluminum plant

LNG ship 1000m³ LNG
Ship to ship LNG transfer

LNG transfer by hoses
LNG powered RoRo Freight ship (gas only)

One gas engine mechanical drive, one storage tank for LNG
Backup power by diesel generator set and power take inn/out arrangement
Transport of fish fodder
New Regulations

“Political measures are needed to facilitate a critical mass of LNG-fuelled vessels and necessary distribution infrastructure which will improve availability and reduce the LNG-price to ships”

Rikke Lind, Norwegian Deputy Minister of Trade and Industry
Challenges

Emission Control Areas

- Baltic Sea
- North Sea
- East coast of USA and Canada
- West coast of USA and Canada
- Asian Regions – where and when?
MARINTEK
Independent research and development institute
Model tests in the Ocean Basin (80mx50mx10m)
The Energy and Machinery Laboratory

Artist impression
R&D – Small Scale LNG

• Engines (Rolls-Royce, Wärtsilä, equipment suppliers)

• Distribution Concepts (Gasnor, Liquiline, Statoil, Shipowners)

• Regulatory Framework (Government, IMO, DNV)
Tailor made LNG Fuel tank systems

Storage factor 2-3 times HFO

Anchor handlers  Passenger ferries  Container carriers

Cruise ships  Oil Tankers  Ro-Ro vessels

...and many other sectors. Bespoke design. Under development now.
New developments – LNG storage for ships

- Two examples new LNG storage concepts (prototype 2011)
  - Aker Solutions
    - Prismatic, free variation in dimensions (LxWxH)
    - Pressure vessel: 7 bar
  - NLI
    - Atmospheric pressure (max 0.7 bar)
    - Free variation in dimensions (LxWxH) and shape
Commercial viability of adopting LNG fuelled ships

Chicken & Egg-problem:
• Ship owners await better retail infrastructure before investing into LNG-propulsion, while retailers await a larger installed base of users

Increased investment:
• Machinery equipped for LNG-fuel demands increased CAPEX. The increase in CAPEX might be offset by reduced OPEX due to;
  • lower fuel costs
  • reduced port fees and
  • decreased maintenance costs
Industrial Research and development Program (IRD)-programme

Targets

• New business relations and partnerships based on cooperation in development

• To succeed in commercialization and marketing of new products

Photo: Kjell A. Nielsen
The roles of the actors

**Demanding customer (Foreign company)**
- States requirements for new products or solutions for a global market.
  - References and market channels

**Norwegian Supplier**
- Provides product and services from R&D

**IRD-contract:**
- Market driven innovation

**New products**

**Norwegian company (SME)**
- Innovation Norway
  - Support the business relations
  - Covers part of the R&D-costs
Funding: Norway Grants Green Industry Innovation program
Market trends: Growth of activities on the Baltic Sea
Opportunities: Maritime transport and production, LNG solutions
An innovative set up, 75 years of experience

Estonia

Director the Baltics
Tiina Link

Senior Adviser the Baltics
Urmas Lepik

Associated Consultant
Anneli Valge

Associated Consultant
Annely Abel

Latvia

Associated Consultant
Inese Andersone

Associated Consultant
Zanda Vipule

Lithuania

Associated Consultant
Rita Boguzaite

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Orinta Jasudaite
Challenges.
What can Innovation Norway contribute?

- Find right partners
- Establish good networks
- Check out laws
- Be aware of the cultural differences
Thank you!

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