



Gass som energibærer

Teknologikonferansen 2011- Gass som energibærer i fiskeflåten

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Ålesund, 13 Oct 2011

Backdrop

Various drivers for LNG as fuel: Emission regulations. Cost efficient ECA alternative. Consumer demands!

sustainableshipping

UK maritime sector warning on annual £3.6 billion ECA cost
7th October 2011 10:37 GMT

An umbrella organisation for maritime industries in the UK has issued a stark warning about the potential side effects of the 0.10% sulphur limit in Emission Control Areas (ECAs) due to take effect in 2015.

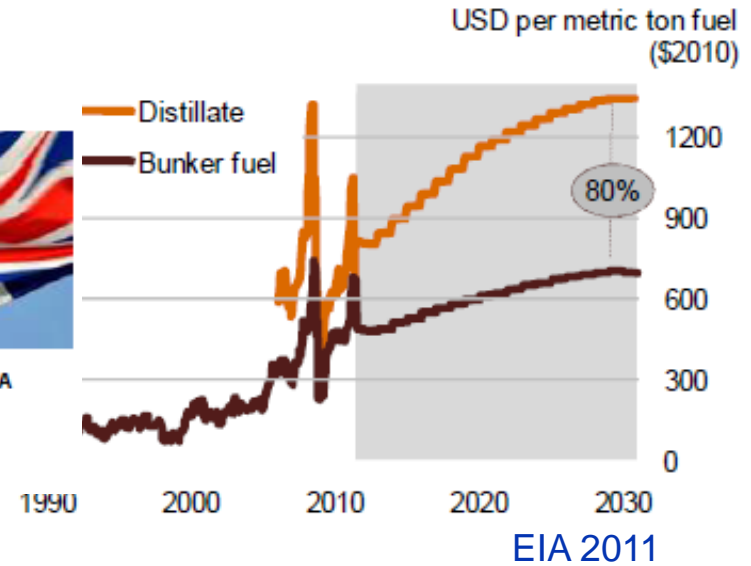
"These regulations will create considerable financial, logistical, societal and even environmental impacts," said Maritime UK in a submission to the UK's Transport Select Committee on Monday.

The submission said the 2015 ECA regulations may increase bunker fuel costs by 87%, and that it could cost £3.6 billion (\$5.6 billion) a year to shipping within 200 miles of the UK.

3,6 MRD GBP/yr!



Maritime UK flags up ECA concerns



Marine Stewardship Council
Certified sustainable seafood



Norway is taking the lead on LNG

Ships in operation

| Year | Type of vessel | Owner | Class |
|------|---------------------|-------------------|-------|
| 2000 | Car/passenger ferry | Fjord1 | DNV |
| 2003 | PSV | Simon Møkster | DNV |
| 2003 | PSV | Eidesvik | DNV |
| 2006 | Car/passenger ferry | Fjord1 | DNV |
| 2007 | Car/passenger ferry | Fjord1 | DNV |
| 2007 | Car/passenger ferry | Fjord1 | DNV |
| 2007 | Car/passenger ferry | Fjord1 | DNV |
| 2007 | Car/passenger ferry | Fjord1 | DNV |
| 2008 | PSV | Eidesvik Shipping | DNV |
| 2009 | PSV | Eidesvik Shipping | DNV |
| 2009 | Car/passenger ferry | Tide Sjø | DNV |
| 2009 | Car/passenger ferry | Tide Sjø | DNV |
| 2009 | Car/passenger ferry | Tide Sjø | DNV |
| 2009 | Patrol vessel | REM | DNV |
| 2009 | Car/passenger ferry | Fjord1 | DNV |
| 2010 | Patrol vessel | REM | DNV |
| 2010 | Car/passenger ferry | Fjord1 | DNV |
| 2010 | Patrol vessel | REM | DNV |
| 2010 | Car/passenger ferry | Fjord1 | DNV |
| 2010 | Car/passenger ferry | Fjord1 | DNV |
| 2010 | Car/passenger ferry | Fosen Namsos Sjø | DNV |
| 2011 | PSV | DOF | DNV |

Confirmed orderbook

| Year | Type of vessel | Owner | Class |
|------|---------------------|-------------------------|-------|
| 2011 | Car/passenger ferry | Fjord1 | DNV |
| 2011 | PSV | Solstad Rederi | DNV |
| 2011 | General Cargo | Nordnorsk Shipping | DNV |
| 2012 | PSV | Olympic Shipping | DNV |
| 2012 | PSV | Eidesvik | DNV |
| 2012 | PSV | Eidesvik | DNV |
| 2012 | Ro-Ro | Sea-Cargo | DNV |
| 2012 | Ro-Ro | Sea-Cargo | DNV |
| 2012 | High speed RoPax | Buquebus | DNV |
| 2012 | PSV | Island Offshore | DNV |
| 2012 | PSV | Island Offshore | DNV |
| 2012 | PSV | REM | DNV |
| 2013 | Ro-Ro | Norlines | |
| 2013 | Ro-Ro | Norlines | |
| 2013 | Car/passenger ferry | Torghatten Nord | DNV |
| 2013 | Car/passenger ferry | Torghatten Nord | DNV |
| 2013 | Car/passenger ferry | Torghatten Nord | DNV |
| 2013 | Car/passenger ferry | Torghatten Nord | DNV |
| 2013 | RoPax | Viking Line | LR |
| 2013 | PSV | Harvey Gulf Int. Marine | |
| 2013 | PSV | Harvey Gulf Int. Marine | |

Planned conversion

| Year | Type of vessel | Owner | Class |
|------|---------------------|-----------------|-------|
| 2011 | Car/passenger ferry | Fjord1 | DNV |
| 2011 | Chemical tanker | Tarbit Shipping | GL |
| 2013 | RoPax | Fjordline | DNV |
| 2013 | RoPax | Fjordline | DNV |

Training & Qualifications

LNG as fuel: Proper training is required

- There are no specific requirements to crew training internationally or nationally
- However, Norwegian Maritime Directorate sets standards for training programmes
- Every ship-owner needs to ensure good safety behaviour through company procedures
- Establish a winning culture from start, anchored with onboard staff and shore side management
- Training from system suppliers for all shifts involved with LNG. Consider additional training.
- Establish and follow good operation and maintenance routines
- Deviation control, Emergency drills



LNG is safe *because* risk is dealt with properly!

Norwegian rules (1)

- LNG fuelled vessels require additional training and certificates.
- Plan training early. Involve all affected personnel, also on shore.
- Engine and tank/cold box suppliers provides high quality, repeated training.
- PAX ship owners/operators must develop a total NMD training programme:
 - FOR 9. Sept 2009 no. 1218 (Construction & operation of gas fuelled PAX vessels) (FAGPLAN). This is common also for operators of LNG fuelled OSVs:

Kapittel 4. Opplæring

§ 28. Opplæring

(1) Opplæring som beskrevet i denne paragraf kommer i tillegg til annen opplæring som kreves for å kunne tjenestegjøre om bord på passasjerskip.

(2) Opplæringen skal være i henhold til den til enhver tid gjeldende veiledning utarbeidet av Sjøfartsdirektoratet.

(3) Hele sikkerhetsbemanningen på gassdrevet passasjerskip skal ha generell basisopplæring, kategori A i gassrelatert sikkerhet, drift og vedlikehold før tiltredelse om bord.

(4) Den delen av besetningen som har direkte ansvar for drift av gassrelatert utstyr om bord, skal i tillegg gis en spesialopplæring, dekksoffiserer kategori B og maskinoffiserer kategori C.

(5) Opplæringsplan/fagplan skal omfatte alle tre kategorier (A, B og C) og skal være godkjent av Sjøfartsdirektoratet.

Norwegian rules (2)

- Norwegian Maritime Directorate, NMD:
 - Onboard training shall always be in accordance with the latest NMD instruction
 - All safety crew onboard: “Basic Training”
 - Deck personnel: Additional training «category B» for relevant LNG equipment
 - Engine personnel: Additional training «category C» for relevant LNG equipment
 - NMD to approve training programme for categories A, B and C prior to training
 - The training programme must have a dedicated owner, and qualified trainers
 - Proof of adequate training for all personnel to be kept onboard
 - Develop Check Lists for Deck& bunkering station, Engine, Bridge, entering Cold box, releasing over pressure etc. Example:

| Vessel: MS LNG | |
|---|--------------------------|
| Preparation All Involved: | OK |
| Toolbox Talk with all involved personnel carried out? | <input type="checkbox"/> |
| Preparation before bunkering: | |
| Check that the ship are properly moored. | <input type="checkbox"/> |
| Prepare fire equipment on main deck. | <input type="checkbox"/> |
| Close drip tray in bunker station. | <input type="checkbox"/> |
| Verify that engine has turned off anti grow system for hull | <input type="checkbox"/> |
| Connect earth cable between shore and ship | <input type="checkbox"/> |

LNG as fuel: Bunkering roles and responsibilities

- Define roles and areas of responsibility clearly
- Bunkering station must ensure good safety behavior through company procedures
- Training for everybody involved with bunkering.
- Establish and follow good operation and maintenance routines
- Deviation control, Emergency drills
- Remember:
 - Bunkering takes some time
 - Bunkering is not difficult
 - Meet the routines (inerting, pressure control etc)
 - Communicate with receiving vessel.



The industry is now developing practices and standards for bunkering

Operational conditions

LNG is safe

- Two main areas of difference from other fuels:
 - Cryogenic effects
 - Forms gas clouds
- LNG has a strong track record
 - No significant incidents with ships
 - Very few incidents on land
- ***But, this performance is due to:***
 - ***Stricter requirements***
 - ***Good safety behaviour***



LNG success stories in Norway due to Government requirements and incentives

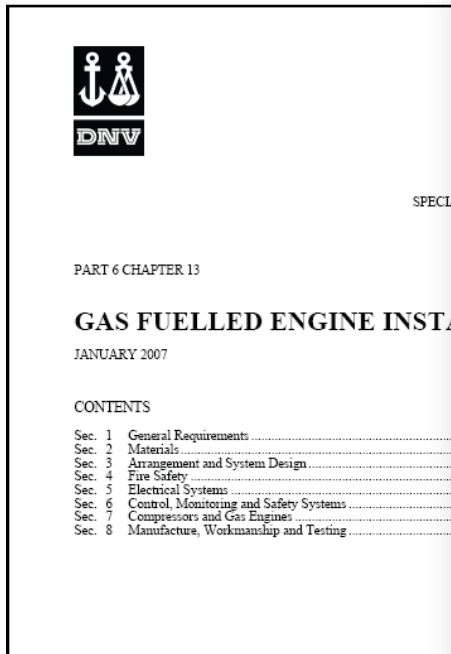
Status on rules, regulation, and standardization

Gas fuelled ships:

- DNV class rules published 2001
- Norwegian Maritime Directorate has rules
- Interim Guidelines for IGF code, 2010

Port and bunker operations:

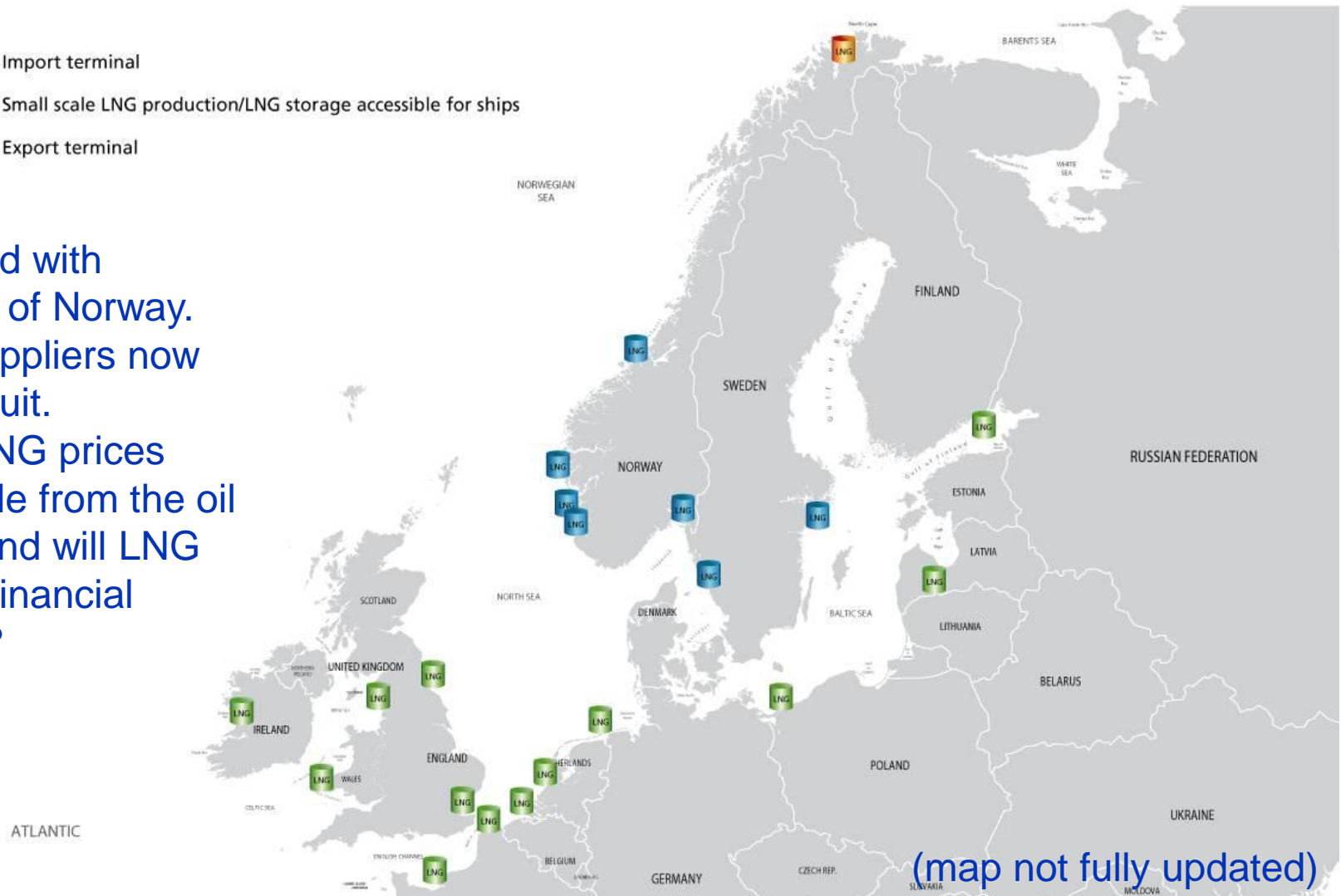
- Limited experience and documentation
- Standards do not cover all bunkering
- Development under way:
 - STS Gothenburg (Got LNG)
 - “Bungas” – Port of Hamburg
 - EU funded study
 - **ISO project:**
Develop standard for LNG bunkering equipment and procedures.
DNV proposal to ISO TC67/WG10 (workgroup for the LNG industry)



Norway's neighbour countries are now developing Bunkering infrastructure. Often emerging form LNG import terminals



It started with Gasnor of Norway. New suppliers now follow suit.
- Will LNG prices decouple from the oil price, and will LNG be the financial winner?



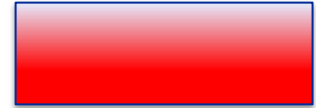
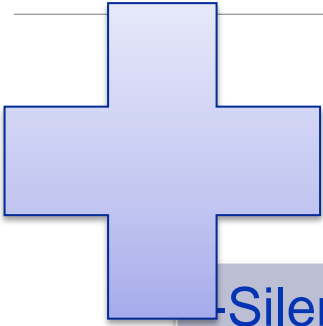
Technical challenges

Time to take stock on experiences with LNG?

- 20 ships launched over the past 10 years
- Some 200 000 hours of operation logged
- Qualitative feedback:
 - Less soot
 - Clean boiler suits
 - Less maintenance
- Quantitative feedback:
 - Nothing we are aware of
 - However; no big incidents are recorded
- LNG fuelled ships has recently been ordered, the technology is safe and available. It is time for growth.
- LNG ships in Norwegian trades qualify for significant NOx fund support .



LNG engines: Some Technical observations



- Silent ship
- Lower oil consumption
- Higher fuel efficiency
- Nice steady engine operation
- Clean and tidy engine room
- Fuel sourcing from two energy markets can give \$ benefits
- Less deposits, corrosion
- (- no fuel separator)

- LNG quality (methane number) appears important
- More load steps required when going from 0 to 100% load
- Although some children's deceases have been observed, these have usually been solved quickly by suppliers

OTHER:

- Suppliers aims to follow their installations closely, after sales programmes
- Pressure variations in different cylinders observed, does not seem critical

Waiting for more experiences with...

- 2-stroke dual fuel engines
- Latest generation 4-stroke engines, lean-burn and dual fuel
- The future belongs to reliable fuel efficient engines with low-emissions...
- What more to come?



Rolls Royce Lean burn

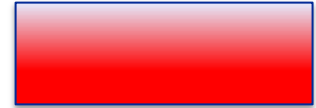
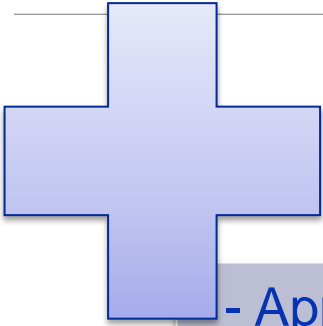
Mitsubishi Lean burn

Wärtsilä Dual fuel

MAN Dual fuel

Maintenance of LNG engines

LNG engines: Maintenance



- Apparently longer maintenance intervals
- Less deposits in engine
- Proud seafarers take good care of equipment

- Spare part costs may appear a little high
- A more complex ship requires a higher skilled crew (this however is true for all new ship systems)

Environmental benefits

Emissions from LNG engines

- The LNG-engines were originally optimized for minimizing local pollution:
 - Reduction of NOx: 85-90%
 - Reduction of SOx and particulates: Close to 100%
- Reduction of CO2/GHG-emissions (up to 25%), but
 - Older engines emits some methane, a potent GHG component
 - New generations engines have a much lower «LNG slip»

- Estimation:

What is the emission savings from the sailing LNG ships in Norway?

- They burn energy equivalent to approx. 63 000 tons MGO (0,1% S)
- Emission savings:
 - NOx: 3 400 t/year (equivalent to removing 1,4 million diesel fuelled cars!)
 - SOx: 125 t/year (Plus some CO2/GHG savings!)

LNG in a Life Cycle Analysis? (Emissions during production, distribution?)

A typical Baltic Sea container ship/feeder: LNG or LS-HFO?



*547 TEU
container vessel
(5000 GT)*

*Propulsion power
3960 kW*

Yearly emissions, tonnes/year

| | SOx | NOx | CO2 | Particle emissions |
|---|-----------|------------|--------------|--------------------|
| With LNG fuel: | 0 | 31 | 5 500 | 0 |
| With low-sulphur HFO (LS380 with 1% sulfur): | 50 | 180 | 7 250 | 4 |

LNG: Minimized oil spill risk



BETYDELIGE MENGDER: Fra luften vises betydelige oljemengder i sjøen ved Mølen utenfor Langesund i Telemark. Foto: Kystverket / SCANPIX

Betydelig oljeutslipp fra lasteskip

New Zealand oil spill: grounded ship threatens environmental disaster

Penguins rescued from slick amid fears Rena could break up and dump 1,700 tonnes of oil into prized Bay of Plenty

Warren Murray

guardian.co.uk, Sunday 9 October 2011 07.09 BST

[Article history](#)



An oil slick streams from the Rena, a 47,000 tonne container ship grounded on a reef in New Zealand's Bay of Plenty. Photograph: Getty

A container ship is grounded and leaking oil into New Zealand's pristine Bay of Plenty, with international crews scrambling to limit the environmental damage and refloat the vessel before it breaks up

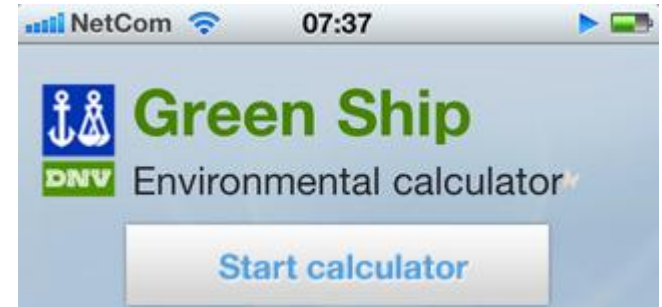
Prepare for ECA 2015 regulations.
Consider your reputation, consumer organizations, Arctic challenges
Prepare for full Norwegian NOx taxation from 2017 without NOx Fund support!

Hot DNV topics

DNV Blog for LNG market + Green ship calculator App

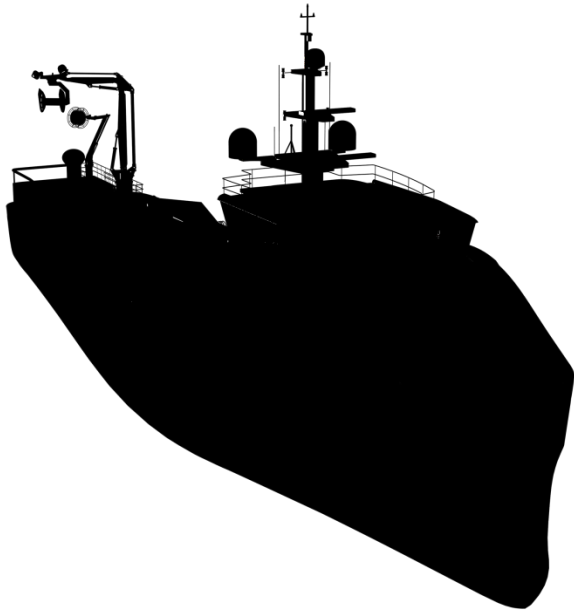


The screenshot shows the DNV blog page for LNG market. The URL is <http://blogs.dnv.com/lng>. The page features the DNV logo and the tagline "MANAGING RISK". The main navigation includes "Home", "About", "DNV's international homepage", and "DNV blog portal". The main content area has a header with "LNG Energy of the Future" and a "blog" button. The article is posted by Lars Petter Blikom on May 3, 2011, and is titled "Analysts are all wrong about LNG demand". The article text reads: "I always spend some time reviewing market comments and projections for natural gas and LNG, thinking it will make me a bit smarter and more informed about what is going on in the market. 'In your dreams' you might say... All you have to do is take a look at the natural gas demand outlook produced by the [International Energy Agency \(IEA\)](#) in their yearly [World Energy Outlook](#). I won't even bother to reproduce the graph: their high case for natural gas demand is practically a straight line from 1980 to 2035. This is a business as usual scenario; the world moves forward more or less in the same way we are used to. Their 'new policies' and '450' scenarios indicate lower demand growth from 2015 onwards. These scenarios assume that the world is quickly successful in moving away from fossil fuels to something else."



AND:
DNV LNG bunker video
on YouTube:
<http://youtu.be/hQ3tqifW9nA>

DNV's future fishing vessel



Business opportunities



Environmental impact and fuel costs



Safety and working conditions



To be presented in detail later this autumn in Ålesund!

Safeguarding life, property and the environment

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