

Project LNG-Conversion

Wessels, TGE, SMB, BV, MAN Diesel & Turbo SE



Wes Amelie DF Conversion / „Alternative Kraftstoffe“

MAN Diesel & Turbo SE

PrimeServ Four-stroke Augsburg

Marcel Lodder

Upgrades & Retrofits

Department SEAAU

Augsburg, Germany



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2 Business Case

3 Technical Background

4 TGE Gas System

5 Timeline

6 References

Introduction DF Conversion Project

MV Wes Amelie SSW Super 1000



MV “Wes Amelie” Facts:

- Managed by Wessels Reederei
- 1.036 TEU container feeder application => equipped with one MDT 8L48/60B Four Stroke Medium Speed engine
- Year of building 2011 => very modern design
- High ice class 1A
- 1 of 16 sister vessels
- Classification society => BV

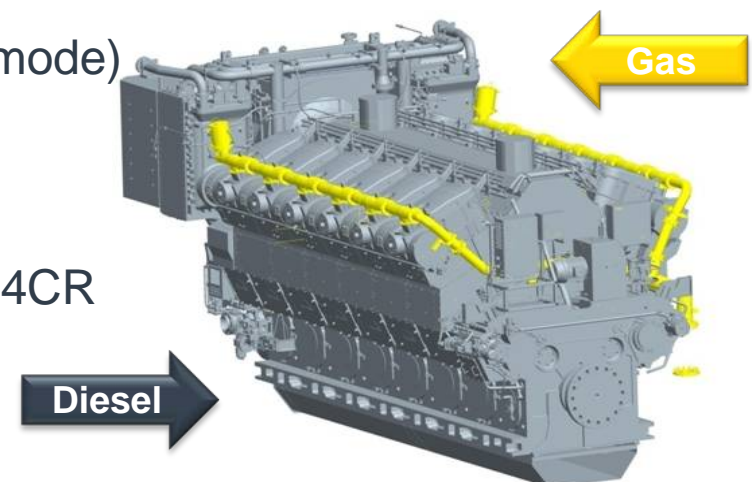
Now operated on HFO/ MGO => from spring 2017 on LNG/ MGO

Introduction DF facts

Reasons for conversion from HFO to Dual-Fuel



- Possibility to have Dual-fuel engines run either on gaseous or liquid fuels on now single fueled ships
- Full fuel flexibility and high availability due to the use of high new building technology standards
- Reduction of bunker costs depending on LNG price
- Conversion set back engine to “0” hrs status
- Improvement of emission profile (Tier III in Gas mode)
- Additionally:
 - MAN PrimeServ also offers to upgrade 32/44CR Tier II engines to 35/44DF
 - Further conversion kits planned

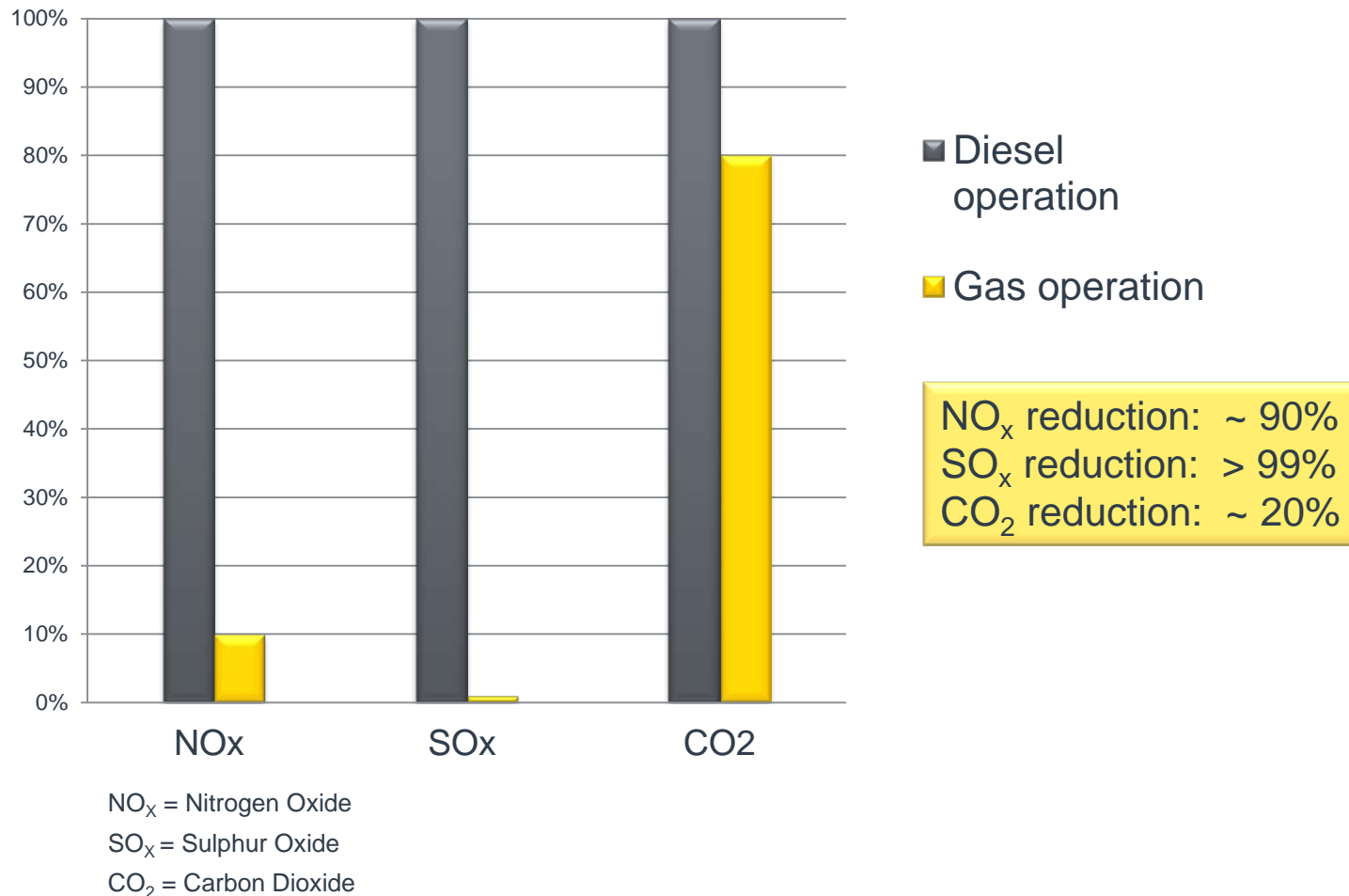


Introduction DF Facts

Emission Reduction of Dual-Fuel Engines



High reduction of emissions after DF conversion:



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Business Case Wes Amelie DF Conversion

Attractive opportunity



Business case Wes Amelie

Important notes:

- Ships extraordinary suited for north and baltic seatriade (100% ECA)
- Ship is one of the newest on the market
- Supported by German government (BMVI)
- Payback time expected around five years (depending on LNG price)
- Attractive for ship charterers (better charter rates)
- IGF Code can be applied



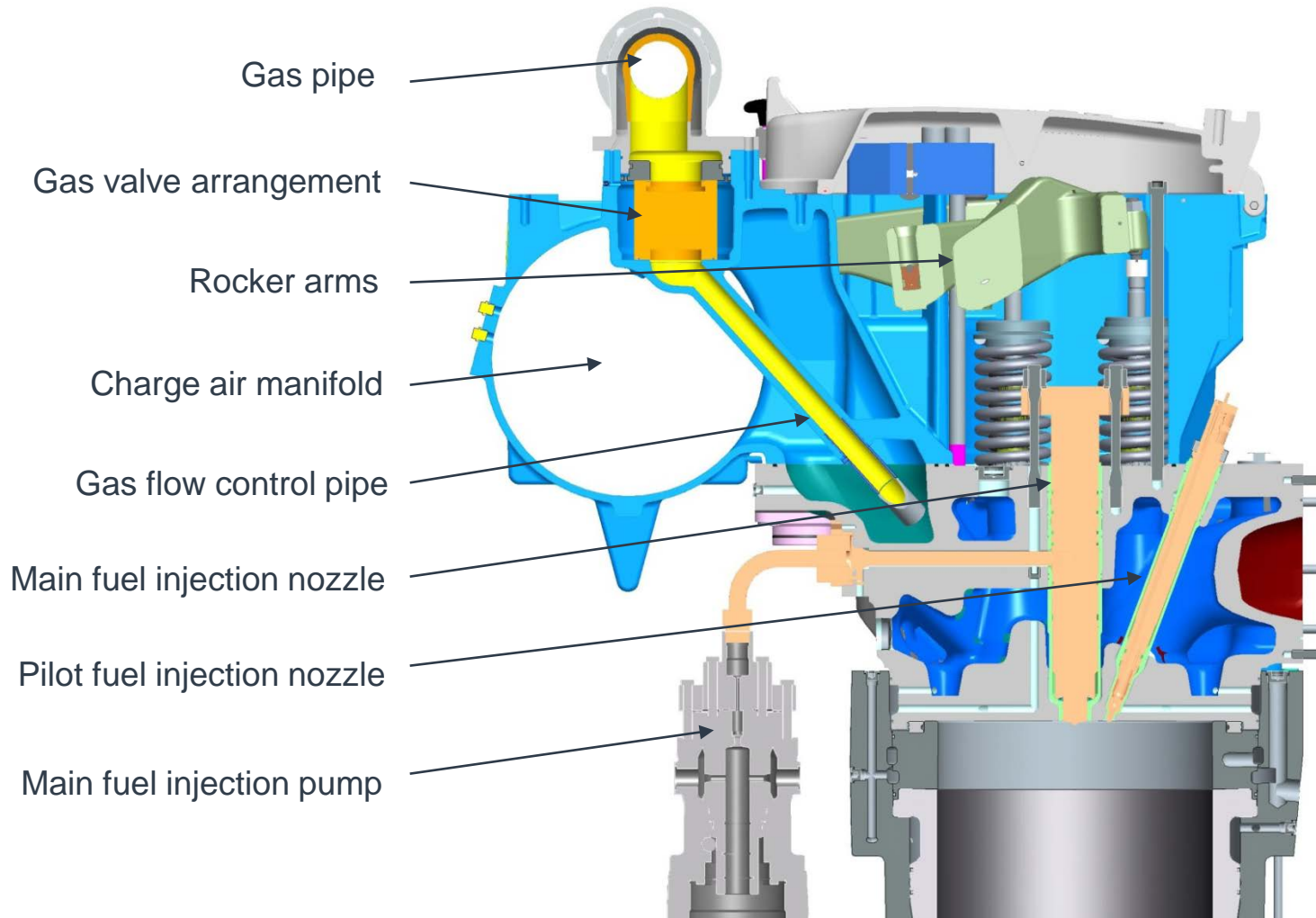
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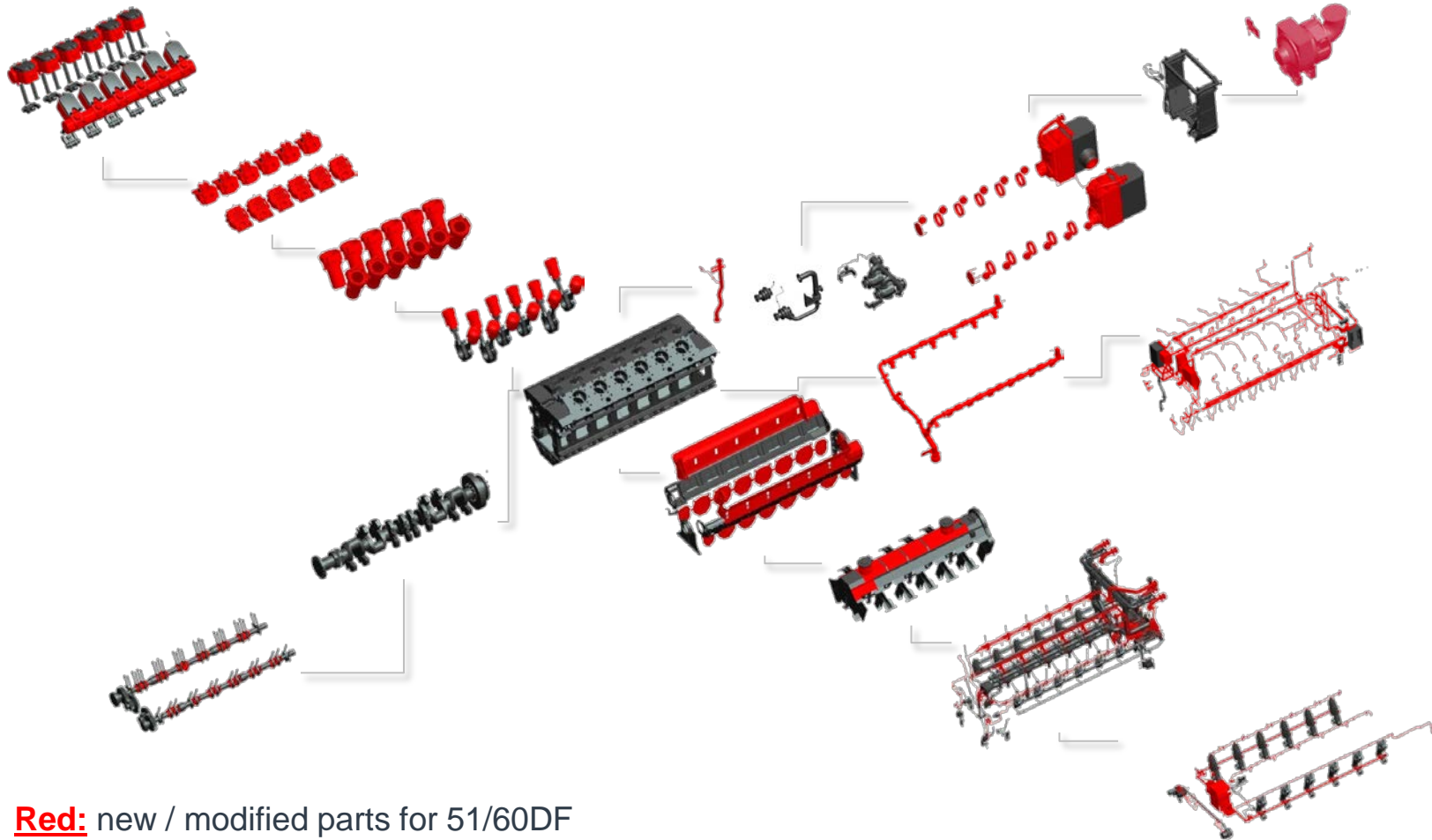
Technical System - DF Design

51/60DF Cylinder Head Cross Section



Technical System - Design

Comparison 48/60 with 51/60DF



Red: new / modified parts for 51/60DF

Grey: original parts 48/60

Technical System - Design

Comparison Technical Data 48/60 with 51/60DF



	Present 8L48/60B	Converted 8L51/60DF
Bore	480 mm	510 mm
Stroke	600 mm	600 mm
Swept volume	108,6 dm ³	122,6 dm ³
Cylinder output * at rpm	1125 kW **	975 kW (B) / 950 kW (A) ***
Output of engine	9.000 kW **	7.800 kW ***
Mean effective pressure	25,8 - 26,5 bar	19 bar
* at ISO Conditions	** min. LCV = 42.700 kJ/kg	*** Methane number ≥ 80 min. LCV = 28.000 kJ/Nm ³ B: based on 48/60B A: based on 48/60A Power values may vary according to: • Specific configuration • Ambient conditions • Methane number • Charge air temperature

Business Case Wes Amelie DF Conversion

Load Profile



Load Profile Wes Amelie recorded

Usual operating load:

- 65 - 75% load, 23% of operation
- 25 – 50% load, 43% of operation

Max load 75% with 48/60B => approx. 90 % on 51/60 DF

Conclusion => reduced output of 51/60 DF acceptable



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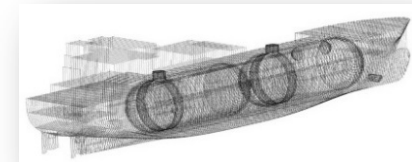
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TGE Marine Gas Engineering is one of the world's leading engineering contractors specialising in gas carriers, offshore units and LNG fuel gas systems



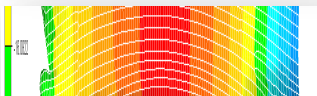
• Cargo handling systems and tanks for

- LPG carriers
- Ethylene carriers
- LNG carriers
- LNG bunker vessels



• Ship design packages

- Basic Ship Classification drawings
- Complete design package including steel drawings



Cargo handling systems & tanks

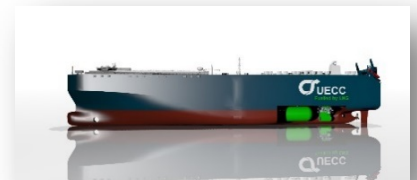
Key expertise & process know-how

Ship design packages

Fuel gas systems

• Cargo handling systems for offshore units

- FSO / FPSO for LPG
- FSRU and FPSO for LNG



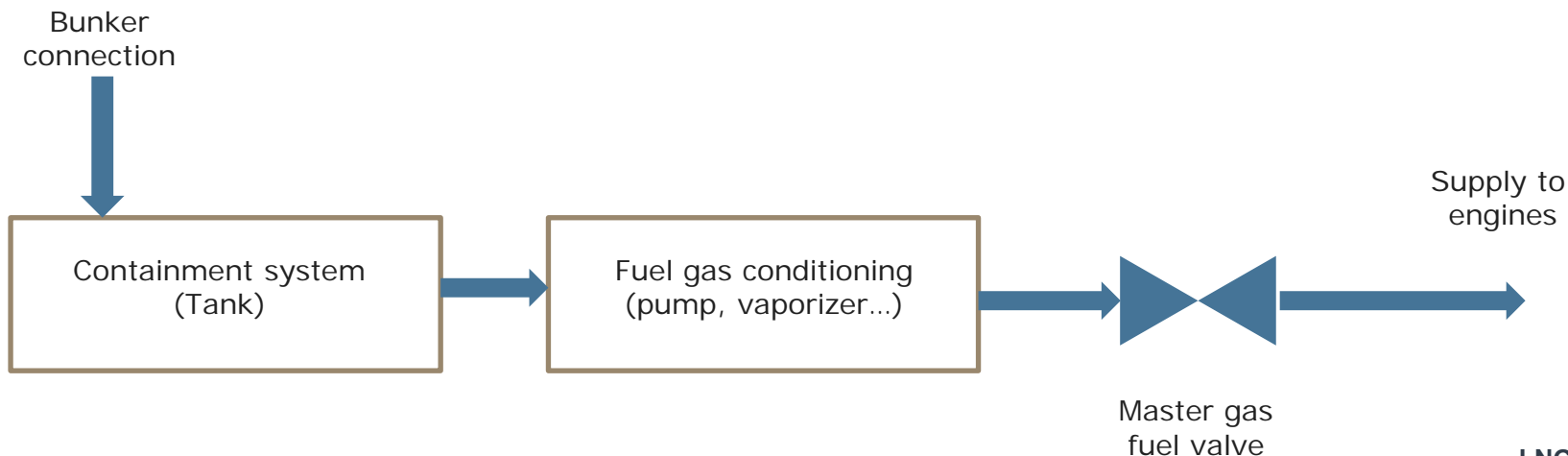
• Fuel gas systems

- Type C LNG tanks or vacuum insulated type
- Gas processing system

TGE Marine - LNG Fuel Gas System WES AMELIE

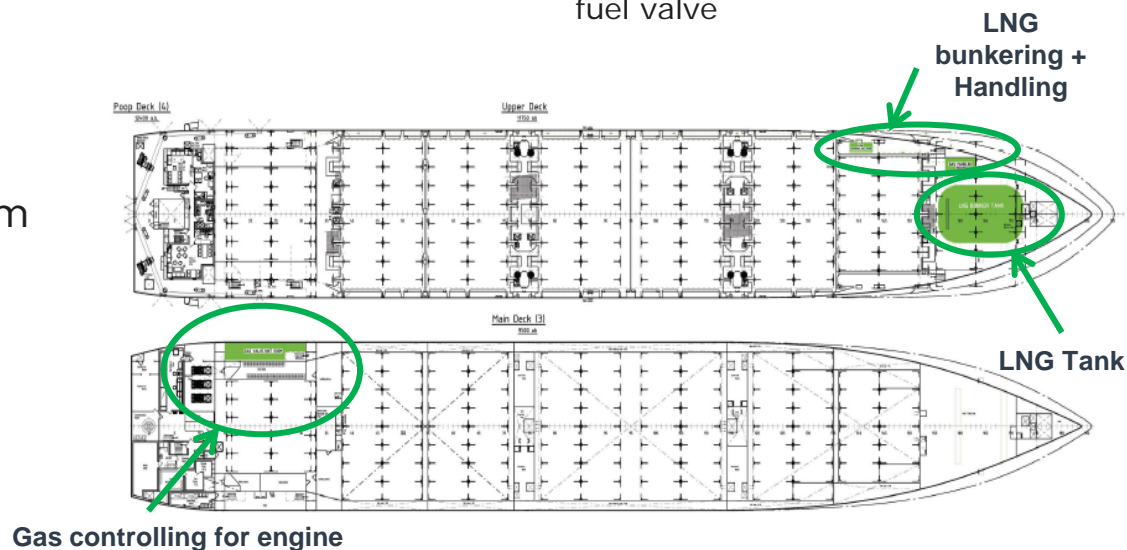
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TGE LNG fuel gas system – basic components



Auxiliary systems:

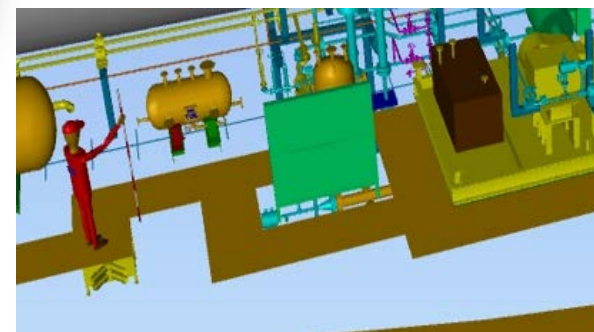
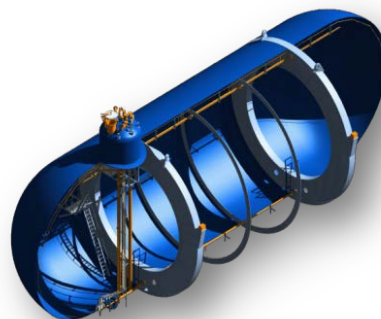
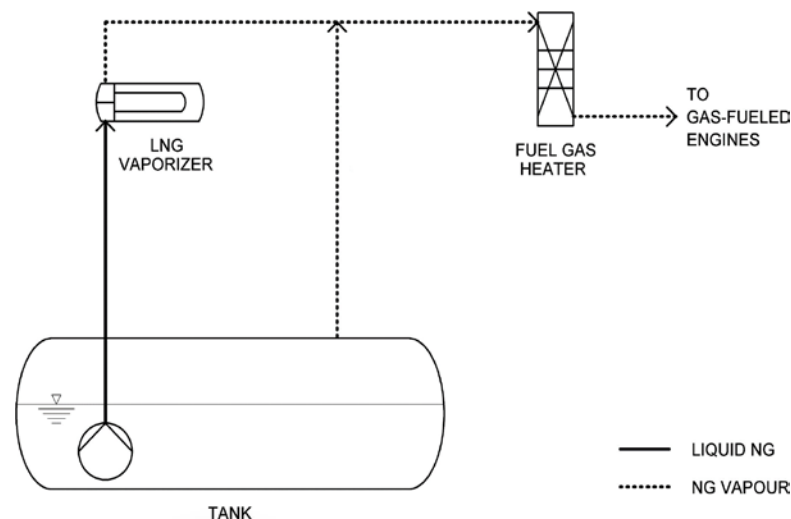
- Water-glycol heating system
- Inert gas system
- Vent / ventilation
- Valve remote operation
- Safety systems
- Automation & control



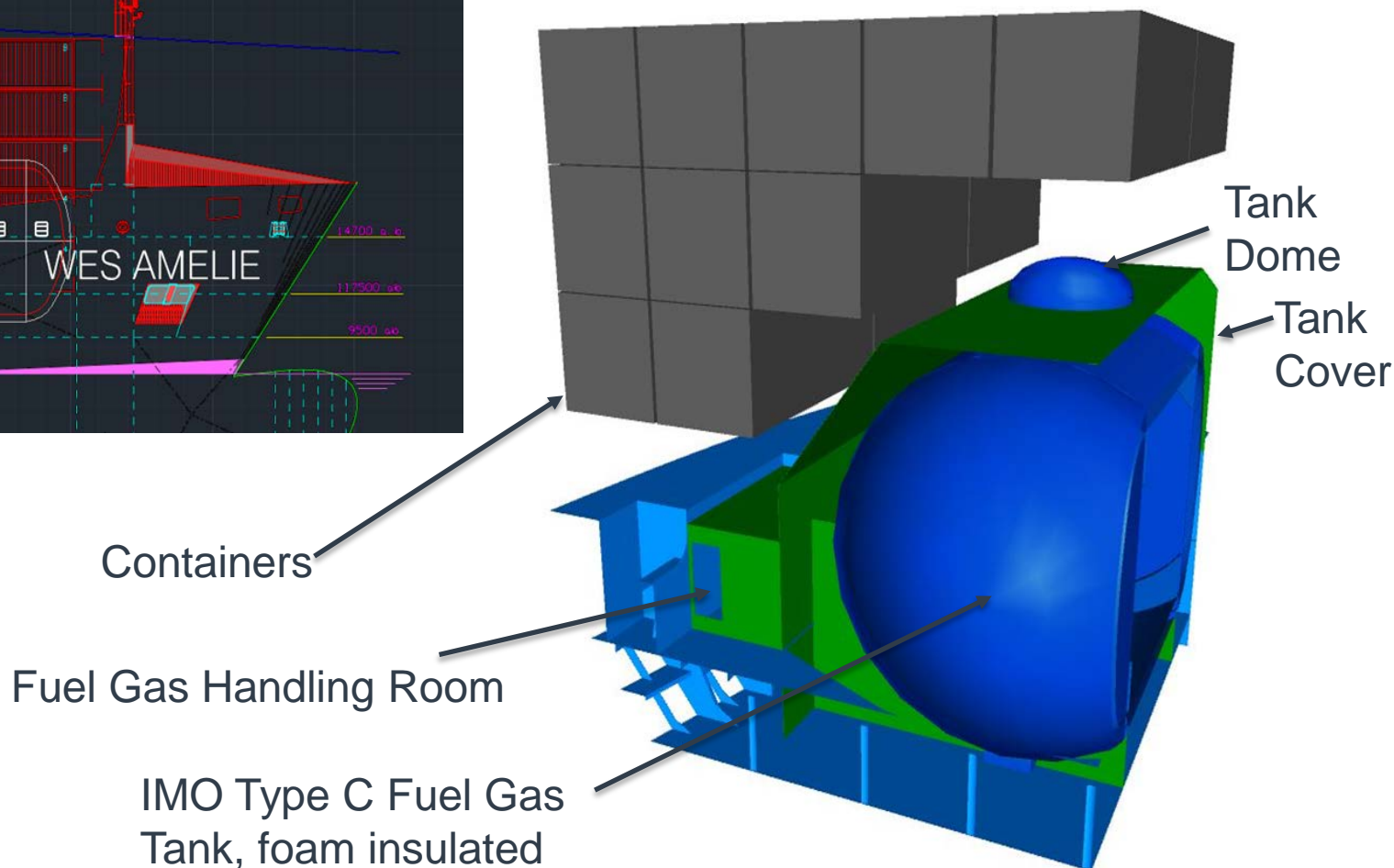
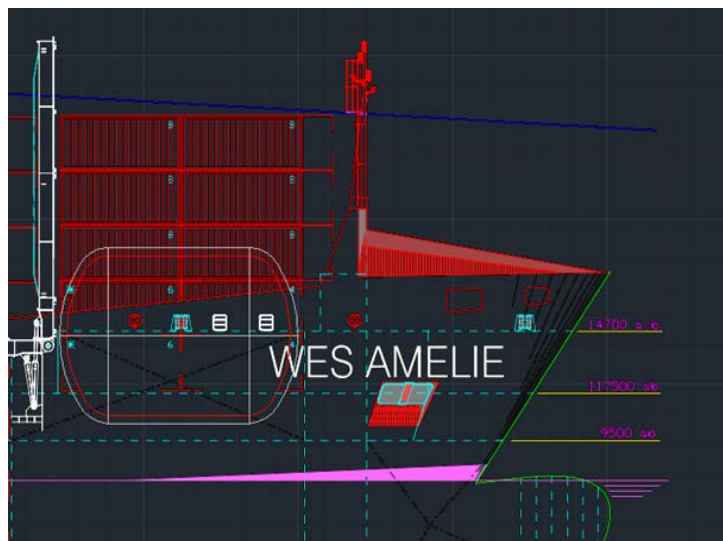
TGE LNG fuel gas system – General Data



General system data	
tank/insulation system	foam insulated IMO type C tank
tank design pressure	8 barg
typical tank operation pressure	1 – 7.2 barg
fuel gas supply	1.2 t/h
fuel gas supply pressure	6 barg
fuel gas supply method	Two (2x100%) submerged motor pumps,
BOG handling	Direct vapour supply to engine at high tank pressure
Special features	Flexible arrangement of fuel gas equipment inside Gas Handling Room, use of existing ship systems (steam, pressurized air, ...)



TGE LNG fuel gas system – Arrangement

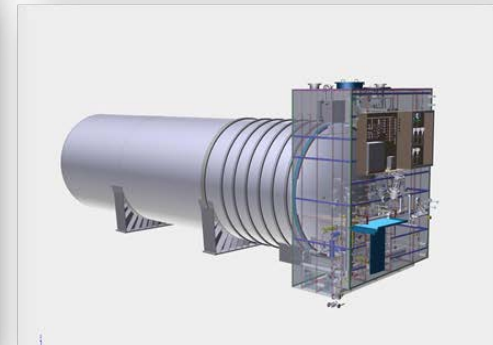


TGE LNG Fuel Gas Tank



Type C preferred solution for LNG Fuel Gas Tanks due to high design pressure 4 to 10 barg, no secondary barrier. High operation flexibility regarding loading and BOG pressure increase.

- PS or PU preformed slabs covered by steel sheets, allow for conical and bilobe shapes
- Tank materials: 9% Ni steel or stainless steel
- TGE Marine's scope of services for type C tanks:
 - Tank design with classification approval
 - Supply of all materials
 - Supervision of fabrication
 - Delivery of tanks with classification certificate to the shipyard



TGE Marine - LNG Fuel Gas System WES AMELIE 18

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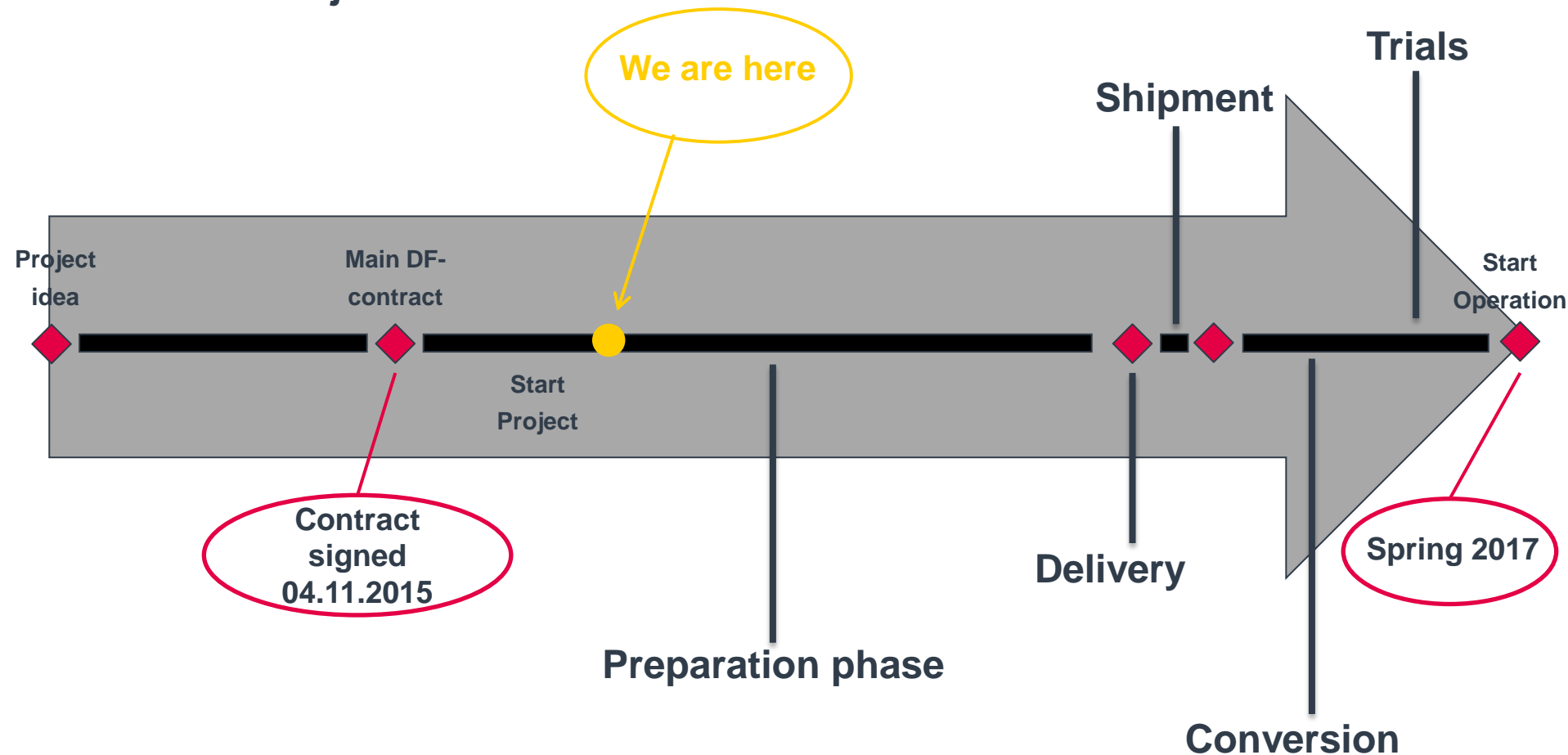


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Dual-Fuel Conversion Project Steps

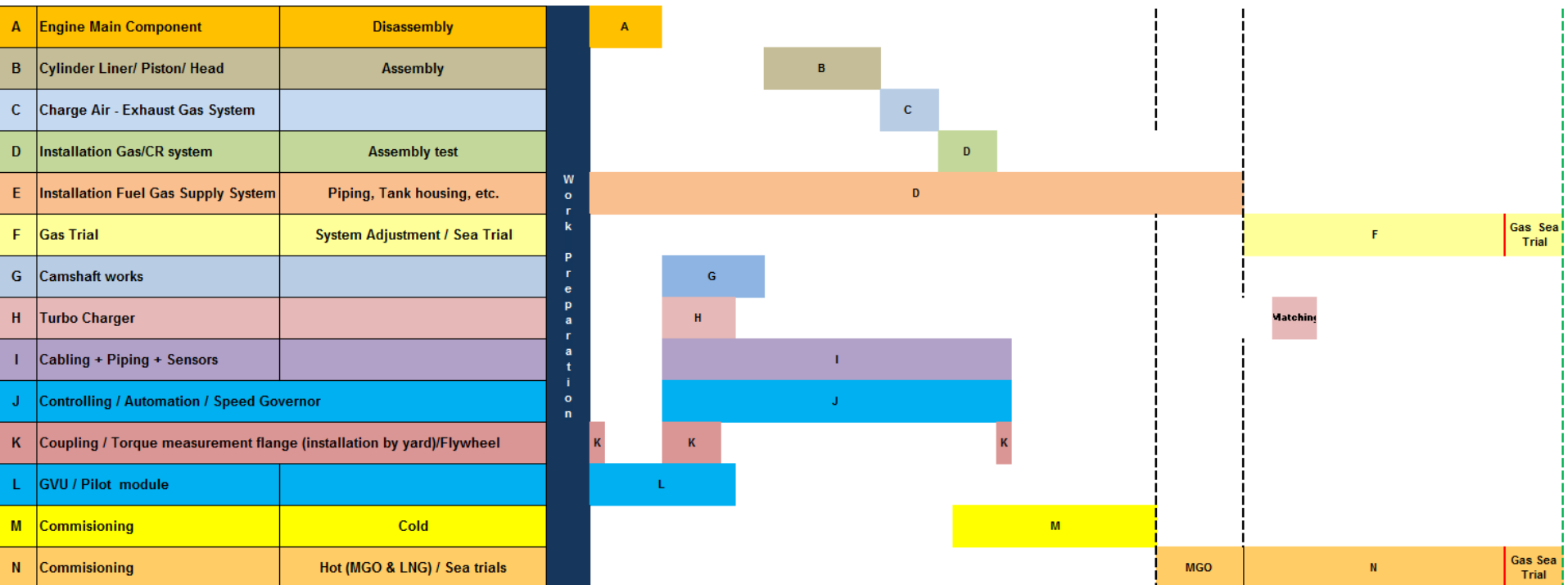


Wes Amelie Project:



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Conversion Time Schedule WES AMELIE



Expected time for conversion including Sea Trials and commissioning => **less 35 days**

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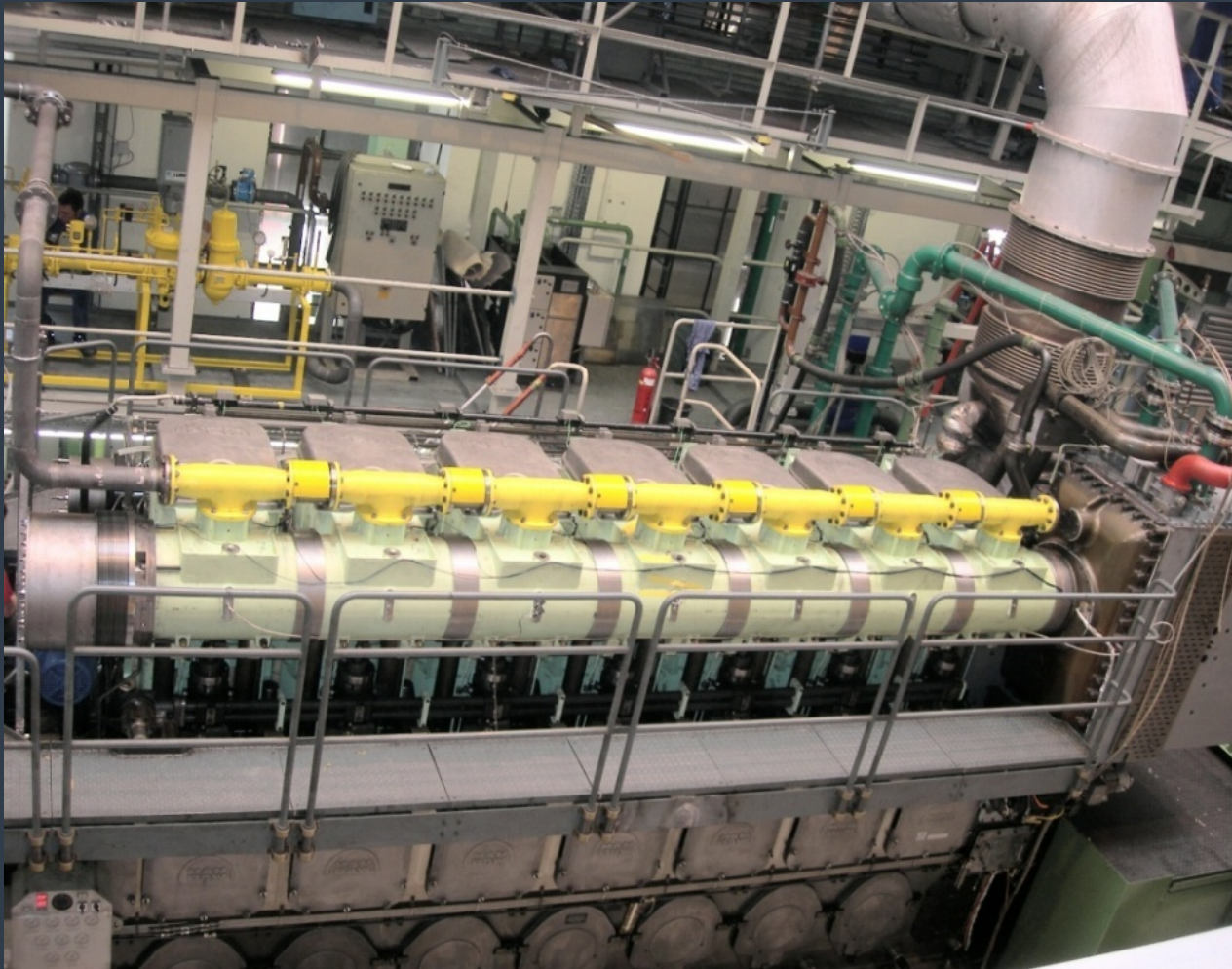
References

51/60DF Reference List (Status: 01/2016)



Order:	Marine	Stationary	No. and Engine type	Engine production	In operation
STX-Elcano, South Korea	X	--	5x 8L 51/60DF	MDT (AUG)	08/2010
STX-Sovcomflot (4 vessels + options)	X	--	2x 2x 9L+2x 8L 51/60DF 2x 2x 9L+2x 8L 51/60DF	MDT (AUG) STX E	02/2013
Alpha Tanker (2 vessel + options)	X	--	2x 2x 9L+ 2x 8L 51/60DF	MDT (AUG)	08/2015
Daewoo, Dynagas (1 vessel)	X	--	4x 9L 51/60DF	MDT (AUG)	Planned 08/2016
Kawasaki, LNGC (1 vessel)	X	--	5x 8L 51/60DF	MDT (AUG)	Planned 10/2016
CSLNG (6 vessel + 2 options)	X	--	6x 5x 8L 51/60DF	MDT (AUG)	First 04/2016
Hudong, BGLNG (4 vessels + options)	X	--	4x 2x 8L + 2x 12V 51/60 DF	MDT (AUG)	First 04/2017
Wessels Reederei 1 x 1000TEU	X	--	1x 8L51/60DF	Retrofit on site	04/ 2017

Thank you for your attention!



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Do you have any more questions?



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