METHANOL - A future fuel for shipping

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SHIPPING FACILITATES TRADE AND PROSPERITY

Increase in world GDP in the last two decades: 135%

Increase in world seaborne trade over the same period: 180%

abt. 90% of world trade travels by sea
THE BIG CHALLENGE FOR THE SHIPPING INDUSTRY

Muscles | Wind | Coal | Oil | ?

Stena
STENA AB GROUP AT A GLANCE
(2014)

REVENUE
MSEK 33,563

ACTIVITIES ALL OVER THE WORLD

16,000 EMPLOYEES

76 YEARS IN BUSINESS

176 VESSELS INCLUDING NEWBUILDINGS

26,700¹ RESIDENTIAL AND COMMERCIAL UNITS

96 WIND TURBINES IN OPERATION

¹) Owned and managed
STENA HAS SIX BUSINESS AREAS

- SHIPPING
- FERRY LINES
- DRILLING OFFSHORE
- PROPERTY
- FINANCE
- NEW BUSINESS
SSSP Positions August 6th 2015

- Almi Navigator, $51.5k/d
- Afroditi, $55k/d
- Montestena, $57k/d
- Amoureux, $32k/d
- Densa Orca, $43.5k/d
- AST Sunshine, $55.5k/d
- Princimar Courage, $31k/d
- Princimar Integrity, $38k/d
- Princimar Pride, $12k/d
- Sonangol Cabinda, $37k/d
- Sonangol Huila, $45k/d
- Sonangol Kalundula, $58k/d
- Stena Superior, $58k/d
- Stena Superior, $36k/d
- Sonangol Namibe, $34k/d
- Sonangol Kassanje, $40k/d
- Sonangol Kizomba, $26k/d
- Sonangol Namibe, $34k/d
- Sonangol Porto Ambon, $45k/d
- Stena Superior, $36k/d
- Stena Supreme, $58k/d
- Stena Sunrise, $26k/d
- Yasa Southern Cross, $41k/d
- Sonangol Huila, $45k/d
- Montestena, $57k/d
- Sonangol Kizomba, $26k/d
- Stena Sunrise, $26k/d
• Important part of European logistics.
• Improved service and development of new travel and intermodal freight solutions.
• Large fleet of about 40 vessels on 22 routes.
• Owns and operates 5 ports.
• Carries about 2 million trailers, 2 million cars and 11 million passengers per year.
• World’s first “Supergreen” methanol fuelled ferry.
STENA LINE positions and route network

22 routes
30 ports/terminals
35 ships in operation
27,000 sailings
SECA = Sulphur Emission Control Areas (North Europe and coastwise North America)
New regulation from 1 Jan 2015 – max 0.1% sulphur allowed in ships fuel instead of 1.0%
(rest of the world still 3.5%)
General alternatives for ship-owners

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>HFO + Aftertreatment</td>
<td>Same fuel but “scrubbers” clean exhaust fumes</td>
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<tr>
<td>MGO (Low Sulphur fuel)</td>
<td>Difference to previous fuel about +$250/MT - most common</td>
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<tr>
<td>GAS as fuel</td>
<td>LNG – Cleaner than MGO but expensive infrastructure</td>
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<tr>
<td>Methanol as fuel</td>
<td>Clean as LNG but untested</td>
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REGULATIONS, TECHNOLOGY, AVAILABILITY AND ECONOMY AFFECTS THE CHOICE OF FUEL

- **Economy**
  - Capex, Opex

- **Availability**
  - Supply
  - Hedging Infrastructure

- **Technology**
  - Existing, new

- **Regulations**
  - IMO, Flag state, Class
LNG is still under development
Enter – methanol, a marine fuel for the future
Stena Germanica – timeline

A full scale project to convert four main engines to methanol-diesel operation (DF) 2013-2015

2013 Stena Germanica and Gothenburg-Kiel identified as suitable vessel/route.
2014 July – December, development and testing of full scale conversion kit in Trieste by Wärtsilä
2014 August – contract with Methanex for methanol supply
2014 September – conversion contract with Remonotowa shipyard
2014 Q4 – risk analyses in the Ports of Kiel and Gothenburg
2015 January – vessel arrived in shipyard
2015 March – vessel sailed shipyard
2015 Nov – one engine operating on the new fuel, engines will convert to methanol one at a time

Length | 240 m
Breadth | 28,7 m
Draught | 6,15 m
Cargo Capacity | 4000 lane meters
Passenger capacity | 1300
Main engines | 4 x Wärtsila 8ZAL40S, 6000 kW
Ballast tank converted to methanol fuel tank

Pump room

Double walled fuel pipes

Engines converted Q1 2015 for methanol combustion

Stena Germanica – Worlds First Methanol Ship

Ballast tank converted to methanol fuel tank
Wärtsilä has developed the technique to convert existing engines

Methanol Engine Conversion Scope

On-engine scope is limited to exchange of cylinder heads, fuel injectors and fuel plungers in existing fuel pumps. A common rail system for methanol injection will be added on the engine.

In addition to the Engine related conversion includes the conversion kit a stand-alone high pressure methanol pump with belonging oil unit for supply of sealing oil and control oil to the fuel injectors. A UNIC C3 solution will be used for engine control.
Shipping fuel is highly regulated and Methanol is not on the approved list (yet)

- Major effort to establish new standard with IMO
- Fueling procedures, storage, fire and other safety measures have been challenges to overcome
- Engine is working fine but there has been issues with pipes and pumps.

Approval from Lloyds register to run on Methanol!
A Sustainable Fuel For Global Shipping

- CO2 - 90% REDUCTION*
- SOX - 90% REDUCTION
- NOX - 60% REDUCTION
- PM - 90% REDUCTION

*with Bio-methanol

International bunker fuel

Methanol

HFO (3.5%)  HFO (1%)  MGO (0.1%)  LNG  MeOH (NG)  MeOH (bio)
Gothenburg – Kiel – a busy route

50,000 Cars
43,000 Trucks/trailers
220,000 passengers

Lifted from the road every year (per ship)
But operationally it’s currently an expensive alternative.
OUR SUPERCLEAN PROJECT IS MAKING WAVES

Winner:
1. Swedish Maritime Day “Innovation Award 2015”
2. Green Ship Technology: “GST Ship-owner of the year”
3. The Swedish Confederation of Transport Enterprises “2015 Pegasus award”
4. 2015 Global Business Excellence Awards UK "Outstanding Green Initiative Award"

Finalist:
• The Economist’s “Ocean Innovation Challenge “
• Seatrade Awards “Clean Shipping Award”
• Fathom Ship Efficiency Awards 2015 as “Sustainable Ship Operator of the Year”
• Lloyds List Global Awards “Environmental Award”
Summary  Methanol as a shipping fuel

- Conversion of existing vessels are possible at a reasonable cost
- It’s a clean fuel that goes beyond existing legislation
- It’s easy to access but there might be limits in supply if many vessels convert
- It’s a fuel that can be renewable

BUT

- Current market price double the price for conventional fuel (heavy fuel oil)

70,000 ships in the world consuming some 300 million tons of bunker oil equals over 600 million tons of methanol

If market prices changes Methanol will be attractive for shipping
Our Supergreen project
WE CARE

WE INNOVATE

WE PERFORM

that's what unites us

Take Care film (short version)