Project “ms Groenland”

REDERIJ DOEKSEN

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An Assessment of Sustainable RoPax Ferry Concepts

This work is part of the iTransfer project, which is funded by the North Sea Region programme, part of the EU Inter-regional (Interreg) initiative and the European Regional Development Fund

iTransfer
sustainable ferry travel

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

European Regional Development Fund
Investing in your future

OBJECTIVES

Pre-design and specification of a sustainable ferry concept, to replace the existing ferry ms Midsland on ferry route Harlingen – Terschelling v.v.

Objectives for Rederij Doeksen meet the Damen philosophy

- Environmentally friendly
- Efficient in operation
- Economically viable

ENVIRONMENTAL TARGETS

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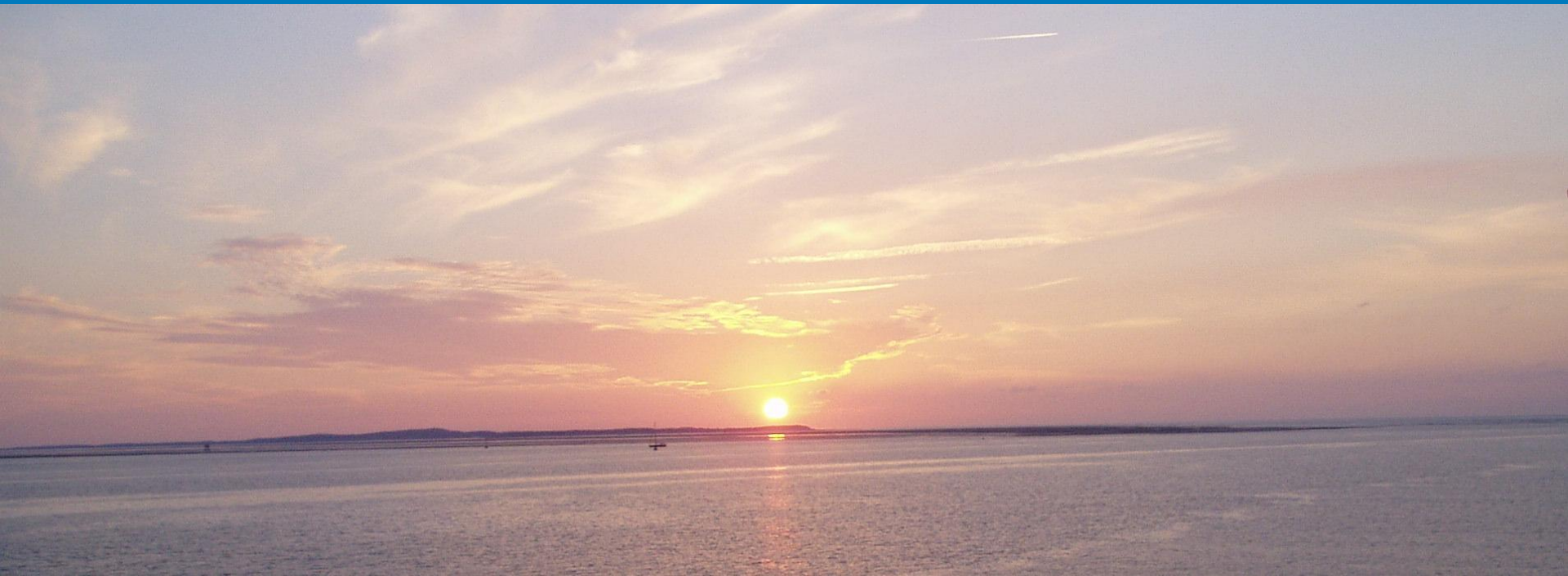
Less Energy = CO2 reduction
No SOX
No PM
Significant NOX reduction



REDERIJ DOEKSEN

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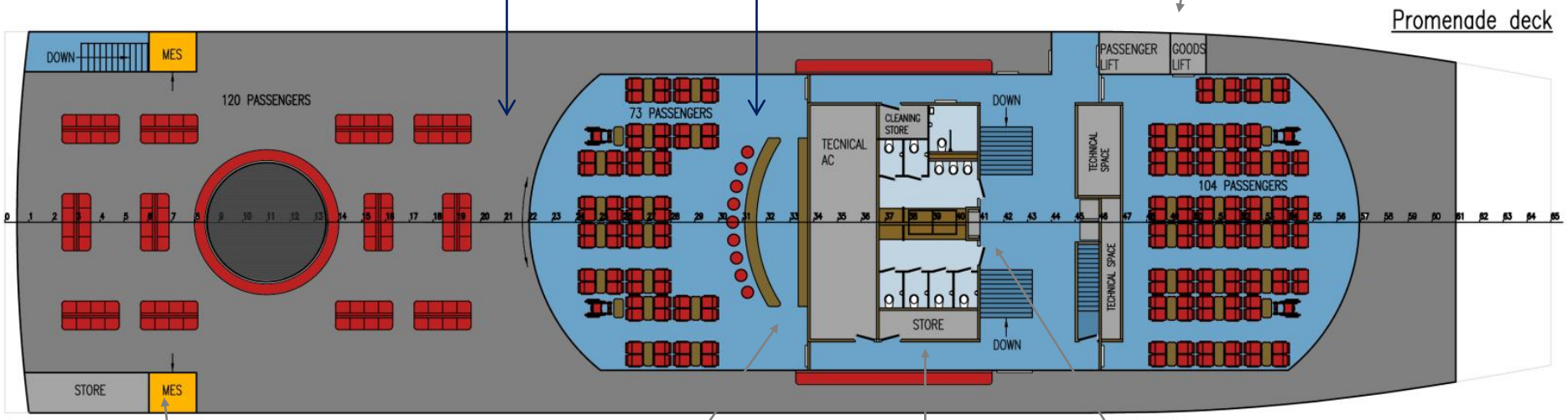
DAMEN

PRINCIPAL CHARACTERISTICS

Promenade deck outside
120 seats

Promenade deck inside
181 seats

1 Passenger lift and 1 goods lift



Evacuation systems

Bar with bar fixed stools

Store space

Grouped passenger sanitary spaces

Source: Damen Shipyards

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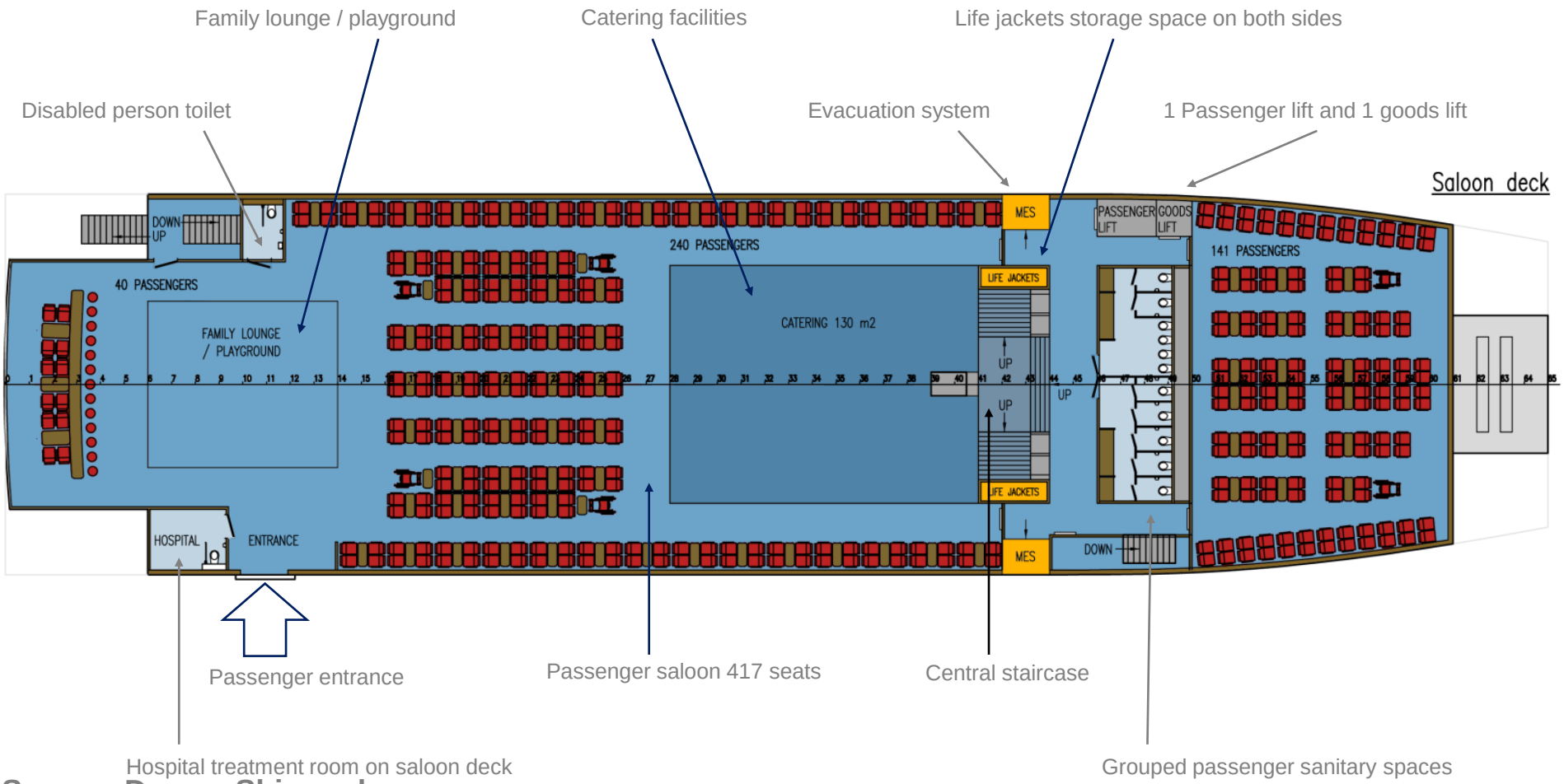
PRINCIPAL CHARACTERISTICS



Source: Damen Shipyards

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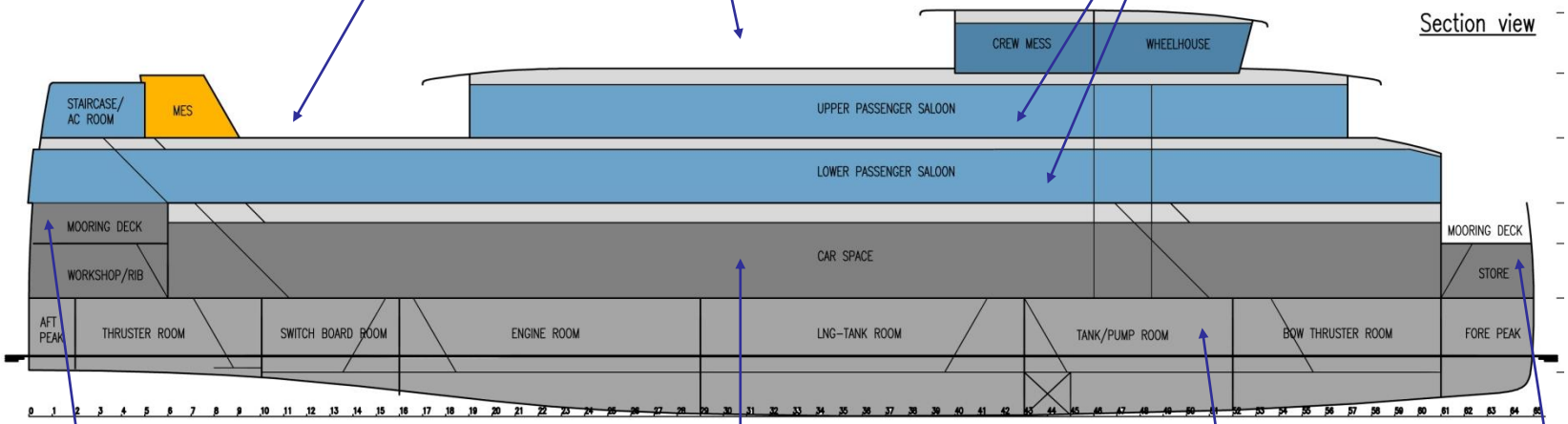
PRINCIPAL CHARACTERISTICS

A-Deck Level **Top Deck**

B-Deck Level **Wheelhouse Deck**

C-Deck Level **Promenade Deck**

D-Deck Level **Passenger Saloon Deck**



E-Deck Level **Mooring Deck**

E-Deck Level **Mooring Deck**

F-Deck Level **Main / Car Deck**

G-Deck Level **Tank Top / Floor Plate Level**

Source: Damen Shipyards

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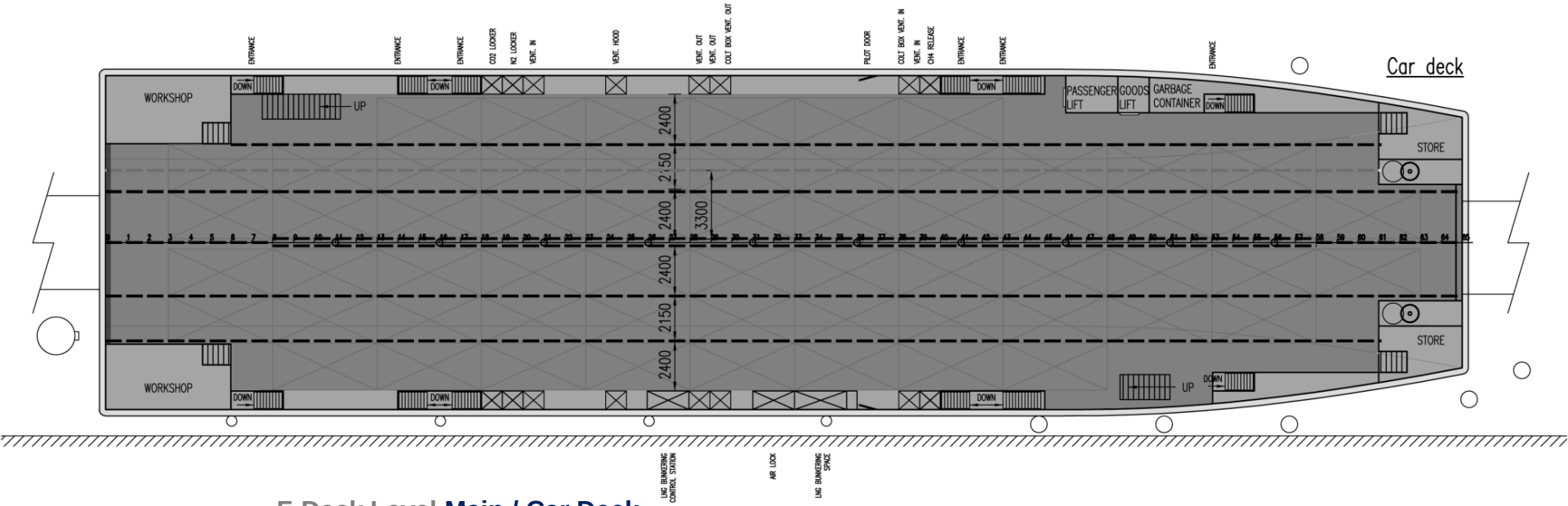
PRINCIPAL CHARACTERISTICS

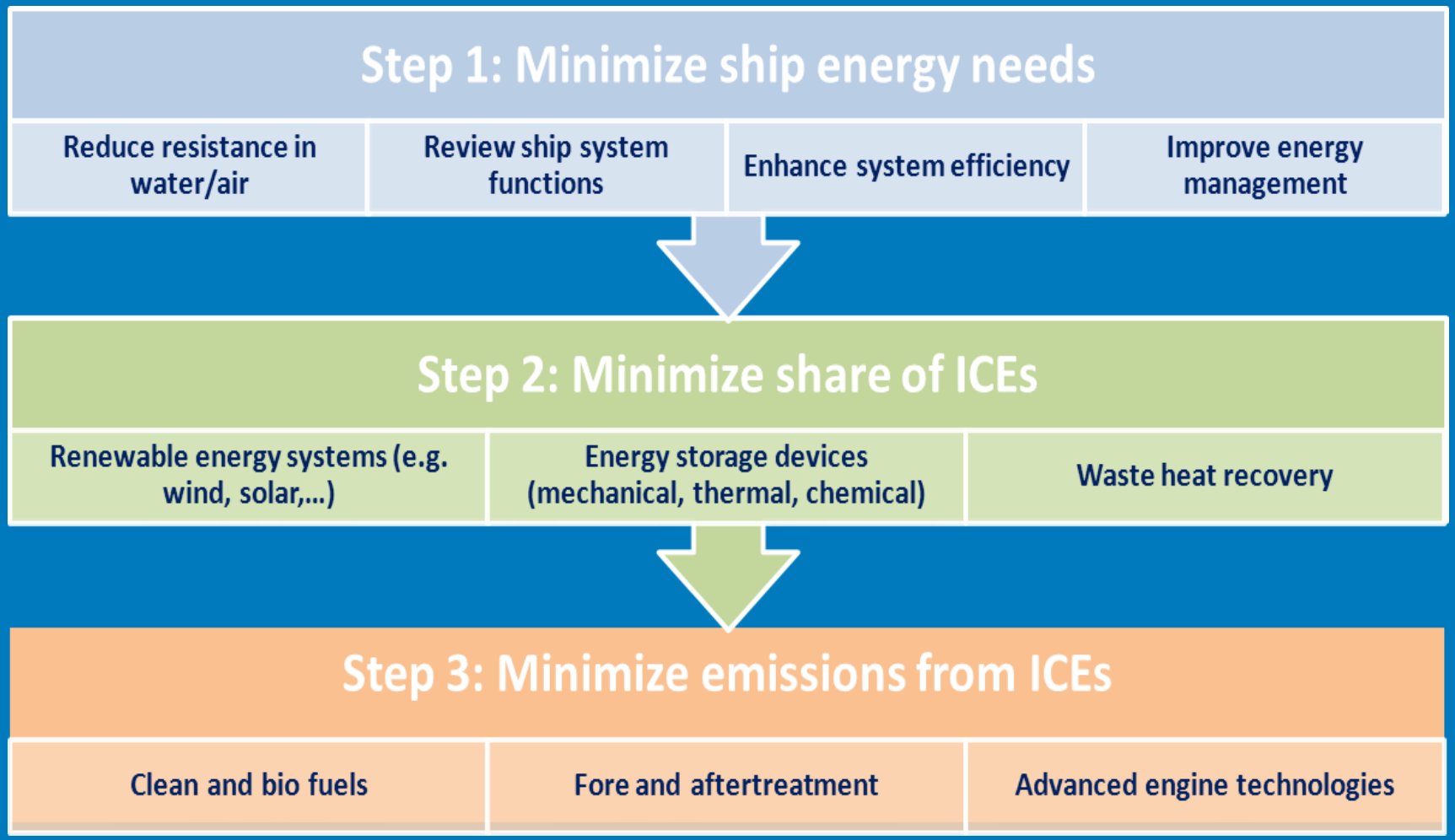


F-Deck Level **Main / Car Deck**

Car Deck Height, free/clear: 3.25 m

Passenger Cars Capacity: 60 in 6 lanes

Source: Damen Shipyards



Source: Damen Shipyards

decision making model for sutainable ferry development

step 1 minimize energy need

fleet adjustment								
	increase fleet to decrease energy consumption of the fleet.							
operational speed								
	increase sailing time to maximum acceptable	reduce turn around time in favour of speed reduction	shorten crossing	economy auto pilot	training of captains			
weight reduction								
	aluminium construction	HT steel	Composite construction	light weight interior	minimize bunkers by decreasing intervals	minimize equipment, choose light weight options	remove inventories such as spares, workshop, tools etc.	reduce empty space make your vessel sleak
hull form improvement								
	reduce beam	catmaran hull	Maximize waterline length					
Reduce climat control								
	reduce sun radiation on windows	close parts of accommodation during down time						
Electrical consumption								
	LED lighting	increase the use of day light	use of outside climate	reduce on board vending / catering				

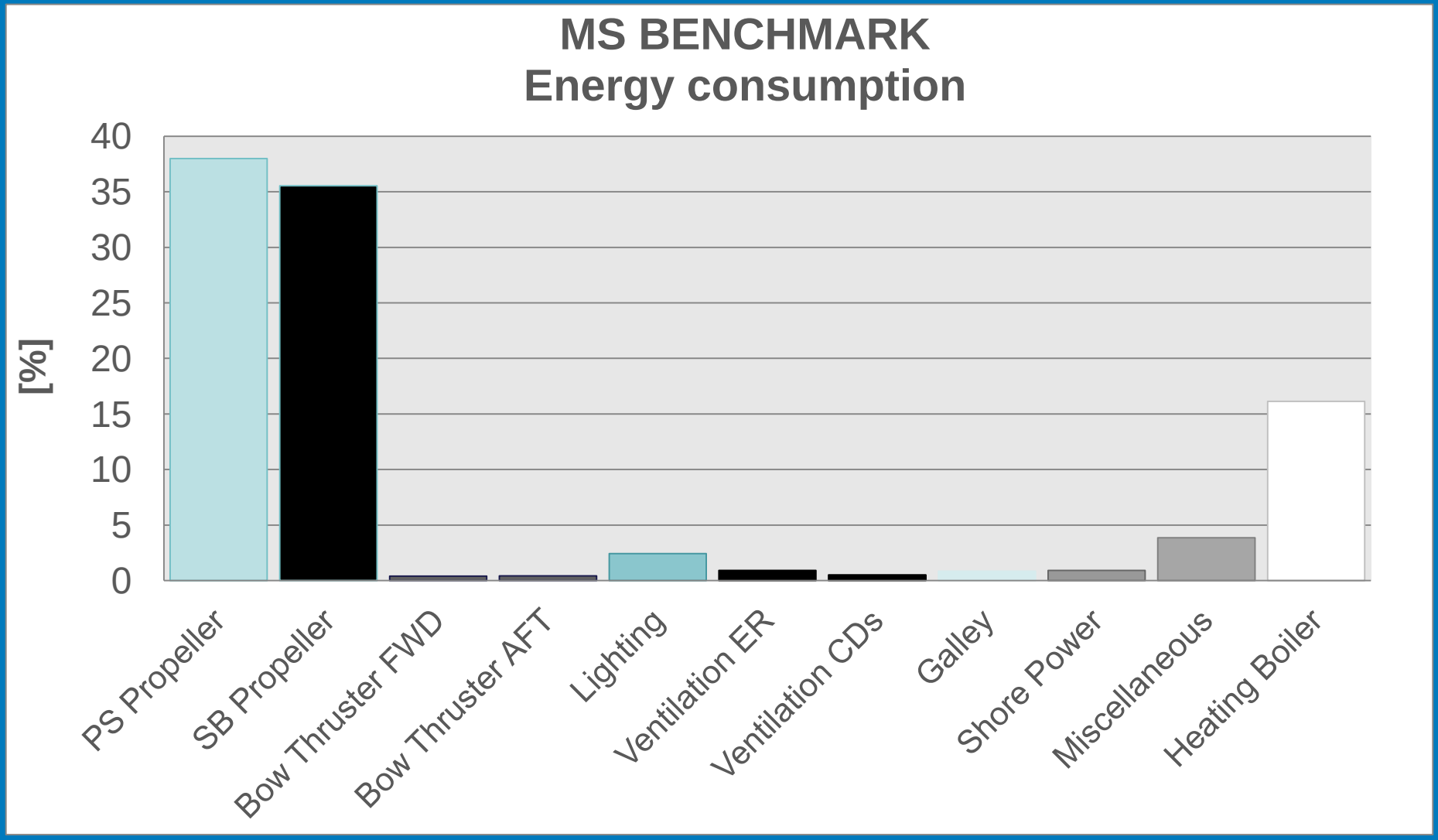
step 2 energy recources

Sources					
	Internal Cumbustion Engines (ICE)	batteries + shore supply + peak shaving	waste heat recovery	solar / wind	fly wheel as alt to batteries
Energy system					
	mechanical drive FPP	mechanical drive CPP	electrical drive	ICE - electrical hybrid	DC platform + PM engines

step 3 minimize emmissions

Fuel				
	Diesel EN 590 low sulpher	LNG	CNG	Methanol
treatment				
	Selective Catalyst Reducer (SCR)	SCR + filter	Boil off gas turbine	

Source: Damen Shipyards



Source: Damen Shipyards

STEEL MONOHULL → ALUMINIUM MONOHULL → ALU CAT

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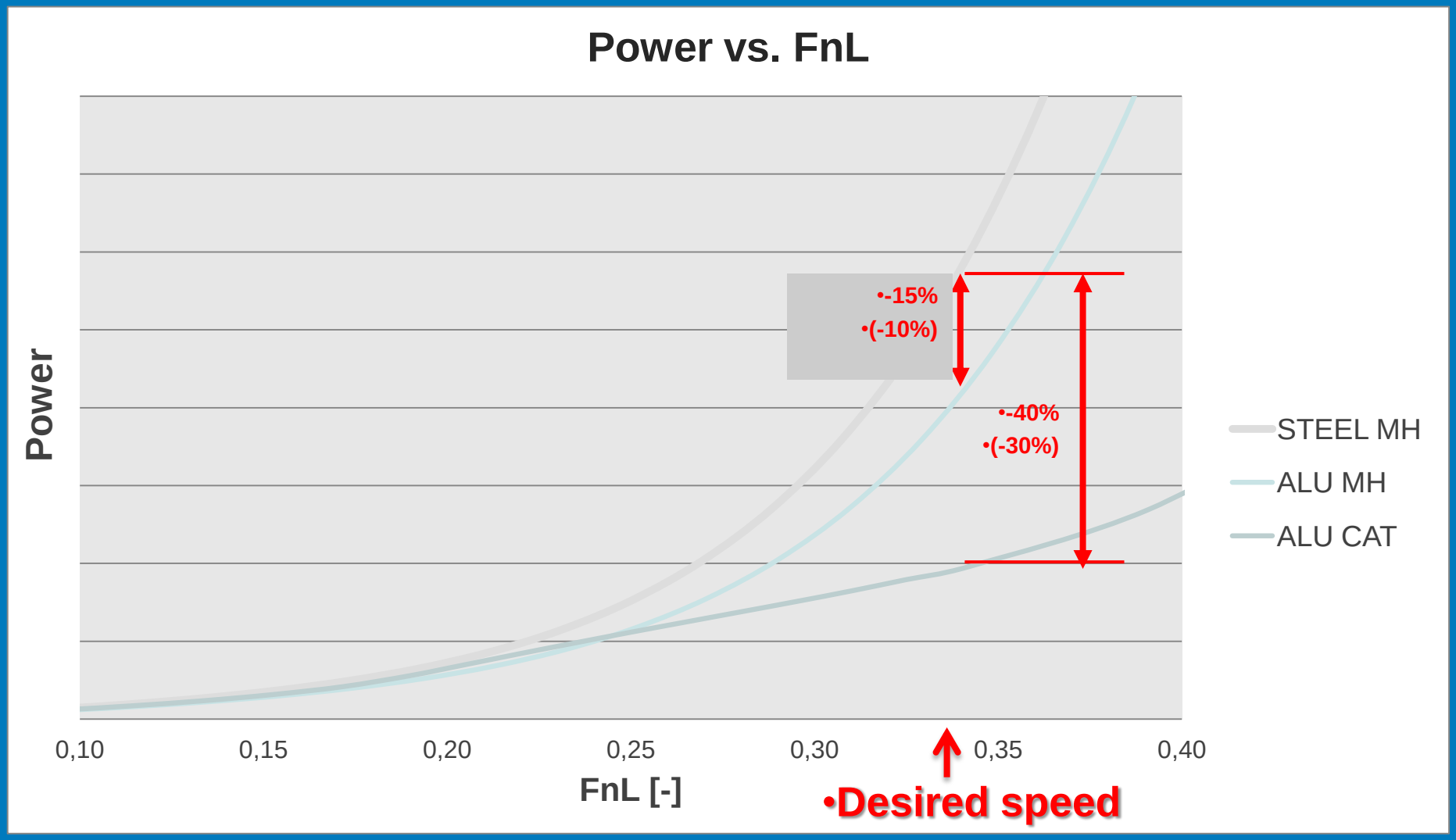

Source: Damen Shipyards

PROPULSION CONCEPTS

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Base: Diesel Direct + generator sets

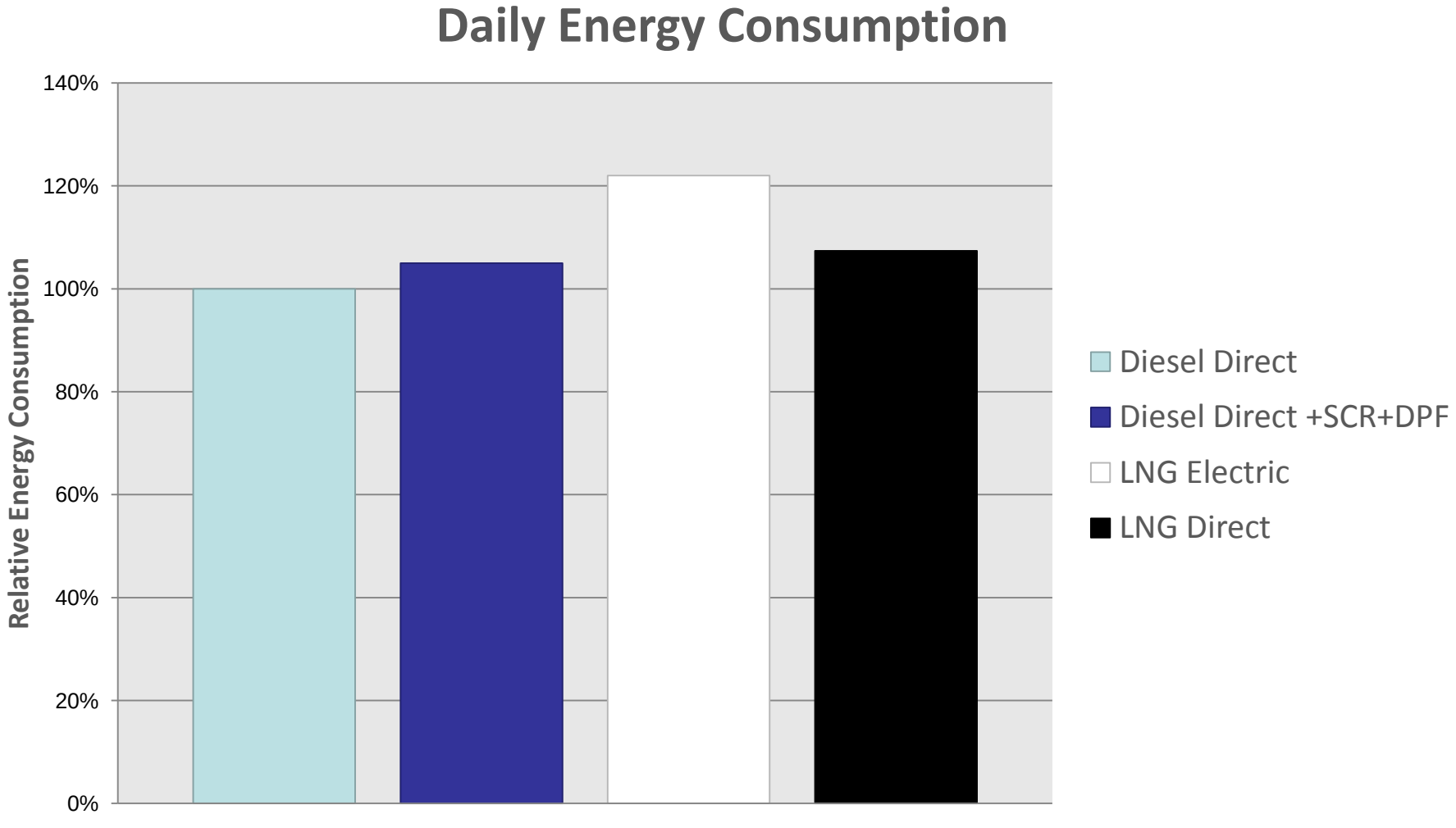
Alt. 1 Diesel Direct + SCR + DPF + generator sets

Alt. 2 LNG – Electrical propulsion

Alt. 3 LNG direct propulsion

Source: Damen Shipyards

Energy Consumption Comparison



Source: Damen Shipyards

LNG GENSET VS DIESEL ENGINE EFFICIENCY

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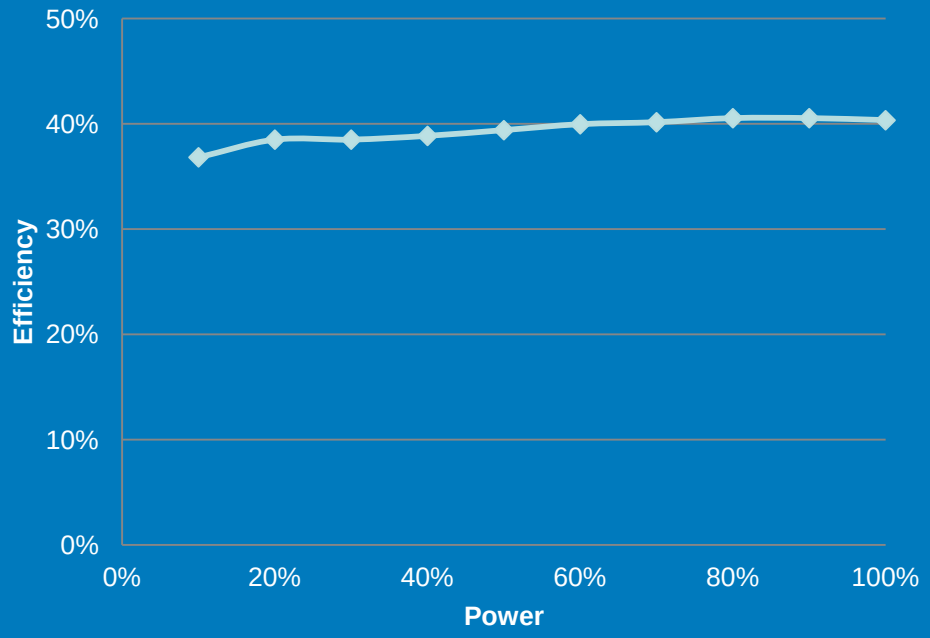
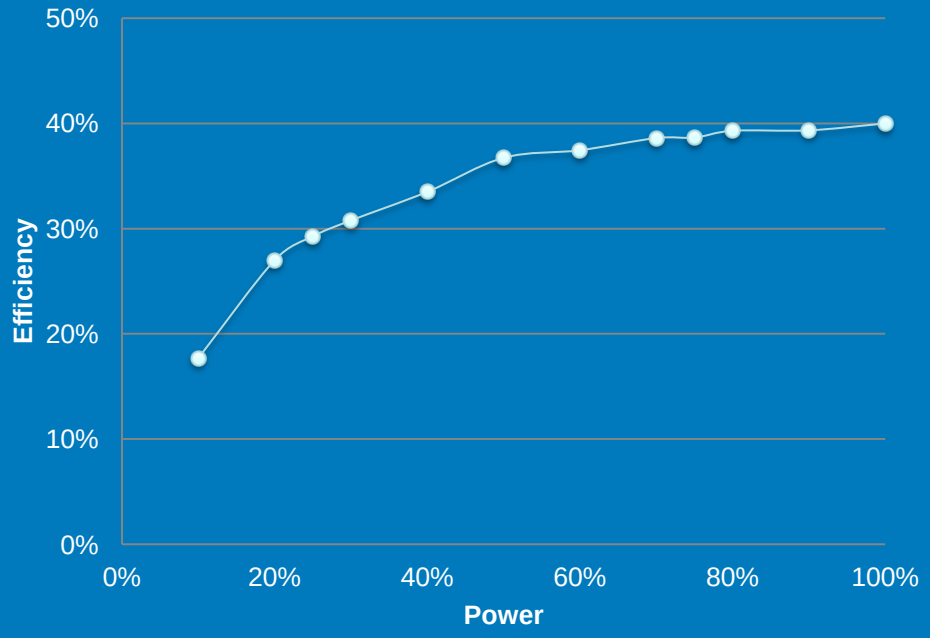
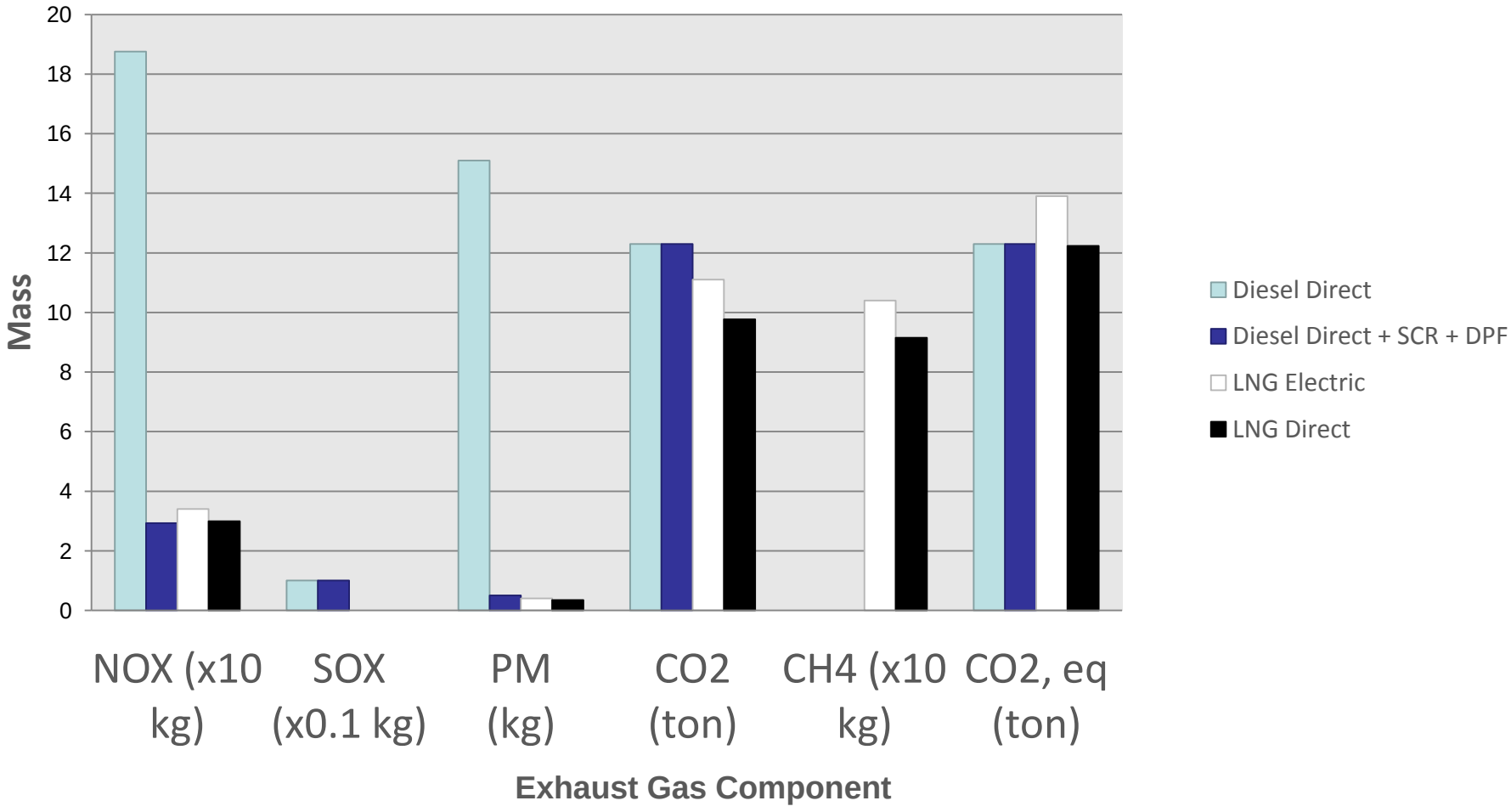
Diesel Engine
MTU 16 V2000 M61



LNG Engine
MHI GS 12R-PTK Miller



EMISSIONS COMPARISON



Source: Damen Shipyards

FLEET CONCEPT FERRY SERVICE TERSCHELLING

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Current fleet





Option 1: 1 new Ropax 900 pax, 92 PAE




Option 2: 2 new Ropax 600 pax, 60 PAE, adjustment freight Roro Cat




FLEET CONCEPT COMPARISON

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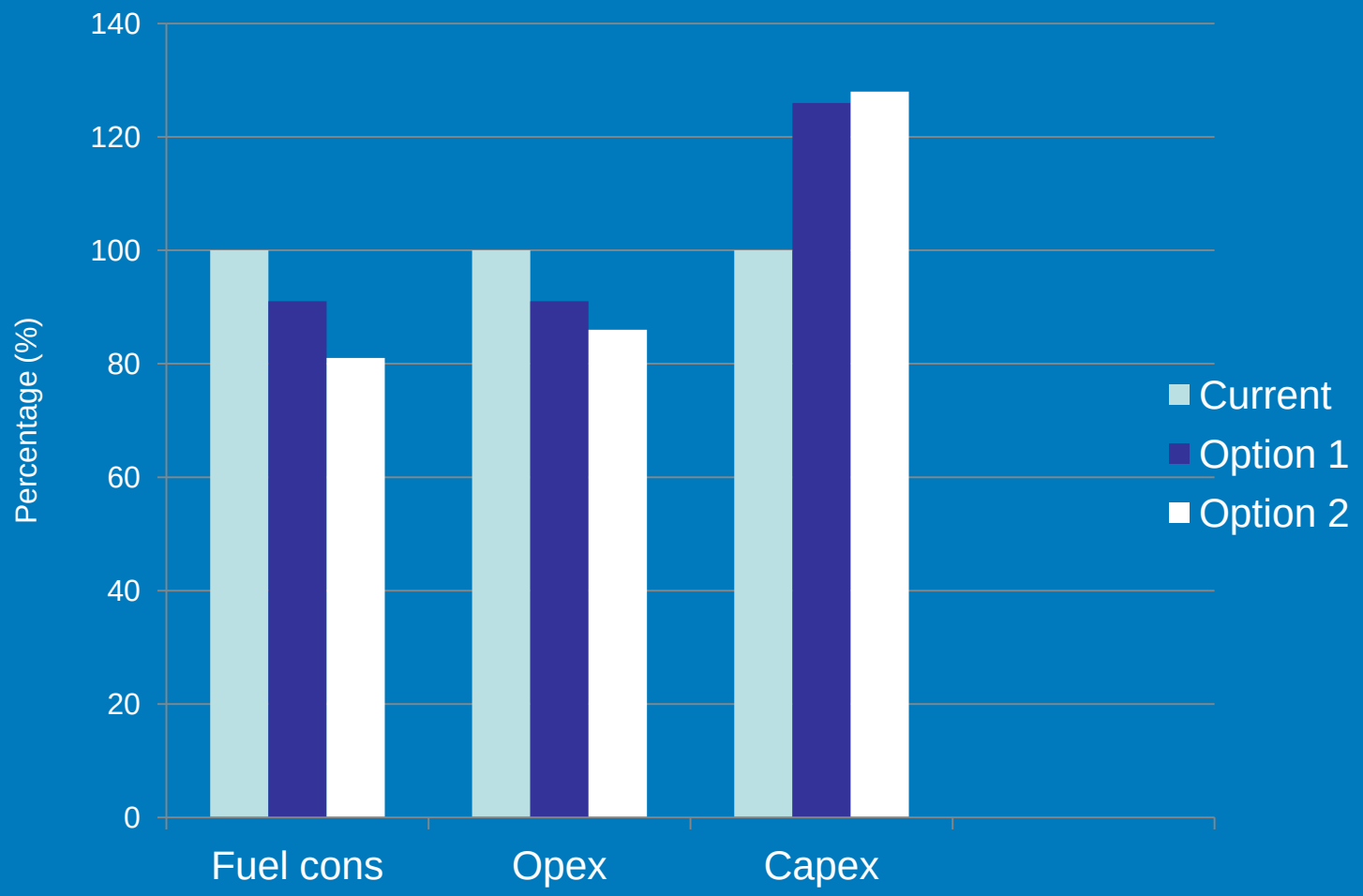
BASED ON DIESEL DIRECT CONFIGURATION



TOTAL COST OF OWNERSHIP (INDICATIVE)

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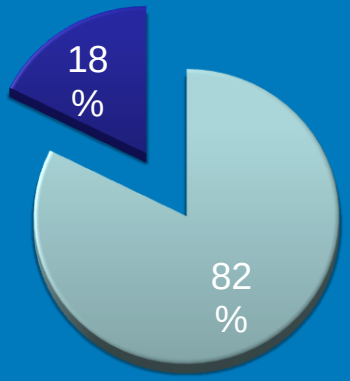
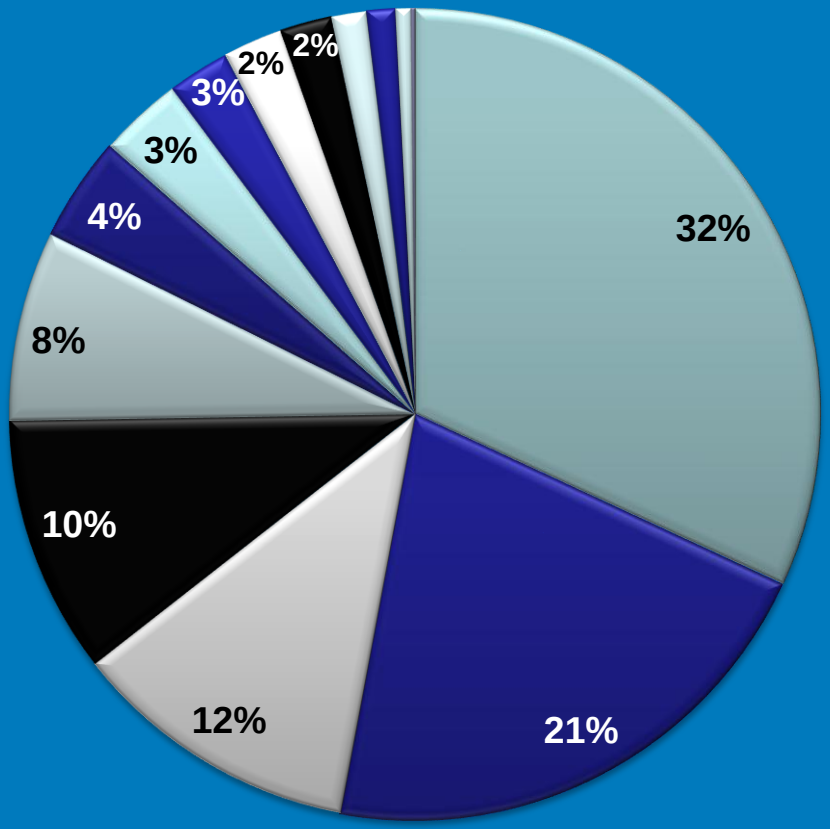
CAPEX vs. OPEX



Operational Expenditures



Source: Damen Shipyards

FUEL COST TODAY

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MGO EN 590 = (USD 864/ton)	=	E 0,137/kWh
HFO 380 = (USD 864/ton)	=	E 0,084/kWh
LNG = (65% of EN 590)	=	E 0,089/kWh
Natural gas (NL)	=	E 0,110/kWh
E-shore supply	=	E 0,062/kWh

Notes

Price level may 2013
Fuel prices vary +/-25%
LNG is linked to cost of MGO in many cases
E-shore supply based on Delta energy NL.
Natural gas based on retail price and quality "Dutch gas"

Source: Damen Shipyards

LIFE CYCLE COST

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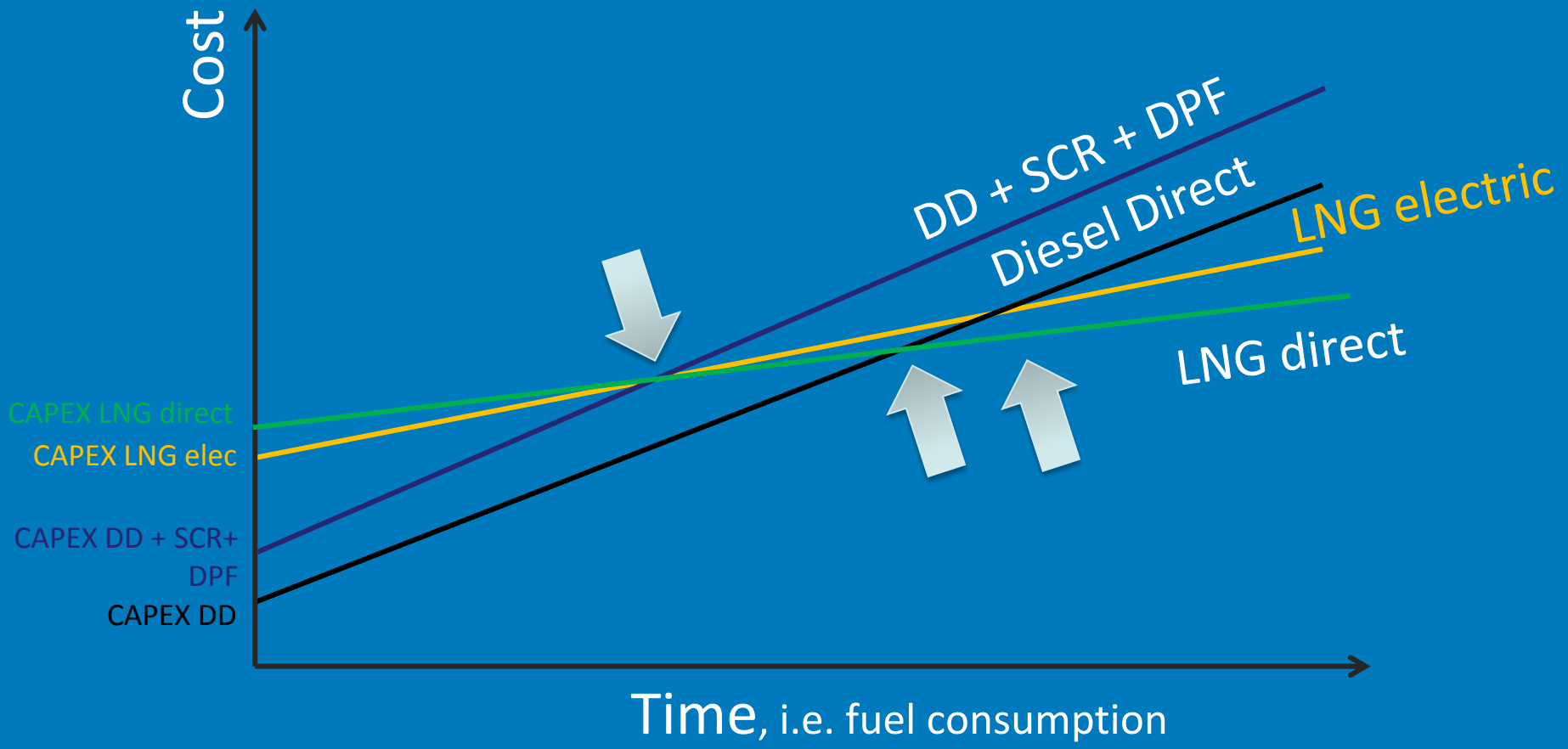

Three parameters influence the economical feasability:

(1) Add. investment cost LNG system, (2) Price difference LNG and fuel oil, (3) Operational profile of the vessel.

Source: Damen Shipyards

CONCLUSIONS

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✓ Preferred fleet configuration, with 2 new Ropax Alucats and adjusted existing Roro Freight cat

✓ LNG Direct propulsion

✓ Aluminium light constructed Cat hull form

✓ Waste heat recovery system can be considered

✓ Divide cargo and pax transport to reduce weight of Ropax Cats

✓ Additional capex for LNG installation and future fuel price development is key

Source: Damen Shipyards

REDERIJ DOEKSEN

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