LNG ENGINES

SPECIFICATIONS AND ECONOMICS

MATTHIAS HAGEDORN
WÄRTSILÄ, SHIP POWER
- INTRODUCTION

- DUAL FUEL TECHNOLOGY & REFERENCES

- LNGPAC STORAGE & HANDLING

- CASE STUDY
INTRODUCTION
From now on…ECA / SECA

Established Emissions Controlled Areas
Emissions Controlled Areas under consideration
Shipping critical points
Factor trends: Environment

- **NO\textsubscript{x}**
  - Acid rains
  - Tier II (2011)
  - Tier III (2016)

- **SO\textsubscript{x}**
  - Acid rains
  - Sulphur content in fuel

- **Particulate matter**
  - Direct impact on humans
  - Locally regulated

- **CO\textsubscript{2}**
  - Greenhouse effect
  - Under evaluation by IMO

Under evaluation by IMO
How to deal with emissions?

JUST TWO WAYS AHEAD:

SELECT THE RIGHT TECHNOLOGY!
Otto or Diesel cycles: effects on NO$_X$

Nikolaus August Otto

Flame front propagation

Rudolf Christian Karl Diesel

Fuel spray

NO$_X$ formation
Otto or Diesel cycles: effects on NO\textsubscript{X}

Big temperature difference → NO\textsubscript{X} formation!

Crank angle [°CA]

Cylinder Temperature [K]

- Diesel, max flame temp.
- Otto, max flame temp.
Select the right technology

**DUAL-FUEL (DF)**
Meets IMO Tier III

**SPARK-IGNITION GAS (SG)**
Meets IMO Tier III
No redundancy
No HFO flexibility

**GAS-DIESEL (GD)**
Does NOT meet IMO Tier III
High gas pressure
Gas burning technologies

- GAS-DIESEL (GD) - 1987
- SPARK-IGNITION GAS (SG) - 1992
- DUAL-FUEL (DF) - 1995

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The marine favourite technology?

**DUAL-FUEL (DF)**
Meets IMO Tier III

**SPARK-IGNITION GAS (SG)**
Meets IMO Tier III
No redundancy
No HFO flexibility

**GAS-DIESEL (GD)**
Does NOT meet IMO Tier III
High gas pressure
Wartsila’s choice

DUAL-FUEL (DF)
Meets IMO Tier III

1. IMO Tier III compliant
2. Low pressure gas
3. Fuel flexibility; GAS, MDO and HFO
Emission values with low pressure DF

NO_x Tier III (2016) and SO_x level in ECA (2015) are fully met!
What about methane slip?

- Methane slip = THC emissions (Total Unburned Hydrocarbons)
- No regulations or limits regarding methane emissions exist
- Methane is 20...25 times stronger green house gas than CO$_2$
- The DF- Technology reduces the total CO$_2$ footprint compared to HFO
- Potential to further reduce the methane slip on DF-engines by further development
Significant reduction of NO$_x$ emissions due to the low pressure DF technology

- clearly below IMO Tier III
- without exhaust gas after treatment
- port fee discounts

Table 3. Discounts for NO$_x$ emissions in selected Swedish ports in 2009.

<table>
<thead>
<tr>
<th>Port</th>
<th>g NO$_x$/kWh</th>
<th>Discount (SEK/GT)</th>
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</thead>
<tbody>
<tr>
<td>Port of Gothenburg</td>
<td>≤ 12</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>≤ 6</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>≤ 2</td>
<td>0.20</td>
</tr>
<tr>
<td>Port of Malmö</td>
<td>≤ 12</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>≤ 6</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>≤ 10</td>
<td>0.15</td>
</tr>
<tr>
<td>Port of Stockholm</td>
<td>≤ 5</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>≤ 1</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Source: Market-based Instruments for NO$_x$ abatement in the Baltic Sea by Per Kågeson
DUAL-FUEL

TECHNOLOGY & APPLICATIONS
Dual Fuel 4s Engine Portfolio

WÄRTSILÄ 20DF
0.5 - 1.8 MW

WÄRTSILÄ 34DF
3.0 - 10.0 MW

WÄRTSILÄ 50DF
5.8 - 17.5 MW

WÄRTSILÄ 46DF
6.2 - 18.3 MW

- LNG Carriers
- Cruise ships
- RO-RO/PAX
- Ferries
- Large Offshore Units

- LNG Carriers
- Cruise ships
- RO-RO/PAX
- Ferries
- Large Offshore Units

- LNG Feeder
- Jack-up
- Tugs
- Small cargo vessels
- Barges
- Small ferries
- Aux. engines with W34DF & W50DF

- Small LNG / CNG vessel
- Small cargo vessels
- Supply vessel
- Offshore application & Production
- Aux. engines with W50DF

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Wärtsilä’s New 2s - DF Engine Portfolio

From 4775 kW to 25,800 kW

Low pressure 2s-DF engines

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Engine characteristics – 4s Operating modes

Gas mode:
- Otto principle
- Low-pressure gas admission
- Pilot diesel injection

Diesel mode:
- Diesel principle
- Diesel injection
Engine characteristics – 2s Operating modes

The Principle

- Engine operating according to the Otto process
- Pre-mixed ‘Lean burn’ technology
- Low pressure gas admission at ’mid stroke’
- Ignition by pilot fuel in pre-chamber
A few key technologies make the difference...

- Micro-pilot common rail system
- Pre-chamber technology
- Gas admission system
- Engine Control & Automation system
4s Engine systems - Gas fuel system (1/2)
4s Engine systems - Pilot fuel system (1/2)

- Injection valve electrical connection
- Pilot-fuel common rail 900bar
- Inlet valve
- Twin-nozzle injection valve
- Pilot fuel quill pipe

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For optimum pilot and diesel fuel distribution

- Pilot solenoid valve
- Pilot needle
- Main needle
Engine control and cylinder load balancing based on cylinder pressure sensors

- **First target:**
  - Increased safety
    - More reliable knock detection
    - Real misfire detection
    - Maximum cylinder pressure control

- **Future targets:**
  - Automatic engine power control
    - “Real” derating control
  - Improved fault detection/diagnostics for preventive maintenance
  - Increase of load due to better engine control and possibility to run closer to maximum cylinder pressure and knock limits
Cylinder pressure sensors

30% reduction in peak pressure fluctuation
• increased safety
• improved performance

No cylinder pressure balancing

With cylinder pressure balancing
Dual-Fuel engines Overview - Conventional carriers

- **FPSO Quip P63**
  - Floating production, storage and offloading vessel
  - BW Offshore
  - 3 x power modules with 2 x Wärtsilä 18V50DF alternators and auxiliaries
  - Engines delivery 2011

- **VS 489 LNG PSV**
  - Eidesvik Offshore
  - Kleven Verft
  - 2x 6R34DF + 2x 6L20DF + E & A

- **Viking Energy / Stril pioner**
  - DF-electric offshore supply vessel
  - Eidesvik
  - Kleven Verft
  - 4x 6R32DF
  - > 4x 23'500 running hours each

- **Sendje Ceiba**
  - FPSO
  - Bergesen
  - 1x 18V32DF
  - > 22'000 running hours

- **Petrojarl 1**
  - FPSO
  - Petrojarl
  - 2x 18V32DF
  - > 2x 34'000 running hours

- **Viking tbn (Gass Avant) hull 29/30**
  - DF-electric offshore supply vessel
  - Eidesvik
  - West Contractors
  - 4x 6R32DF
  - Engines delivery 2007 / 2008

- **DF-electric offshore supply vessel**
  - Aker yards
  - 3x W6L34DF
  - Engines delivery 2010

- **5 x DF-electric LNG Carrier**
  - Exmar
  - 12V32DF
  - Auxiliary generating sets

- **Chemical tanker conversion**
  - Tarbit
  - 2x 6L50DF (Conv) + LNGPac

© Wärtsilä
### Dual-fuel application references

<table>
<thead>
<tr>
<th>Merchant</th>
<th>Conversion</th>
<th>Coastal Patrol</th>
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<tbody>
<tr>
<td>LNGC</td>
<td>1 Chem. Tanker</td>
<td>DF-propulsion</td>
</tr>
<tr>
<td>- 147 vessels</td>
<td>2 engines</td>
<td>DF main and auxiliary engines</td>
</tr>
<tr>
<td>- 593 engines</td>
<td>8 engines</td>
<td></td>
</tr>
<tr>
<td>Multigas Carrier</td>
<td>2 vessels</td>
<td></td>
</tr>
<tr>
<td>- 5 vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 20 engines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ro-Ro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2 vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 8 engines</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Navy</th>
<th>OSV’s</th>
<th>Production</th>
<th>TUG</th>
<th>Guide Ship</th>
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<tr>
<td></td>
<td></td>
<td>2 platform</td>
<td>2 vessel</td>
<td>1 vessel</td>
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<tr>
<td></td>
<td></td>
<td>9 FPSO’s etc.</td>
<td>2 engines</td>
<td>/engine</td>
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<tr>
<td></td>
<td></td>
<td>1 FSO</td>
<td>each</td>
<td>IWW</td>
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<td></td>
<td>40 engines</td>
<td></td>
<td>2 vessel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 engines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Offshore</th>
<th>Others</th>
<th>LNG Cruise ferry</th>
<th>LNG ferries</th>
<th>DF Power Plant</th>
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<tbody>
<tr>
<td>OSV’s</td>
<td></td>
<td>- 1 vessels</td>
<td>- 4 ferries</td>
<td>- 67 installations</td>
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<tr>
<td>- 31 vessels</td>
<td></td>
<td>- 4 engines</td>
<td>- 18 engines</td>
<td>- 354 engines</td>
</tr>
<tr>
<td>- 96 engines</td>
<td></td>
<td>Complete gas train</td>
<td>1 ferry</td>
<td>Output 4600 MW</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td></td>
<td>- 2 engines</td>
<td>Online since 1997</td>
</tr>
</tbody>
</table>

- 6 segments > 1,000 engines > 10,000,000 running hours
LNGPAC

NEW-BUILDING AND EXISTING FLEET
LNGPac- Fully Automated and integrated solution

A complete and modularized solution for LNG fuelled ships

A. Storage tanks
B. Evaporators
C. Dual-Fuel Main engine
D. Dual-Fuel Aux engines
E. Bunkering station(s)
F. Integrated control system
LNGpac Main Components

- Main Engine Room
- Gas Valve
- Tank room
- Pressure build up evaporator
- Bunkering line, insulated pipes
- Bottom tank filling
- Water/Glycol system
- LNG – gas evaporator

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Tarbit LNGPac: A turn key solution

- Tank room – All cryogenic valves
- Length minimized
- Auxiliary equipment room

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Inner tank – sloshing baffle
Installations today

- Forced ventilation
- Single wall fuel gas pipe
- Double wall fuel gas pipe

Gas safe area
Gas hazardous area

Engine room, gas safe area

GVU room, Ex Zone 1

Air in *

Air out

* to double wall fuel gas feed pipe annular space

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Installation with GVU enclosure

- Forced ventilation
- Double wall fuel gas pipe

Gas safe area
Enclosure

Saved space!
Engine room, gas safe area
Fuel Gas Tank

Air in

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Gas Valve Unit in enclosure

Main features

• Can be located in the same engine room, dedicated compartment not needed

• Compact design and easy installation (plug-and-play concept)

• Integrated ventilation system when combined with LNGPac
### Vessel: Bit Viking – 25000DWT Chemical Tanker

<table>
<thead>
<tr>
<th>Owner</th>
<th>Tarbit (Sweden)</th>
</tr>
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<tbody>
<tr>
<td>Yard</td>
<td>STX (Finland)</td>
</tr>
<tr>
<td>Number of vessels:</td>
<td>1 (conversion, year built 2007)</td>
</tr>
<tr>
<td>Classification:</td>
<td>GL</td>
</tr>
<tr>
<td>Delivery:</td>
<td>2011</td>
</tr>
</tbody>
</table>

**Main vessel characteristics:**

- **Length x Width(m):** 177,0 x 26,0
- **Speed:** 15,0 kts
- **DWT:** 25,000 tonnes

### Wärtsilä scope of supply:

- **2x LNGPac™ 500m³**
  - Horizontal, double-walled tank with vacuum-perlite insulation
  - 2x Bunkering Station, 400m³/hr, including vapour return
  - Process Control Automation & Safety System
  - Autonomy: 12 days @ 80% load
  - Gas feed interconnection between tanks

- **2x 6L50DF (4-stroke, 5700kW)**
**Vessel: Viking Grace - Ropax**

<table>
<thead>
<tr>
<th>Owner</th>
<th>Viking Line (Sweden)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yard</td>
<td>STX (Finland)</td>
</tr>
<tr>
<td>Number of vessels:</td>
<td>1 (new building)</td>
</tr>
<tr>
<td>Classification</td>
<td>LR</td>
</tr>
<tr>
<td>Delivery</td>
<td>2013</td>
</tr>
</tbody>
</table>

**Main vessel characteristics:**

- Length x Width(m): 218.0 x 31.8
- Service Speed: 21.8 kts
- GT/DWT: 57.000/5.030 tonnes

**Wärtsilä scope of supply:**

- **2x LNGPac™ 200m³**
  - Horizontal, double-walled tank with vacuum-perlite insulation
  - 1x Bunkering Station, 400m³/hr, including vapour return
  - Process Control Automation & Safety System
  - Gas feed interconnection between tanks
  - Integrated auxiliary room
  - Cold Recovery System

- **4x Generator Set 6L50DF (4-stroke, 5700kW)**
### Vessel: Harvey Gulf - Platform Supply Vessel

<table>
<thead>
<tr>
<th>Owner</th>
<th>Harvey Gulf Marine (USA)</th>
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</thead>
<tbody>
<tr>
<td>Yard</td>
<td>Trinity Shipyards (USA)</td>
</tr>
<tr>
<td>Number of vessels</td>
<td>6 (new building)</td>
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<tr>
<td>Classification</td>
<td>ABS / USCG</td>
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<tr>
<td>Delivery</td>
<td>2014/2015</td>
</tr>
</tbody>
</table>

### Main vessel characteristics:

<table>
<thead>
<tr>
<th>Length x Width(m)</th>
<th>130</th>
</tr>
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<tbody>
<tr>
<td>Speed</td>
<td>20,0 kts</td>
</tr>
<tr>
<td>Passengers</td>
<td>800</td>
</tr>
</tbody>
</table>

### Wärtsilä scope of supply:

- **1x LNGPac™ 295m³**
  - Horizontal, double-walled tank with vacuum-MLI insulation
  - 1x Bunkering Station, 200m³/hr, including vapour return
  - Process Control Automation & Safety System
  - Gas feed interconnection between tanks
- **3x 6L34DF (4-stroke, 2880 kW)**
- **2x Steerable Trusters**
- **2x Transverse Thrusters**
- **Integrated Automation & Power management System**
CASE STUDIES
Project data

Capacity: 20'600m3

**Wärtsilä engine**
Main engine: **6RT-flex50DF**
- MCR: 8640 kW / 124.0 rpm
- CMCR: 7620 kW / 115.4 rpm
- CSR (85% of CMCR): 6477 kW / 109.3 rpm

**Wärtsilä engine**
Main engine: **5RT-flex50-D**
- MCR: 8725 kW / 124.0 rpm
- CMCR: 7620 kW / 115.4 rpm
- CSR (85% of CMCR): 6477 kW / 109.3 rpm

**Forecasted Operating Profile**
- Days in port: 79
- Days at sea: 281
- Days off-hire: 5
- TOTAL DAYS: 365

**Forecasted ECA Operation**
- Scenario A: 100% in ECA
- Scenario B: 80% in ECA
- Scenario C: 60% in ECA
Engine room configuration with 6RT-flex50DF

6RT-flex50DF
CMCR = 7620 kW / 115.4 rpm

8L20DF
1352 kWe / 1200 rpm

Low pressure gas system
Very low el. power demand for LNG system
No exhaust treatment for ECA, TIER III compliance
Fuel consumption optimised main and auxiliary engines
High-Sulphur HFO as main fuel
ECA and Tier III compliant through exhaust gas treatment
Scenarios A – OPEX comparison

Consumables per year

Consumables costs per year

Loading and unloading is not included in the calculation

Prices used:
- HFO: 650 USD/ton (16.9 $/mmBTU)
- MDO: 1000 USD/ton (24.7 $/mmBTU)
- LNG: 710 USD/ton (15.0 $/mmBTU)
- Urea: 260 USD/ton
- NaOH: 340 USD/ton
- FW: 4 USD/ton
- USD/EUR: 1.36
### Scenario A – Payback time

<table>
<thead>
<tr>
<th></th>
<th>Alt. 1 6RT-flex50DF</th>
<th>Alt. 2 5RT-flex50-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX [USD]</td>
<td>12'450'000</td>
<td>8'090'000</td>
</tr>
<tr>
<td>CAPEX difference [USD]</td>
<td>4'360'000</td>
<td></td>
</tr>
<tr>
<td>OPEX per trip [USD]</td>
<td>5'503'867</td>
<td>6'800'106</td>
</tr>
<tr>
<td>OPEX per year [USD]</td>
<td>5'503'867</td>
<td>6'800'106</td>
</tr>
<tr>
<td>OPEX difference per year [USD]</td>
<td>-1'296'238</td>
<td></td>
</tr>
<tr>
<td>Payback time [years]</td>
<td>3.4</td>
<td>base case</td>
</tr>
</tbody>
</table>

Payback time is based on consumable prices and maintenance cost assumptions used in this comparison.
Scenario B – OPEX comparison

**Consumables per year**

- **Alt. 1 6RT-flex50DF**
  - FW
  - NaOH
  - UREA
  - LNG
  - MDO
  - HFO

- **Alt. 2 5RT-flex50-D**
  - FW
  - NaOH
  - UREA
  - LNG
  - MDO
  - HFO

**Consumables costs per year**

- **Alt. 1 6RT-flex50DF**
  - FW
  - NaOH
  - UREA
  - LNG
  - MDO
  - HFO

- **Alt. 2 5RT-flex50-D**
  - FW
  - NaOH
  - UREA
  - LNG
  - MDO
  - HFO

Loading and unloading is not included in the calculation.

Prices used:
- HFO: 650 USD/ton (16.9 $/mmBTU)
- MDO: 1000 USD/ton (24.7 $/mmBTU)
- LNG: 710 USD/ton (15.0 $/mmBTU)
- Urea: 260 USD/ton
- NaOH: 340 USD/ton
- FW: 4 USD/ton
- USD/EUR: 1.36
## Scenario B – Payback time

<table>
<thead>
<tr>
<th></th>
<th>Alt. 1 6RT-flex50DF</th>
<th>Alt. 2 5RT-flex50-D</th>
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</thead>
<tbody>
<tr>
<td><strong>CAPEX [USD]</strong></td>
<td>12'450'000</td>
<td>8'090'000</td>
</tr>
<tr>
<td><strong>CAPEX difference [USD]</strong></td>
<td>4'360'000</td>
<td></td>
</tr>
<tr>
<td><strong>OPEX per trip [USD]</strong></td>
<td>5'653'241</td>
<td>6'597'105</td>
</tr>
<tr>
<td><strong>OPEX per year [USD]</strong></td>
<td>5'653'241</td>
<td>6'597'105</td>
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<tr>
<td><strong>OPEX difference per year [USD]</strong></td>
<td>-943'864</td>
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</tr>
<tr>
<td><strong>Payback time [years]</strong></td>
<td>4.6</td>
<td>base case</td>
</tr>
</tbody>
</table>

- Payback time is based on consumable prices and maintenance cost assumptions used in this comparison.
Scenario C – OPEX comparison

Loading and unloading is not included in the calculation.

Consumables per year

<table>
<thead>
<tr>
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<th>Alt. 1 6RT-flex50DF</th>
<th>Alt. 2 5RT-flex50-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>FW</td>
<td>3694</td>
<td>8754</td>
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<tr>
<td>NaOH</td>
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<tr>
<td>UREA</td>
<td>4415</td>
<td>508</td>
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<tr>
<td>LNG</td>
<td>0</td>
<td>402</td>
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<tr>
<td>MDO</td>
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<td>3621</td>
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<tr>
<td>HFO</td>
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<tr>
<td>Total</td>
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<td>13295</td>
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Consumables costs per year

<table>
<thead>
<tr>
<th></th>
<th>Alt. 1 6RT-flex50DF</th>
<th>Alt. 2 5RT-flex50-D</th>
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</thead>
<tbody>
<tr>
<td>FW</td>
<td>$2'401'109</td>
<td>$5'689'981</td>
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<tr>
<td>NaOH</td>
<td>$138'538</td>
<td>$0</td>
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<tr>
<td>UREA</td>
<td>$3'134'440</td>
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<tr>
<td>LNG</td>
<td>$0</td>
<td>$0</td>
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<tr>
<td>MDO</td>
<td>$0</td>
<td>$136'806</td>
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<tr>
<td>Total</td>
<td>$5'674'087</td>
<td>$5'973'223</td>
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Prices used:
- HFO: 650 USD/ton (16.9 $/mmBTU)
- MDO: 1000 USD/ton (24.7 $/mmBTU)
- LNG: 710 USD/ton (15.0 $/mmBTU)
- Urea: 260 USD/ton
- NaOH: 340 USD/ton
- FW: 4 USD/ton
- USD/EUR: 1.36
### Scenario C – Payback time

<table>
<thead>
<tr>
<th></th>
<th>Alt. 1 6RT-flex50DF</th>
<th>Alt. 2 5RT-flex50-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX [USD]</td>
<td>12'450'000</td>
<td>8'090'000</td>
</tr>
<tr>
<td>CAPEX difference [USD]</td>
<td>4'360'000</td>
<td></td>
</tr>
<tr>
<td>OPEX per trip [USD]</td>
<td>5'802'614</td>
<td>6'394'104</td>
</tr>
<tr>
<td>OPEX per year [USD]</td>
<td>5'802'614</td>
<td>6'394'104</td>
</tr>
<tr>
<td>OPEX difference per year [USD]</td>
<td>-591'489</td>
<td></td>
</tr>
<tr>
<td>Payback time [years]</td>
<td>7.4</td>
<td>base case</td>
</tr>
</tbody>
</table>

- Payback time is based on consumable prices and maintenance cost assumptions used in this comparison.
Conclusions

- When considering annual operation of the vessel for 80% of the time or more within ECA zones, the 2-Stroke DF technology provides a distinct advantage. This is mainly due to its competitive OPEX figures that rapidly compensate for the additional initial investment.

- For operation within ECA zones for 60% of the time or less, the SCR paired with the integrated SOx Scrubber solution builds on its comparatively lower CAPEX with also reduced OPEX due to the lower utilization of SCR and SOx Scrubber, making it a potentially more sensible solution.

- This study is heavily influenced by the relation between HFO and LNG prices and the assumed operating profiles of the vessel. For the purposes of comparison, only time at sea, while sailing at service speed was considered. Slow steaming and time at ports in loading and discharging operations would change the overall picture.
Expected Engine Load Profile For 12,5k DWT MPV

<table>
<thead>
<tr>
<th>Load</th>
<th>Operation Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of SMCR</td>
<td>[%]</td>
</tr>
<tr>
<td>25,0</td>
<td>3,0</td>
</tr>
<tr>
<td>30,0</td>
<td>5,0</td>
</tr>
<tr>
<td>50,0</td>
<td>5,0</td>
</tr>
<tr>
<td>70,0</td>
<td>7,0</td>
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<tr>
<td>75,0</td>
<td>15,0</td>
</tr>
<tr>
<td>80,0</td>
<td>30,0</td>
</tr>
<tr>
<td>85,0</td>
<td>20,0</td>
</tr>
<tr>
<td>90,0</td>
<td>10,0</td>
</tr>
<tr>
<td>95,0</td>
<td>5,0</td>
</tr>
</tbody>
</table>

2-Stroke Engine, SMCR: 4.800kW
Thank you for your attention!

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