Convert from fuel oil to gas

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Ship Power technology

EMSA/ECSA WORKSHOP

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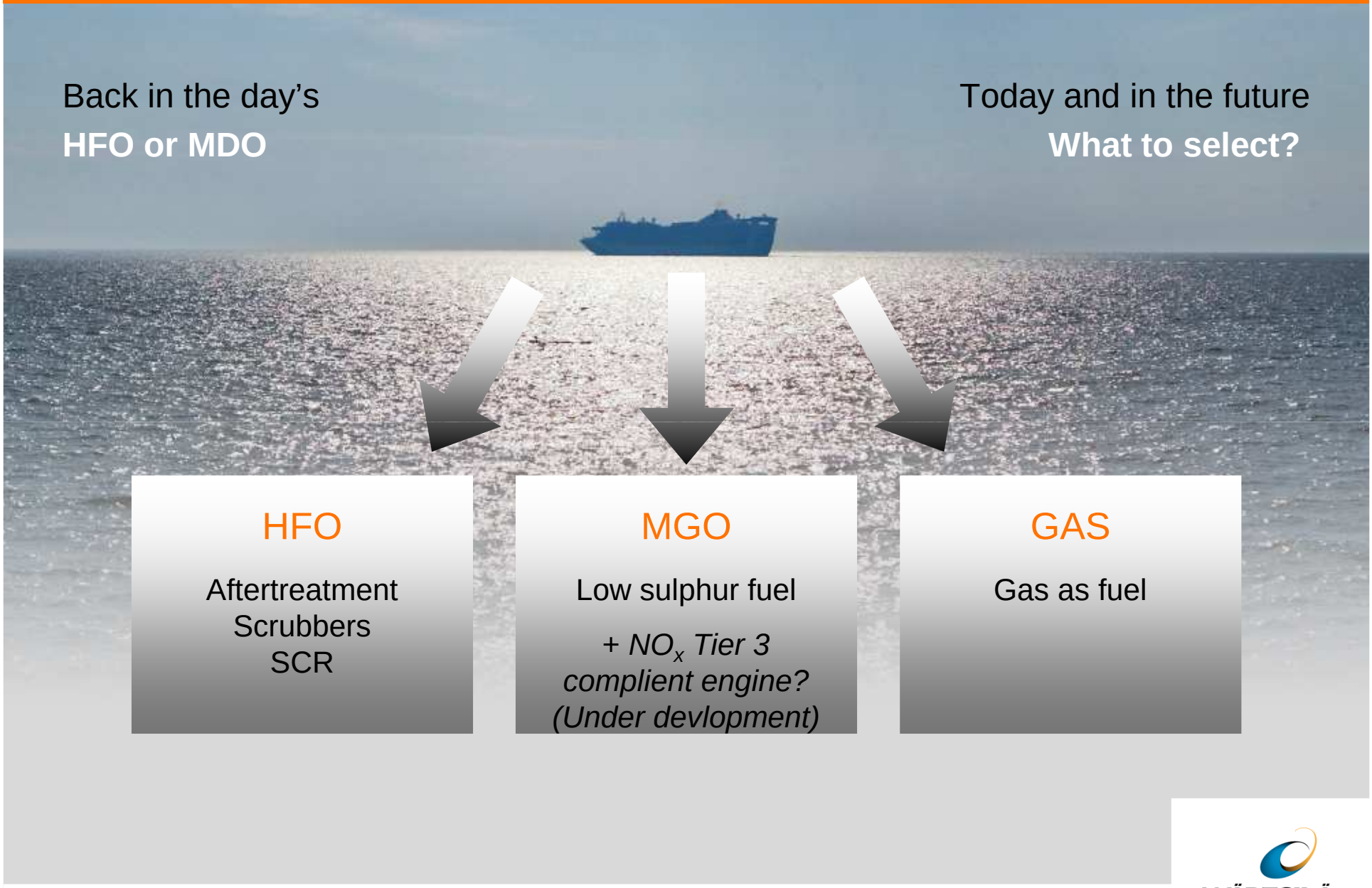
This is Wärtsilä

Reduce emissions - What are the options?

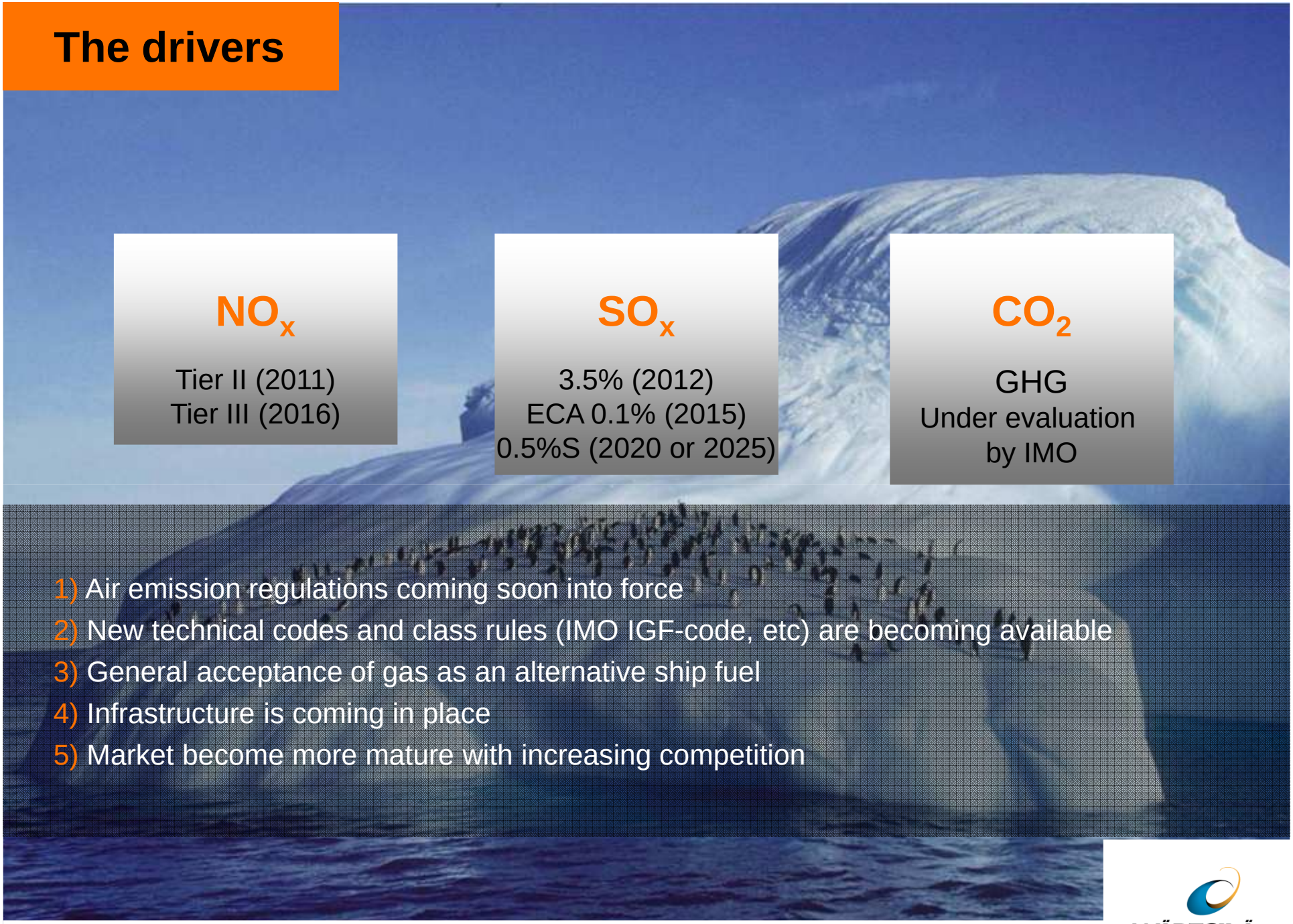
Back in the day's
HFO or MDO

Today and in the future
What to select?



HFO	MGO	GAS
Aftertreatment Scrubbers SCR	Low sulphur fuel *+ NO_x Tier 3 complient engine? (Under devlopment)*	Gas as fuel

The drivers



NO_x

Tier II (2011)
Tier III (2016)

SO_x

3.5% (2012)
ECA 0.1% (2015)
0.5%S (2020 or 2025)

CO_2

GHG
Under evaluation
by IMO

1) Air emission regulations coming soon into force
2) New technical codes and class rules (IMO IGF-code, etc) are becoming available
3) General acceptance of gas as an alternative ship fuel
4) Infrastructure is coming in place
5) Market become more mature with increasing competition

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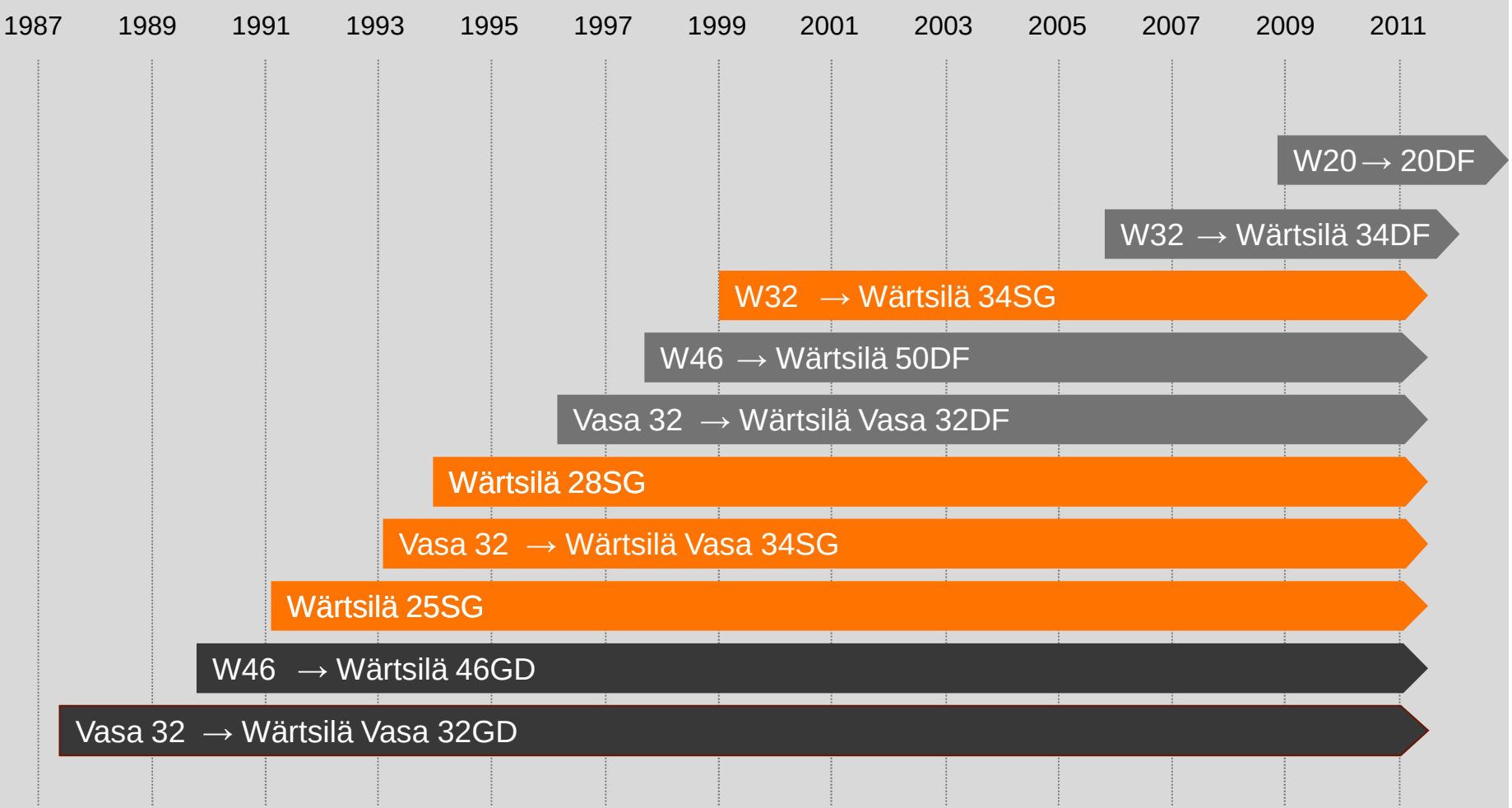
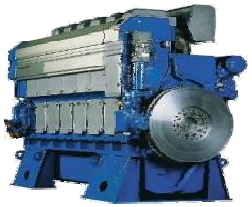
Wärtsilä gas engine history



- GD = Gas Diesel engine
- SG = Spark ignited Gas engine
- DF = Dual Fuel engine

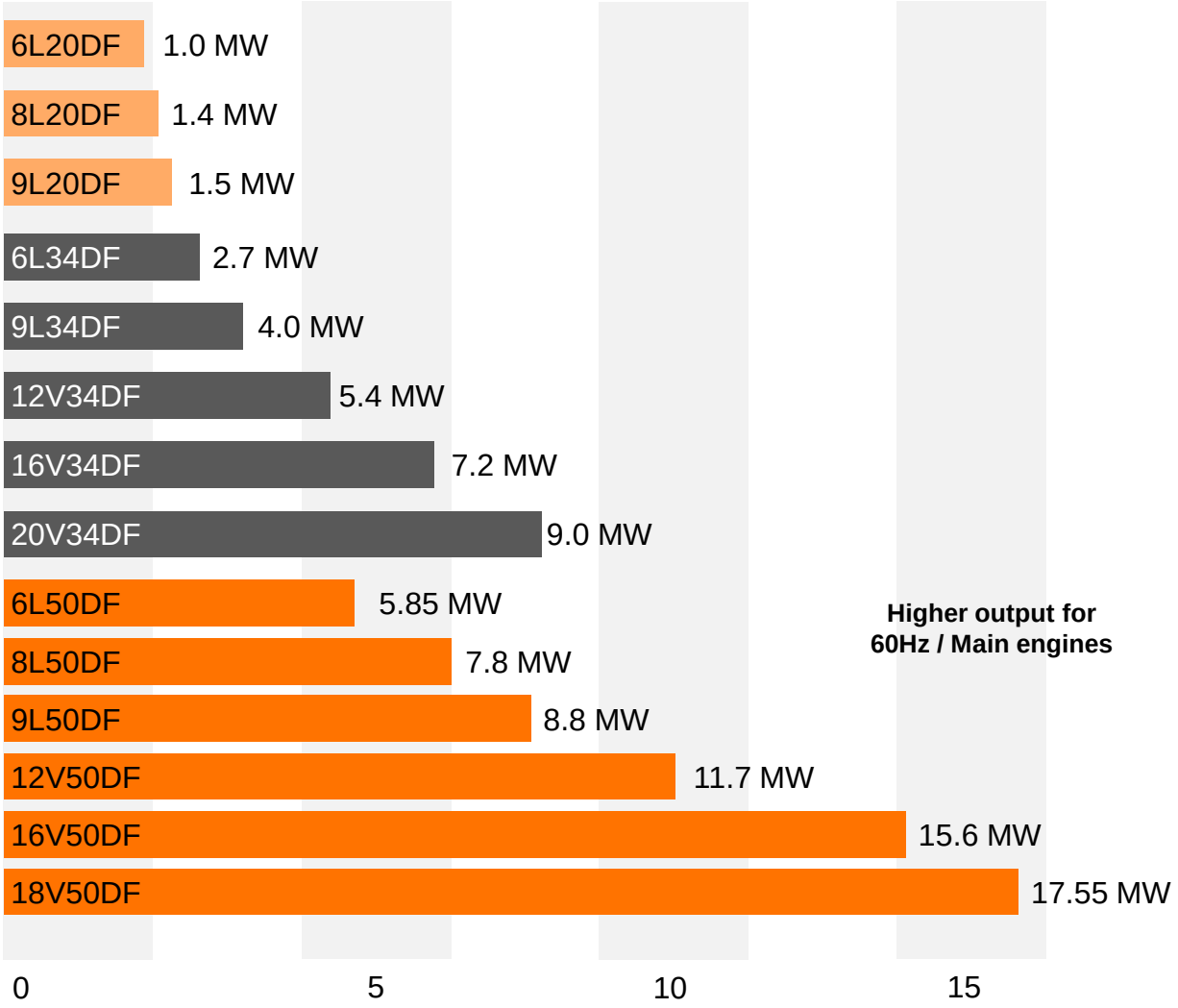
Dual-fuel engine range

20DF



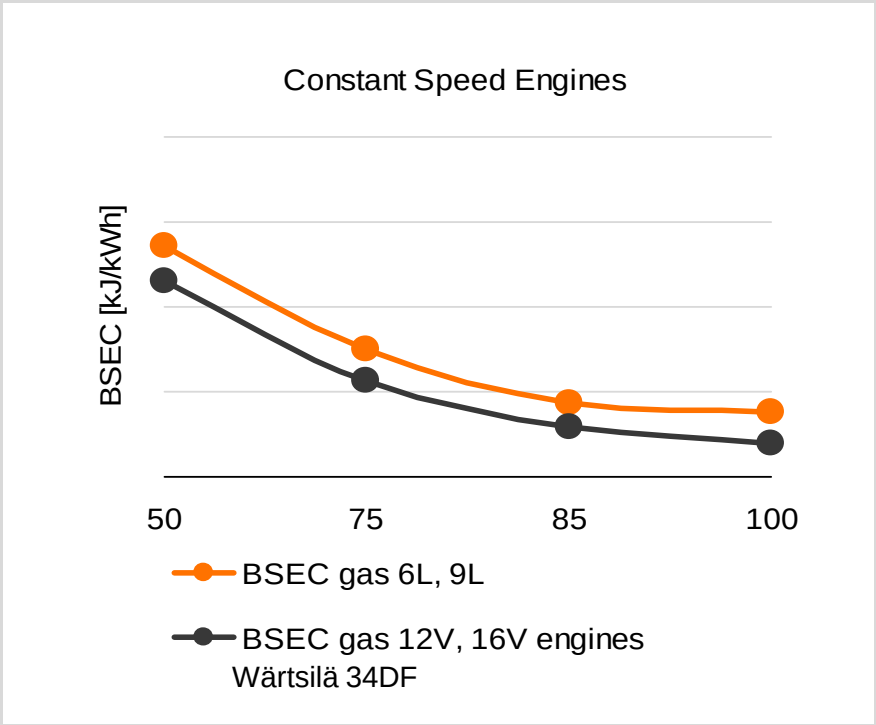
34DF

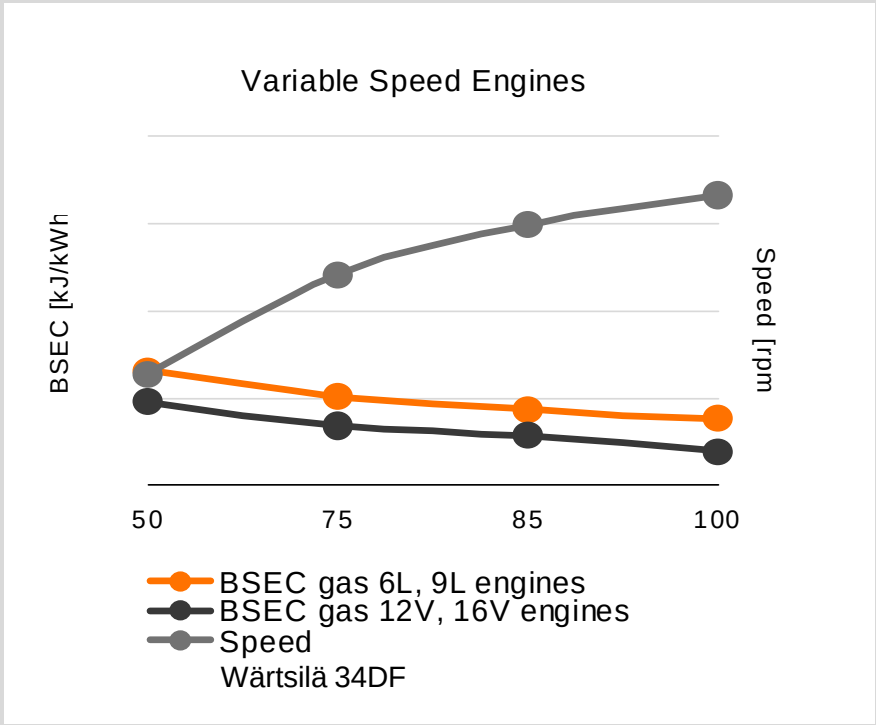
50DF



Gas consumption variable and constant speed

By operating the engine according to propeller curve both SFOC and emissions are reduced in the same manner as with a conventional diesel engine.





LNGPac - a *complete* solution for LNG fuelled ships

1. Storage tanks
2. Evaporators
3. Bunker station
4. Gas valve unit enclosure
5. Dual-Fuel Main engine
6. Dual-Fuel Aux engines

Fully Automated
No moving parts
In the fuel system

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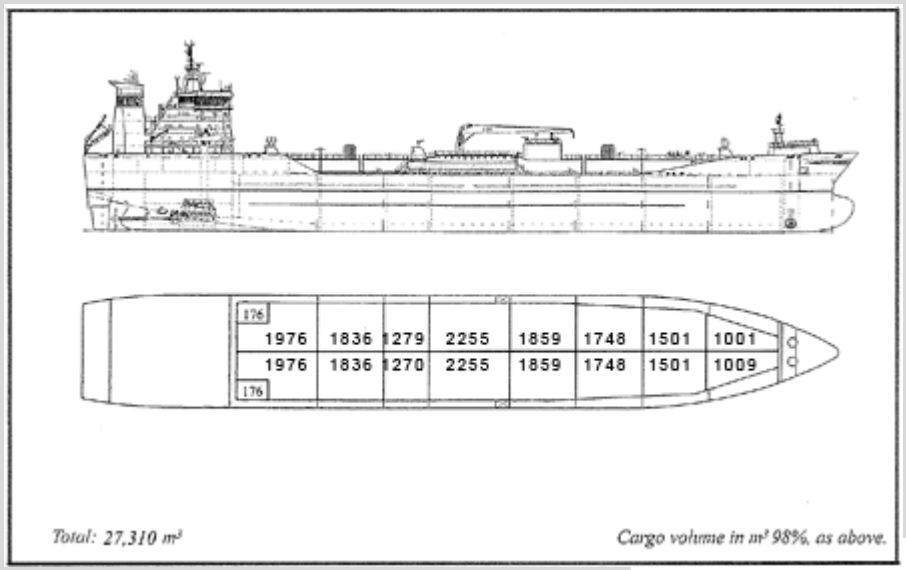
Case study - Conversion of Bit Viking

The project in a nutshell

- 25,000 dwt Twin Screw Chemical Tanker by Wärtsilä Ship Design
- Built by Shanghai Edward Shipbuilding 2007
- Classification society GL
- Main Engines:
  2 x Wärtsilä 6L46 / 5850 kW
- Auxiliary engines:
  2 x Wärtsilä 8L20 / 1360 kW

- 2 x W6L50DF / 5700 kW
- Autonomy = 12 days operation on ~80% load
- 2 x 500 m3 LNG tanks

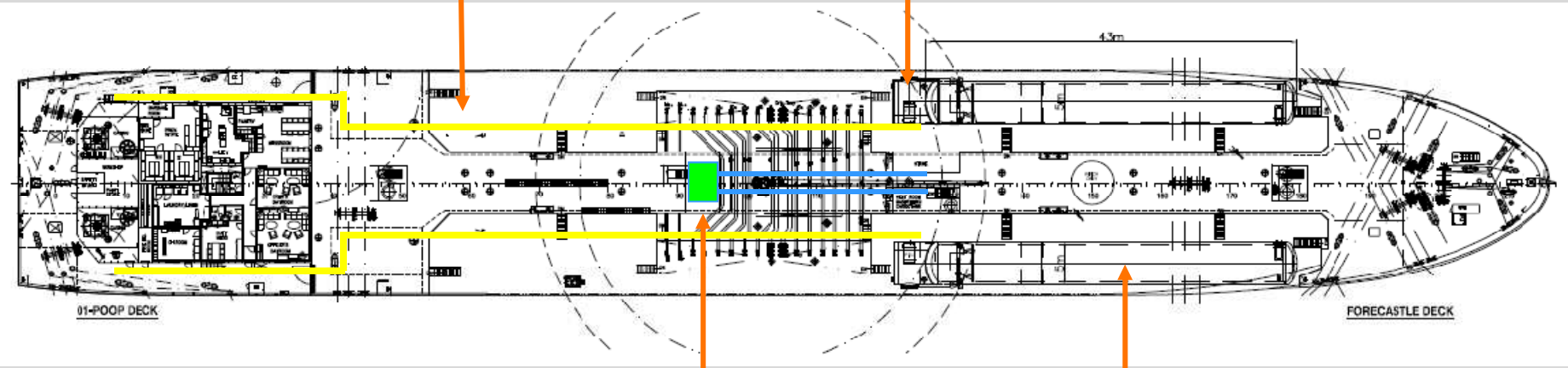


Conversion of Bit Viking

Placement of equipment

Gas feed pipe

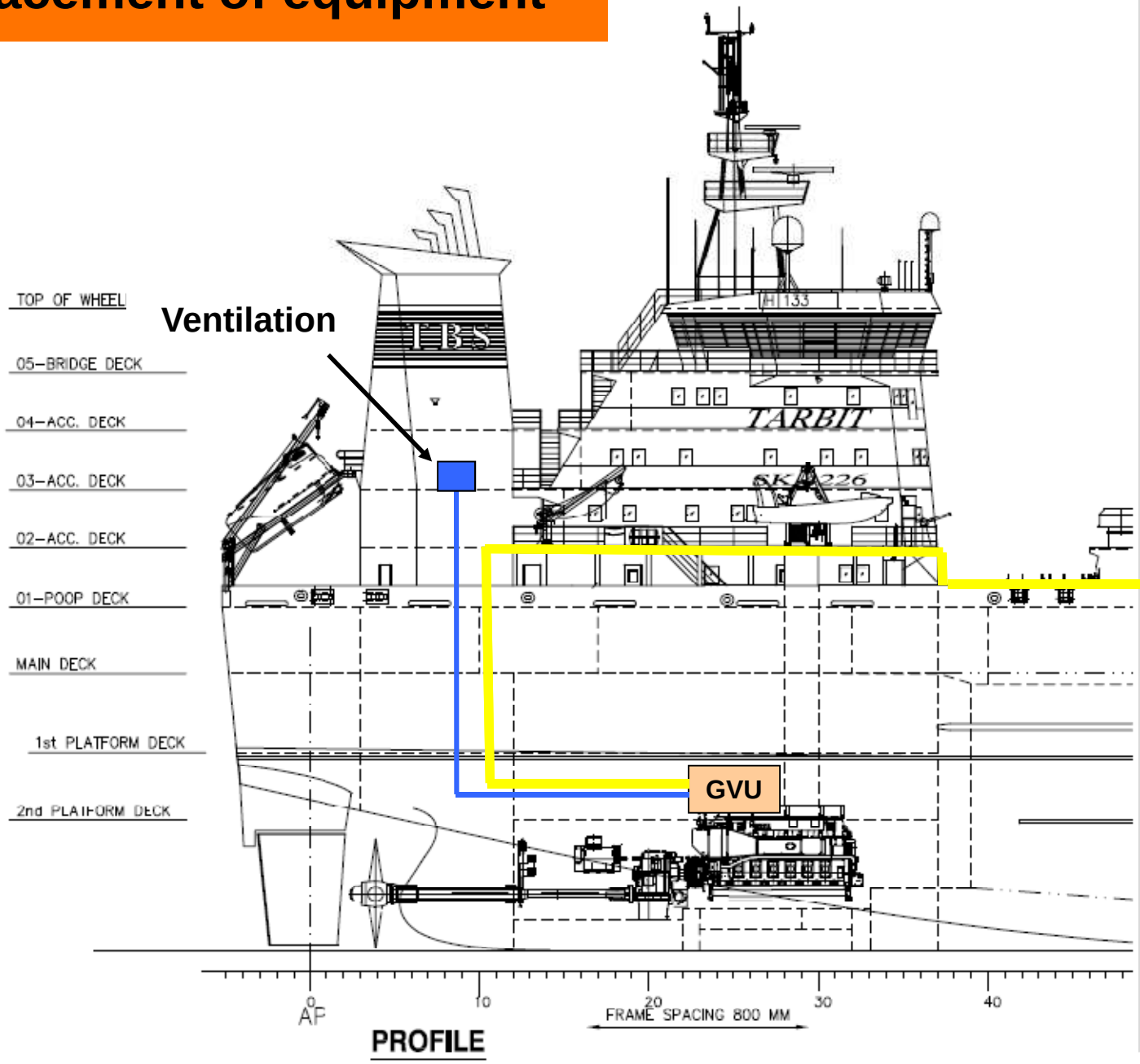
Tank room



Thermal oil heater for LNG evaporation

LNG storage tank

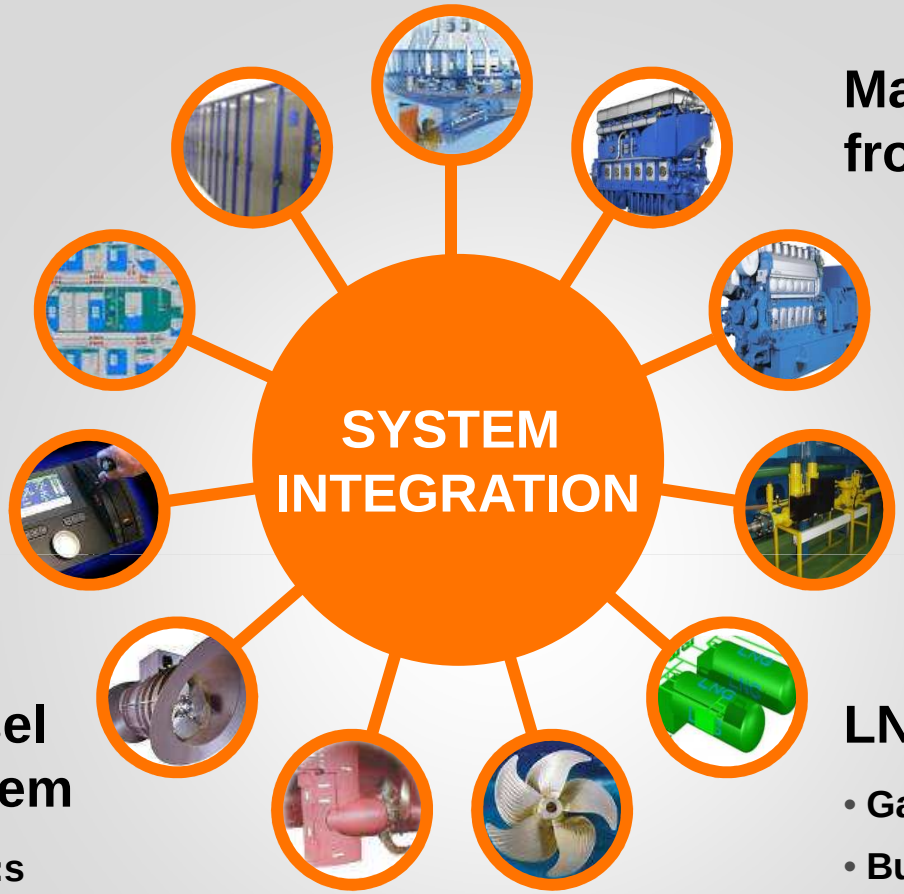
Placement of equipment



System integration

Ship Design

- Stability calculations
- Tank foundations
- Mechanical design



Main engines converted from HFO to Gas

- Cylinder heads
- Pistons
- Built on gas system
- Control system

Upgrade of vessel automation system

- Integration of new I/O:s into existing system
- Control of new equipment

LNG storage system

- Gas valve units
- Bunker skid
- LNG tanks

Propulsion system integration

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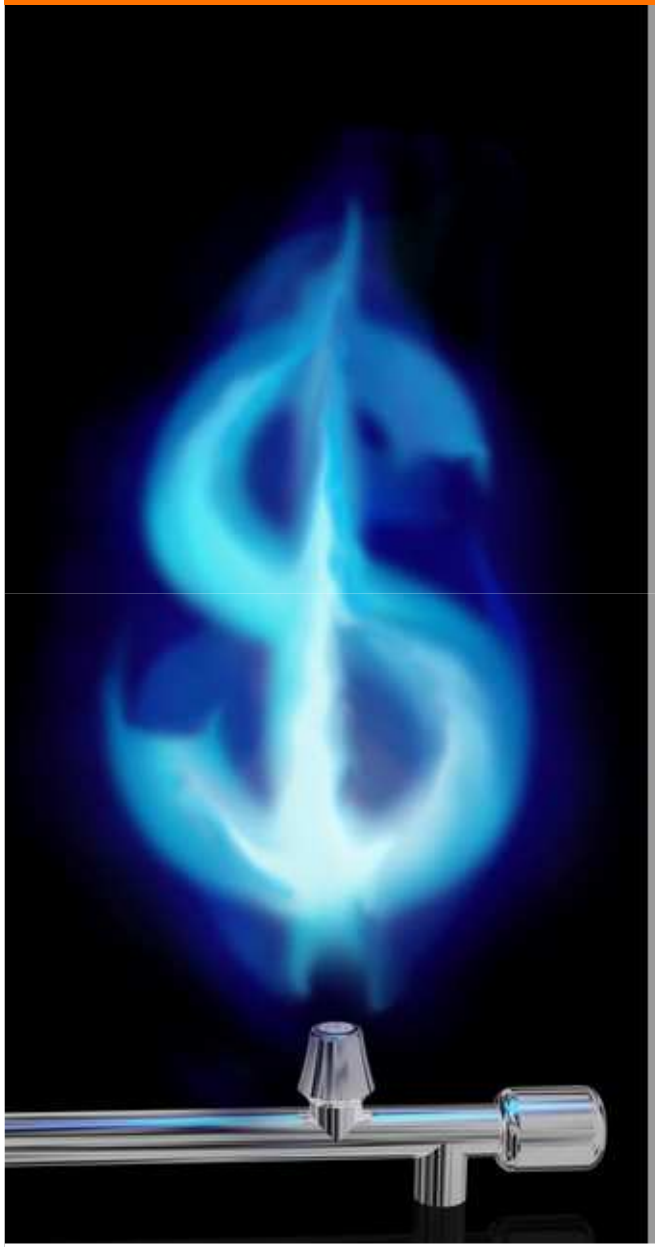
Conversion costs



- Time for conversion minimized and carried out during normal docking
- Conversion partly funded by the Norwegian NOx fund
- All existing systems on vessel was kept
- Approx 50% of the cost is derived from LNG-storage system
- Approx 50% derived from installation, engine conversion, auxiliaries, etc
- More cost effective to convert the engines compared to install new engines
- For old installations/smaller engines may be more commercially viable to install new engines

Conclusions

Wärtsilä engineers solutions for LNG delivery, storage, transportation and utilization onboard.