



# Gass som energibærer

Teknologikonferansen 2011- Gass som energibærer i fiskeflåten

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Ålesund, 13 Oct 2011

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# 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.

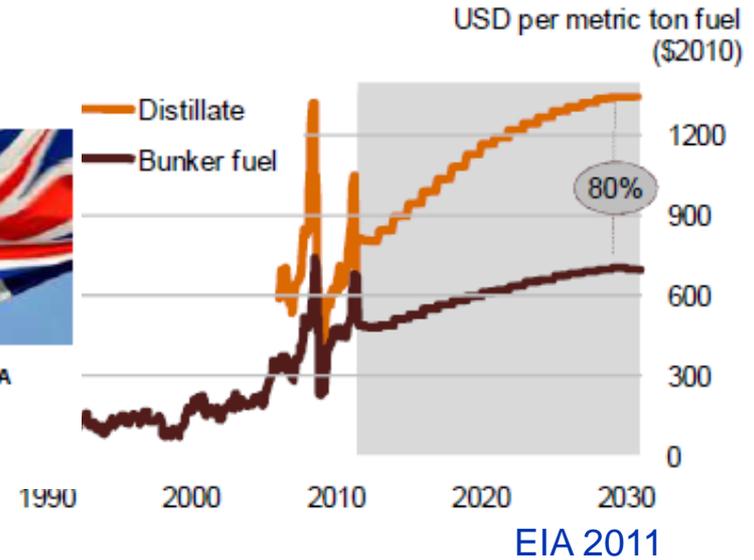
"These regulations will create considerable financial, logistical, societal and even environmental impacts," said Maritime UK in a submission to the UK's Transport Select Committee on Monday.

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

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# 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)

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- 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:

<b>Vessel: MS LNG</b>	
<b>Preparation All Involved:</b>	<b>OK</b>
Toolbox Talk with all involved personnel carried out?	<input type="checkbox"/>
<b>Preparation before bunkering:</b>	
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

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# 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

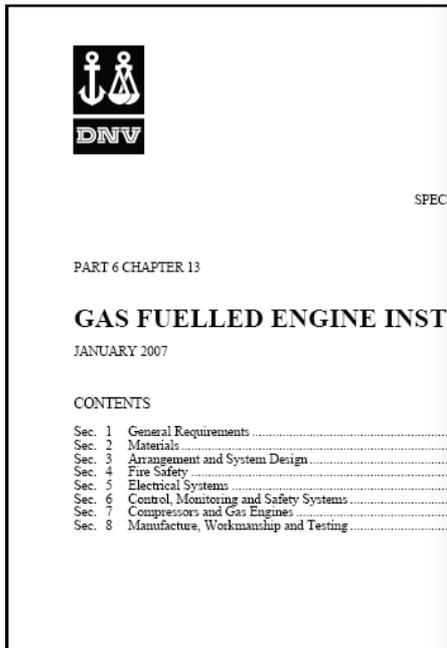
# Status on rules, regulation, and standardization

## 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)

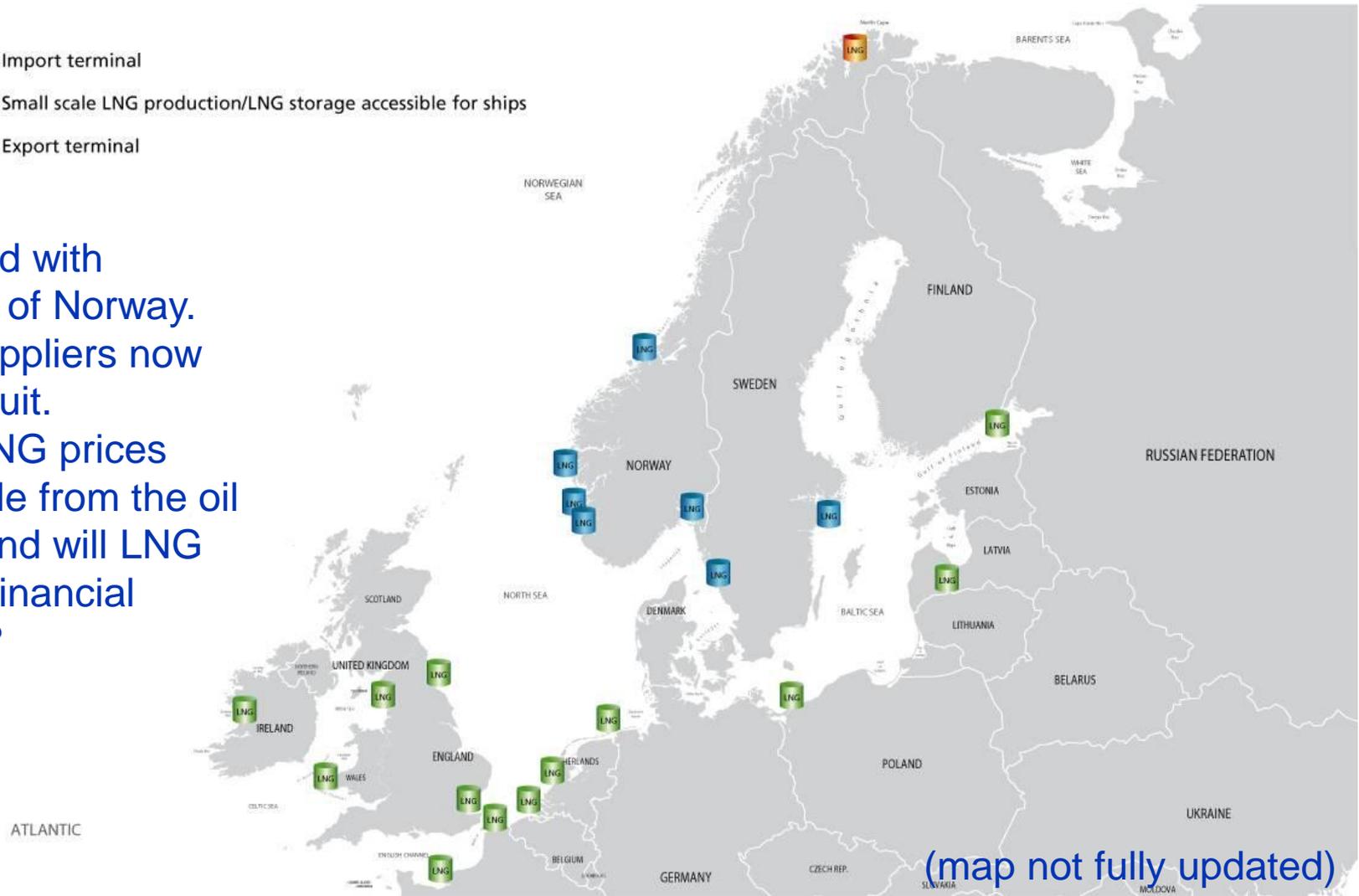


# Norway's neighbour countries are now developing Bunkering infrastructure. Often emerging form LNG import terminals



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?



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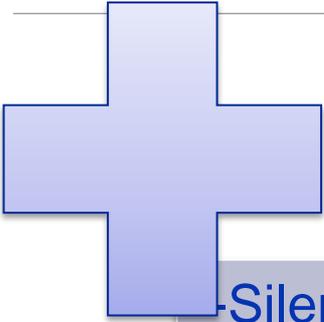
# Technical challenges

# 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

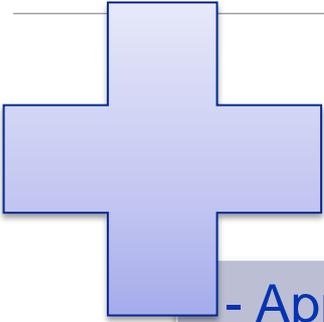
Wärtsilä Dual fuel

MAN Dual fuel

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# 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)

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# Environmental benefits

# Emissions from LNG engines

- The LNG-engines were originally optimized for minimizing local pollution:
  - Reduction of NO<sub>x</sub>: 85-90%
  - Reduction of SO<sub>x</sub> and particulates: Close to 100%
- Reduction of CO<sub>2</sub>/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:
  - NO<sub>x</sub>: 3 400 t/year (equivalent to removing 1,4 million diesel fuelled cars!)
  - SO<sub>x</sub>: 125 t/year (Plus some CO<sub>2</sub>/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
<b>With LNG fuel:</b>	<b>0</b>	<b>31</b>	<b>5 500</b>	<b>0</b>
<b>With low-sulphur HFO (LS380 with 1% sulfur):</b>	<b>50</b>	<b>180</b>	<b>7 250</b>	<b>4</b>

# 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!

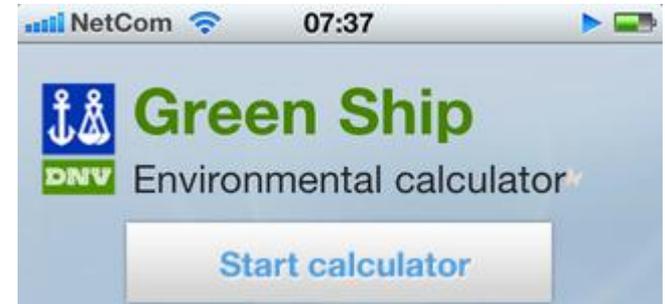
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# Hot DNV topics

# DNV Blog for LNG market + Green ship calculator App

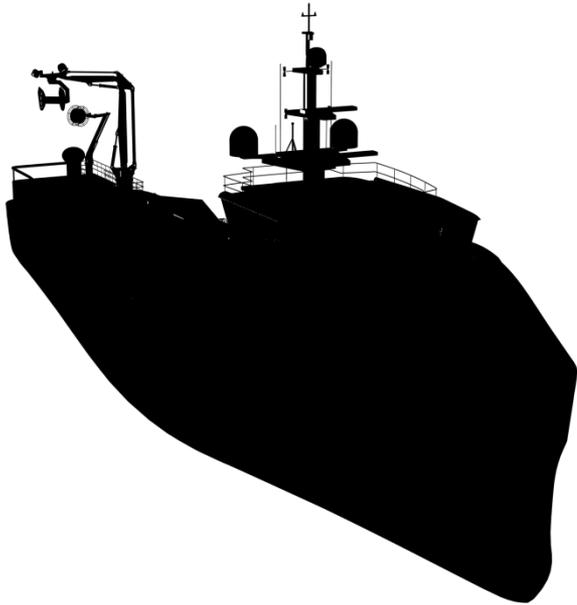


The screenshot shows the DNV blog page for LNG. At the top left is the DNV logo with the tagline 'MANAGING RISK'. The URL <http://blogs.dnv.com/lng> is displayed in blue. Below the URL is a navigation menu with links for 'Home', 'About', 'DNV's international homepage', and 'DNV blog portal'. A large banner features the text 'LNG Energy of the Future' and a circular 'blog' icon. Below the banner, it says 'Posted by Lars Petter Blikom' and 'May 3, 2011'. The main article title is 'Analysts are all wrong about LNG demand'. The article text begins with '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...'. The article continues: '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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