New Fuels for Ship Engines

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Emission Legislation – in general

**Tier I**
- Pre-2000 Ships
- SECA
- EU in ports

**Tier II**

**Tier III**

**New Ships**
- Mandatory use of Low Sulphur Marine Distillate Fuel

**Pre-2000 Ships**

**World**

**EU in ports**

**SECA**

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EffShip

Environmental friendly and efficient shipping

CHALMERS  D.E.C. Marine AB  Göteborg Energi  EUROBOILERS  S-MAN  Scand/NAOS AB

SWEDISH Orient Line  Stena Rederi  STORAVSNO  SSPA  Wärtsilä
Alternatives to Heavy Fuel Oil

- MGO Marine Gas Oil, (Diesel)
- LNG Liquefied Natural Gas
- Methanol
- Ethanol/glycerol
- DME Di-Methyl-Ether
- Synthetic Diesel (Gas To Liquid, Coal To Liquid)
- FFME Free-Fatty-Methyl-Ester e.g. Bio diesel
- Bio oils e.g. Palm oil
SPIRETH
Alcohol (Spirit) and Ether as Marine fuel
CO2 Electrofuels
CO2 and H2O to fossil free transport fuels
Reduce emissions - options

Back in the day’s
HFO or MDO

Today and in the future
What to select?

HFO
Aftertreatment
Scrubbers
SCR

MGO
NO$_x$ Tier 3
compliant engine
+ Low Sulphur fuel
.....or LS fuel + SCR

GAS
Gas as fuel

Methanol
DME in diesel
engine or methanol
in DF engine

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Alternative gas engine concepts

1987

GAS-DIESEL (GD)
- Diesel cycle
- Fuel quality tolerant
- High pressure gas

1992

SPARK-IGNITION GAS (SG)
- Otto cycle
- Mono fuel
- Low pressure gas

1995

DUAL FUEL (DF)
- Otto & Diesel cycle
- Fuel flexibility
- Low pressure gas
Bit Viking - The first LNG conversion project in the world

Classed GL* 100A5 E3 ESP IW NAV-OC Chemical Tanker Type-2
Oil Tanker with Double Hull MC E3 AUT * INERT RP2-50%
Ice Class 1A (Swedish/Finnish)

Deadweight: 25,000 MT
Length over all: 177 m
Service speed: 16 knots
Methanol general

- A multi source and multi purpose fuel
- Infrastructure and safety similar to Ethanol
- Liquid – no pressure tanks
- Estimated engine performance acceptable

However:

- Toxic
- Safety
- Dubble volume versus Diesel
- Corrosive
Main Characteristics

Methanol
- Density 0.79 kg/l
- Boiling point 65°C
- Flash point 11°C
- Auto ignition 464°C
- Viscosity ~0.6 cSt at 20°C
- Octane 108 RON
- LHV 20 MJ/kg

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Diesel
- Density 0.85 kg/l
- Boiling point 150-370°C
- Flash point 60°C
- Auto ignition 240°C
- Viscosity ~13.5 cSt at 20°C
- Cetane No. 45-55
- LHV 42.9 MJ/kg
Fuel feedstock

Simplified process diagram

NG → Bio mass → Syngas → MeOH
NG → Syngas → DME/OBATE
NG → LNG
NG → GTL

Art photo synth → Syngas
From a combustion point of view short chained molecules are preferable

- NG/LNG methane \( \text{CH}_4 \)
- MeOH methanol \( \text{CH}_3\text{OH} \)
- DME di-methyl ether \( (\text{CH}_3)_2\text{O} \)

Generate no sulfur and particle emissions and less NOx
Feed stock market structure

Today’s world MeOH production capacity is 90 million tons

Methanol production feedstock

Natural gas 85%
Coal 15%
Biomass
Black liquor
Geothermal
Methanol bunkering – OBATE conversion
Inland waterways
SPIRETH
Alcohol (Spirit) and Ether as Marine fuel

Thank you