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# Project “ms Groenland”

*Henk Grunstra*

*Damen Ferries 2013*

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# DAMEN Ferry, an Assessment of Sustainable RoPax Ferry Concepts

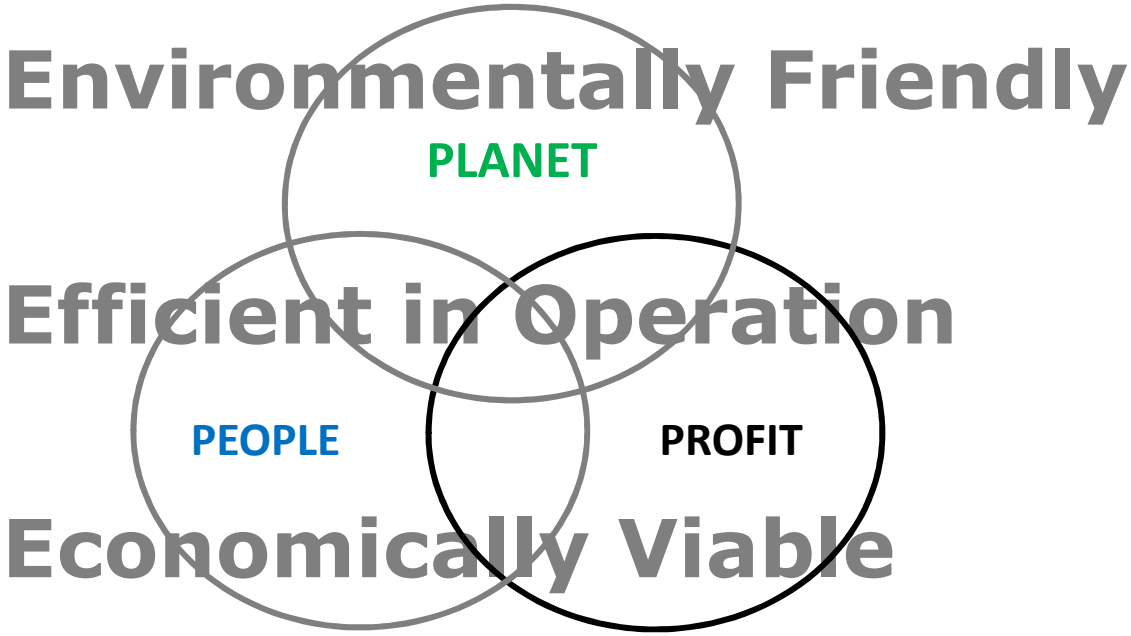
This work is part of the iTransfer project, which is funded by the North Sea Region programme, part of the EU Inter-regional (Interreg) initiative and the European Regional Development Fund

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

# DAMEN Philosophy



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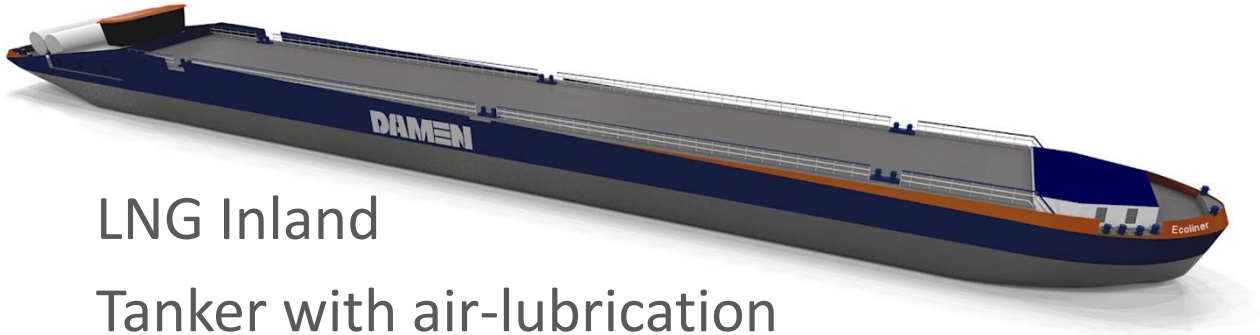


LNG Inland

Tanker with air-lubrication


Hybrid Tug & LNG Tug


PSV with aftertreatment and CD notation

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# Targets

***Less Energy = CO2 reduction***

***No SOX***

***No PM***

***Significant  NOX reduction***

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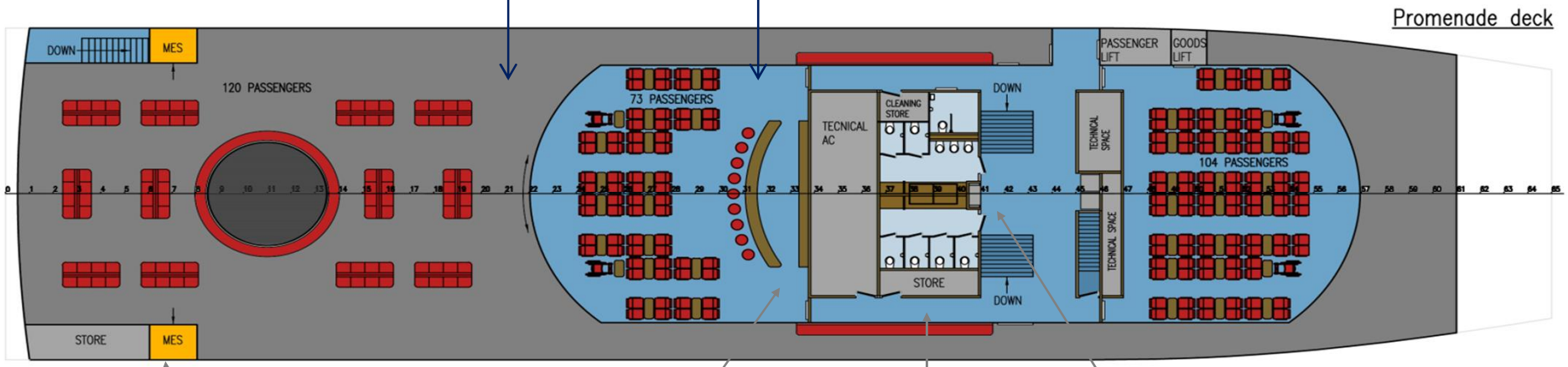
# PRINCIPAL CHARACTERISTICS

- 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

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# PRINCIPAL CHARACTERISTICS

•Family lounge / playground

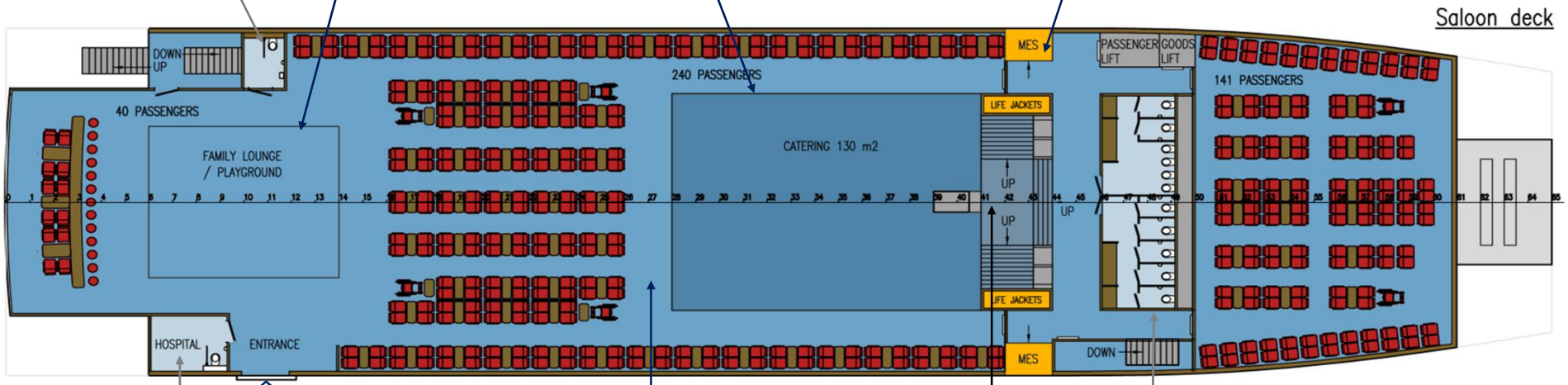
•Catering facilities

•Life jackets storage space on both sides

•Disabled person toilet

•Evacuation system

•1 Passenger lift and 1 goods lift




•Passenger entrance

•Passenger saloon 417 seats

•Central staircase

•Hospital treatment room on saloon deck

•Grouped passenger sanitary spaces

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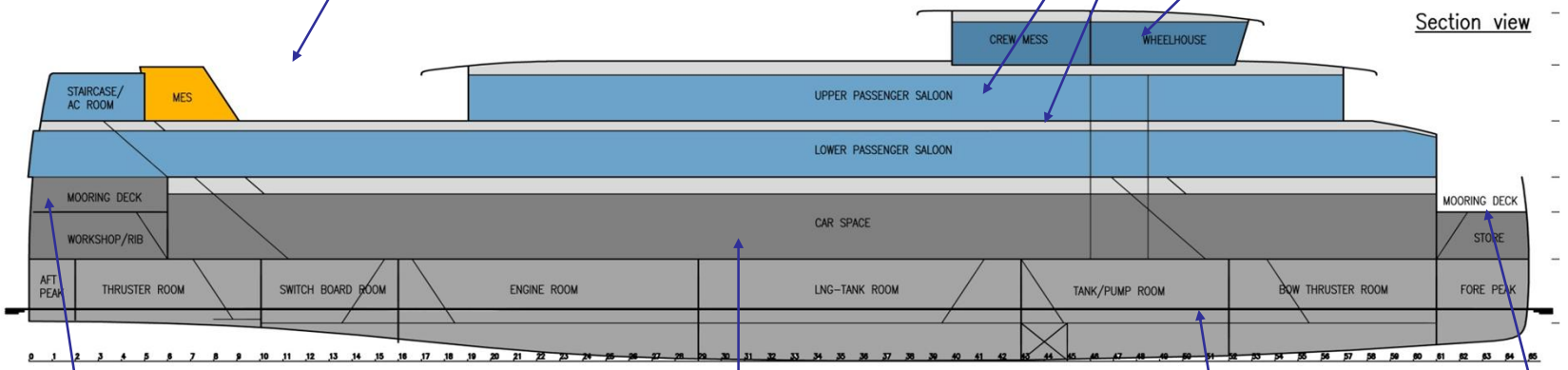
# PRINCIPAL CHARACTERISTICS

•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**

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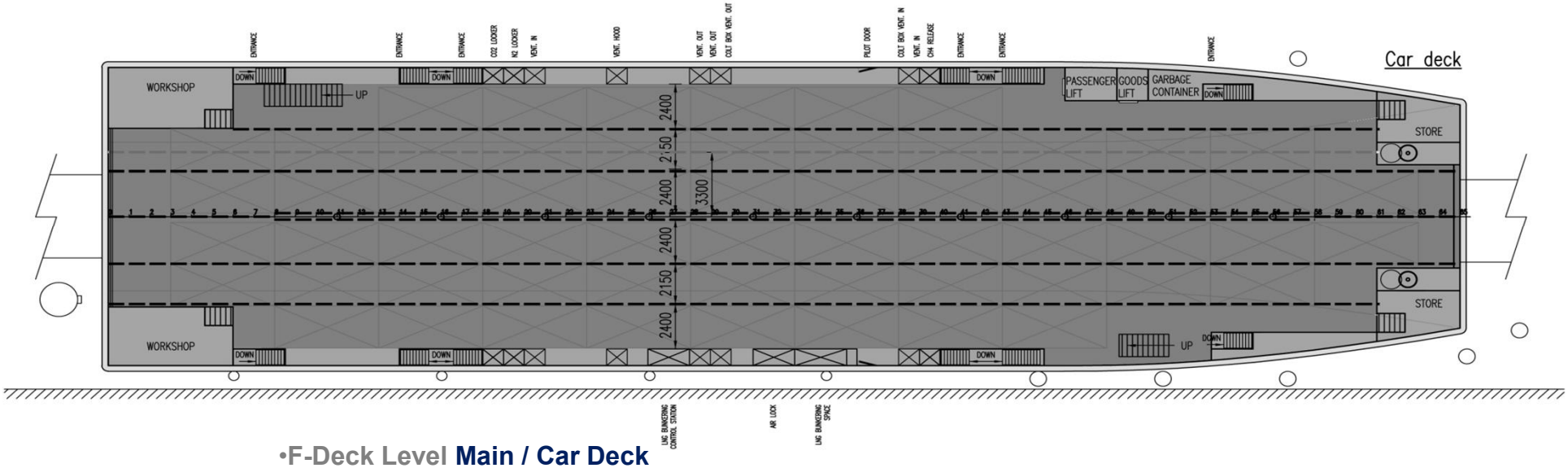
# PRINCIPAL CHARACTERISTICS




- F-Deck Level **Main / Car Deck**
- Car Deck Height, free/clear: 3.25 m
- Passenger Cars Capacity: 60 in 6 lanes

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## Sustainability @ DAMEN

| Step 1: Minimize ship energy needs | | | |
|---|---|---|---|
| Reduce resistance in water/air | Review ship system functions | Enhance system efficiency | Improve energy management |

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# Method

**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

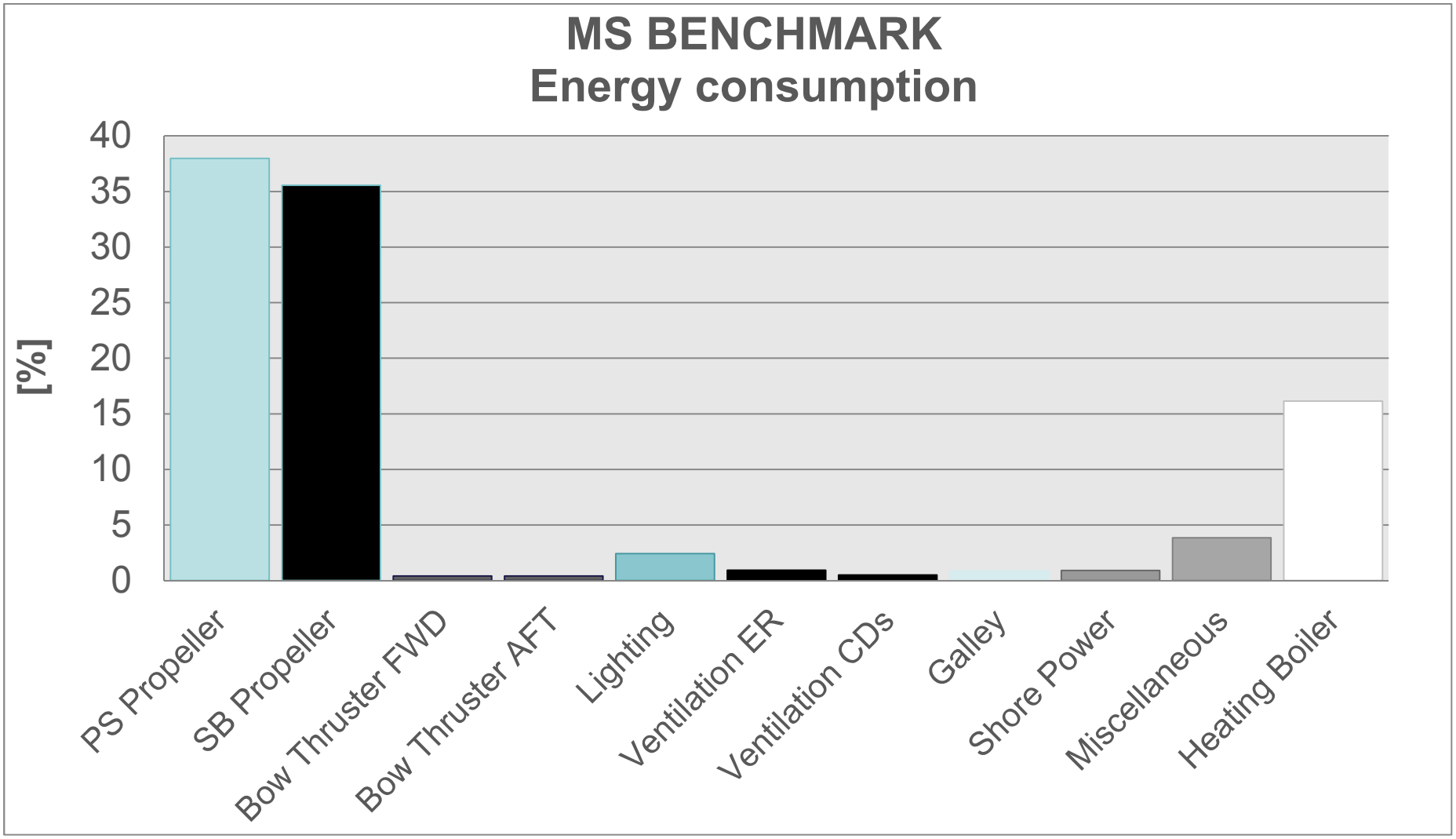
**Energy system**
- mechanical drive FPP
- mechanical drive CPP
- electrical drive
- ICE - electrical hybrid
- DC platform + PM engines

***step 3 minimize emmissions***

**Fuel**
- Diesel EN 590 low sulpher
- LNG
- CNG
- Methanol

**treatment**
- Selective Catalyst Reducer (SCR)
- SCR + filter
- Boil off gas turbine

# Energy consumption



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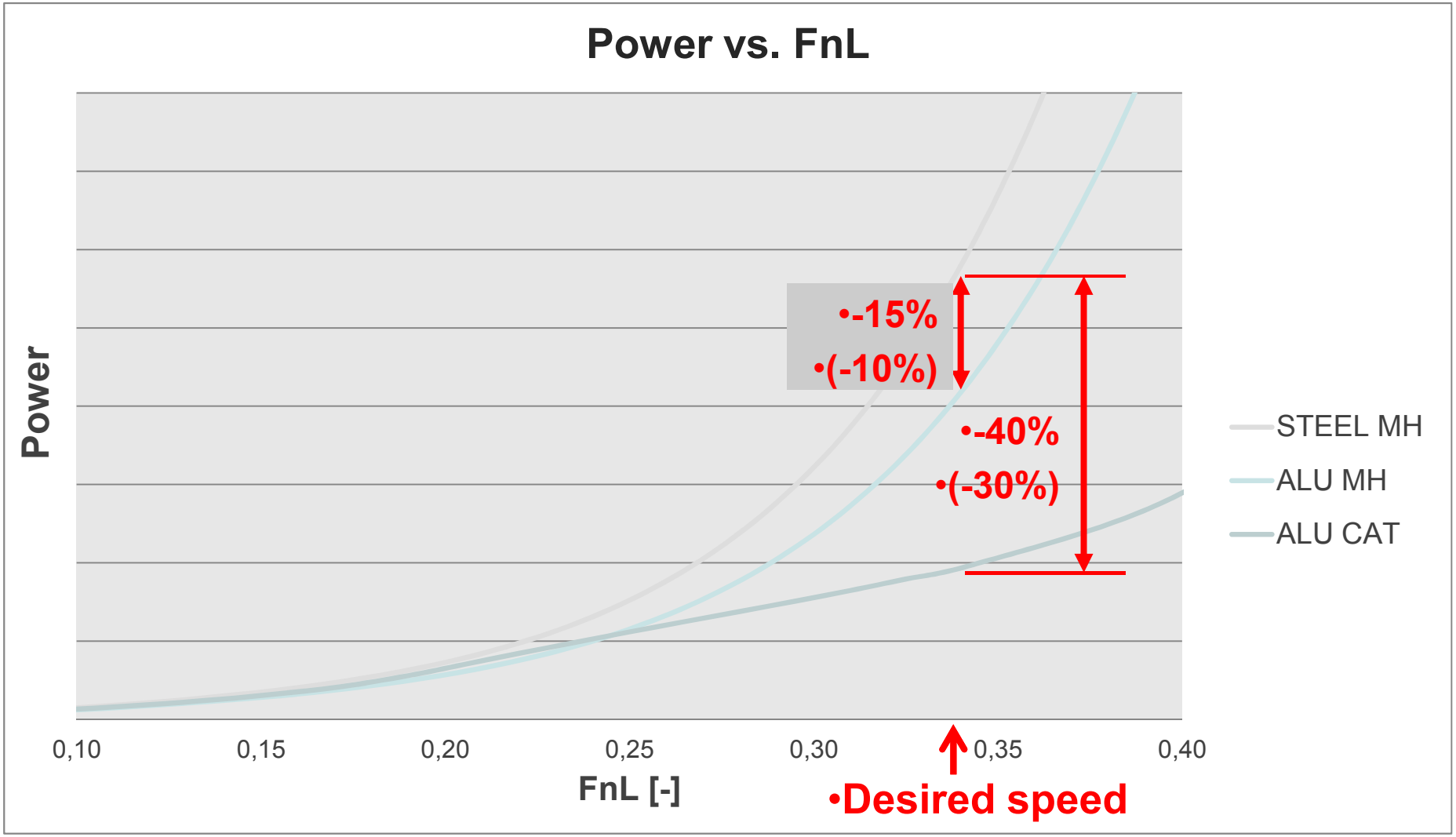
## Steel MH → Alu MH → Alu CAT



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## PROPULSION CONCEPTS

**Base:** Diesel Direct + generator sets

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

**Alt. 2** LNG – Electrical propulsion

**Alt. 3** LNG direct propulsion

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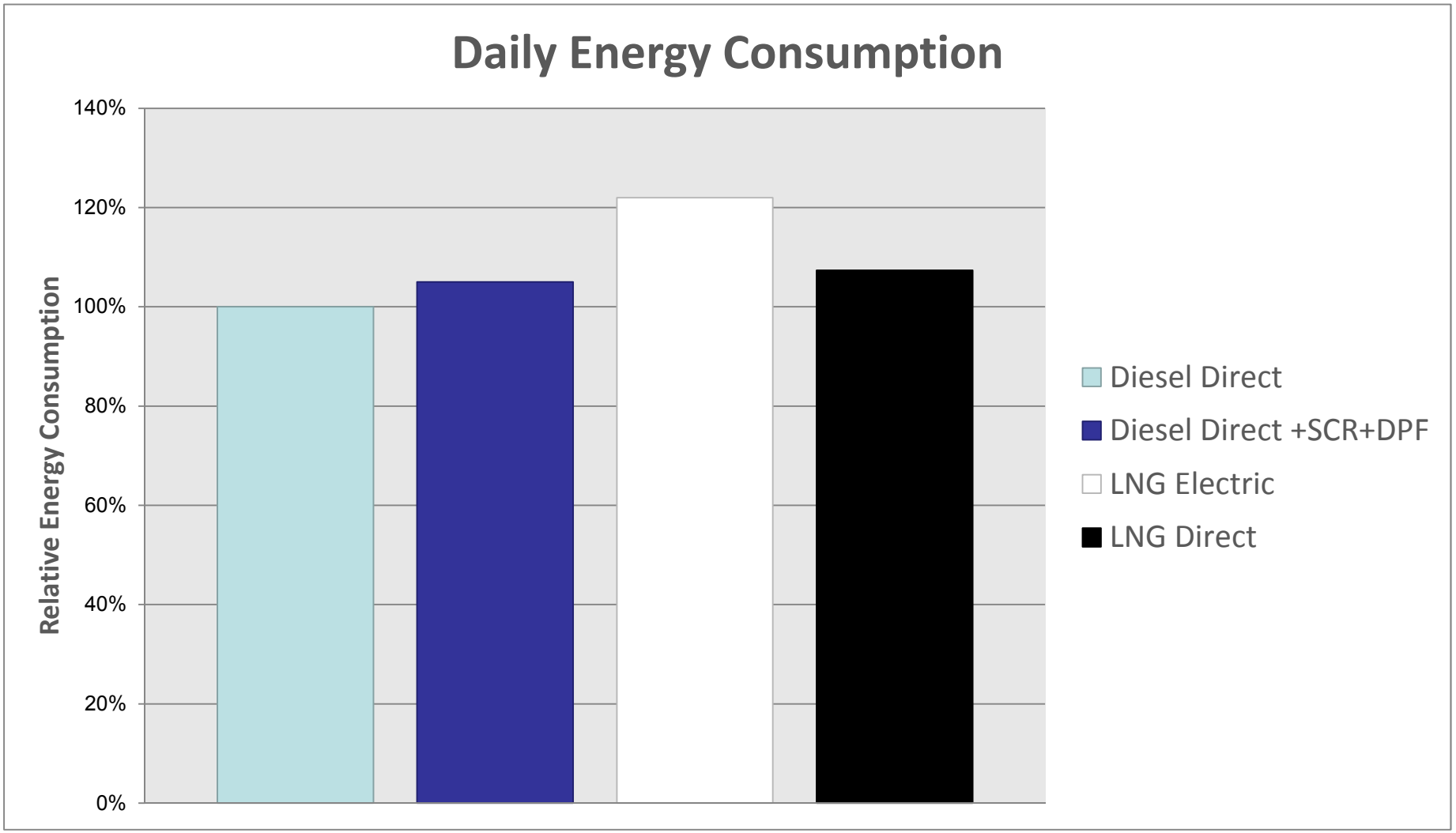
# Energy Consumption Comparison



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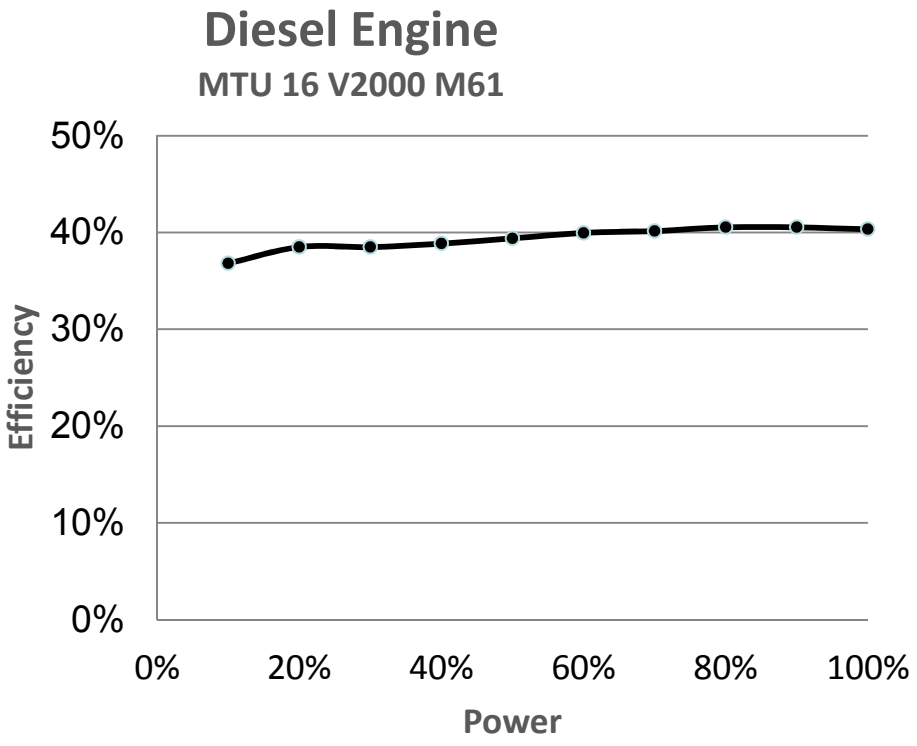
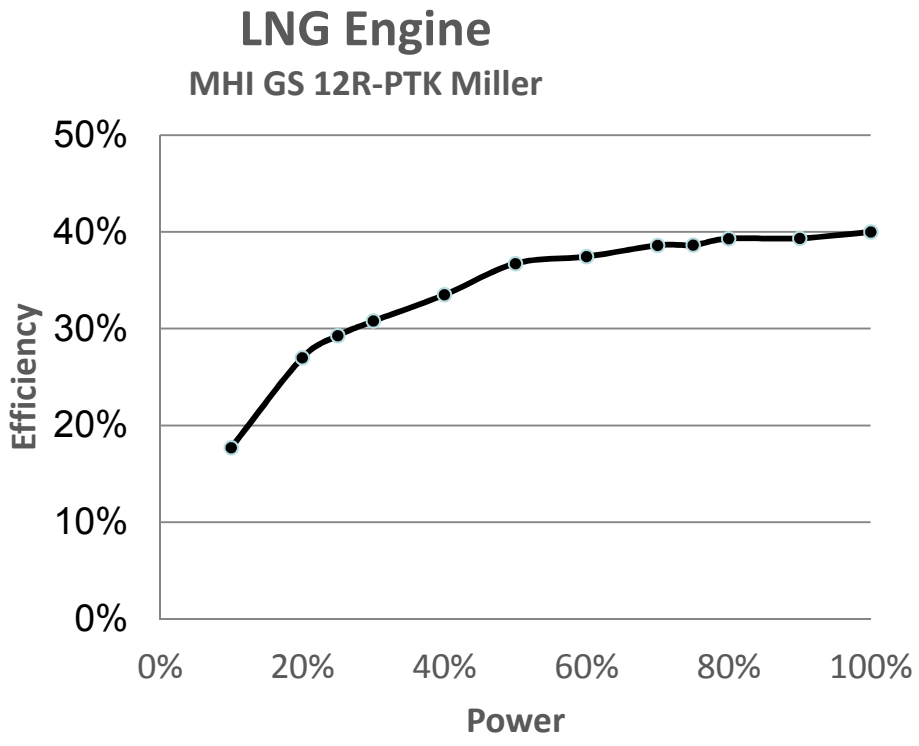
## LNG Genset vs Diesel Engine Efficiency




•No LNG engines available for Gas-Direct at the time of this project (mid. 2012)

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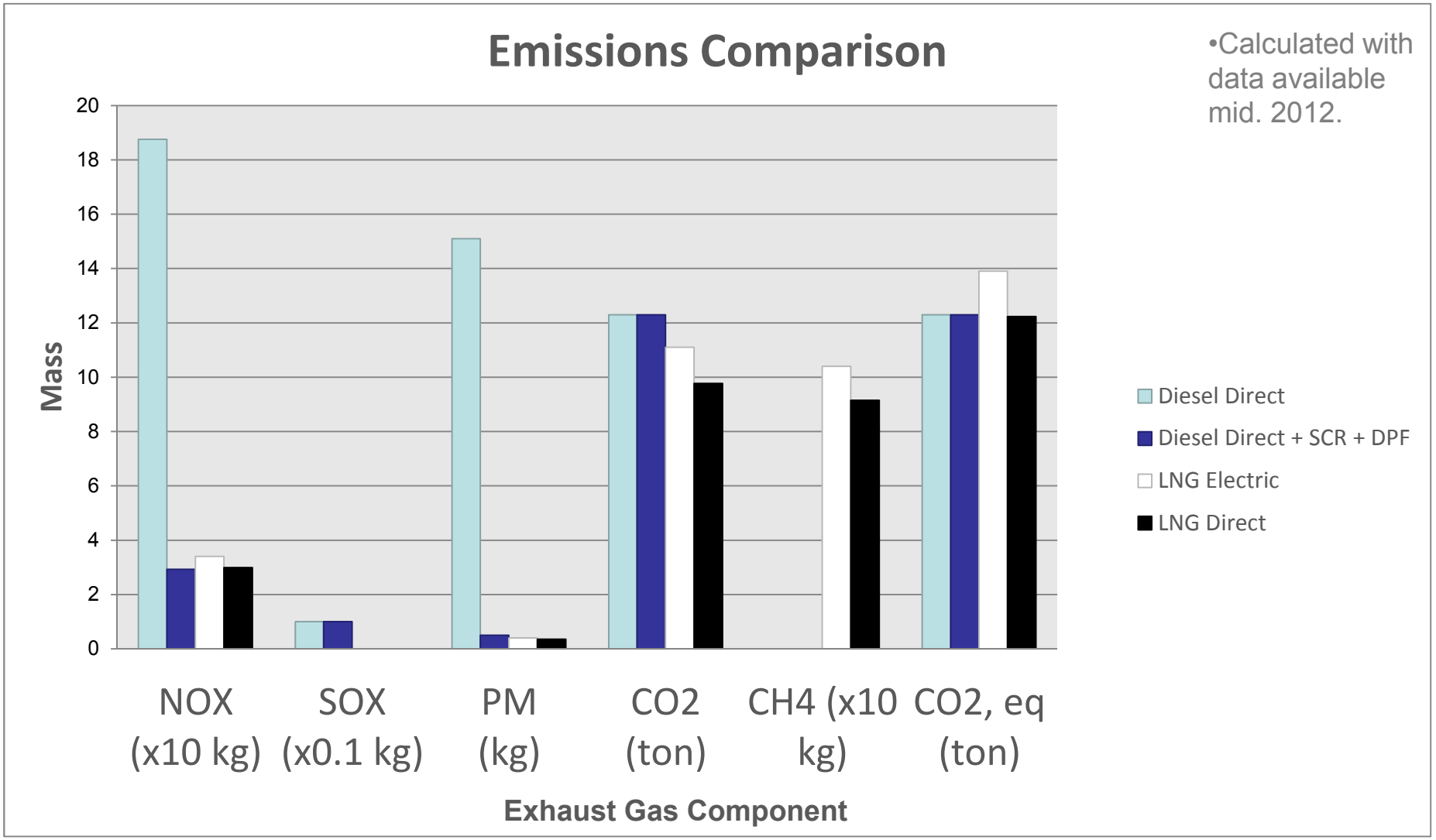
## Emissions comparison



## Green features

- Aluminum Construction
- Light weight interior
- Catamaran hull form
- Heat insulated windows
- Waste heat for heating of the vessel and systems (24/7 self sufficient)
- Reduced AC capacity
- LED lights
- Solar panels

# Fuel cost today

- 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
- Aardgas (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.*
- *Aardgas based on retail price and quality "Dutch gas"*

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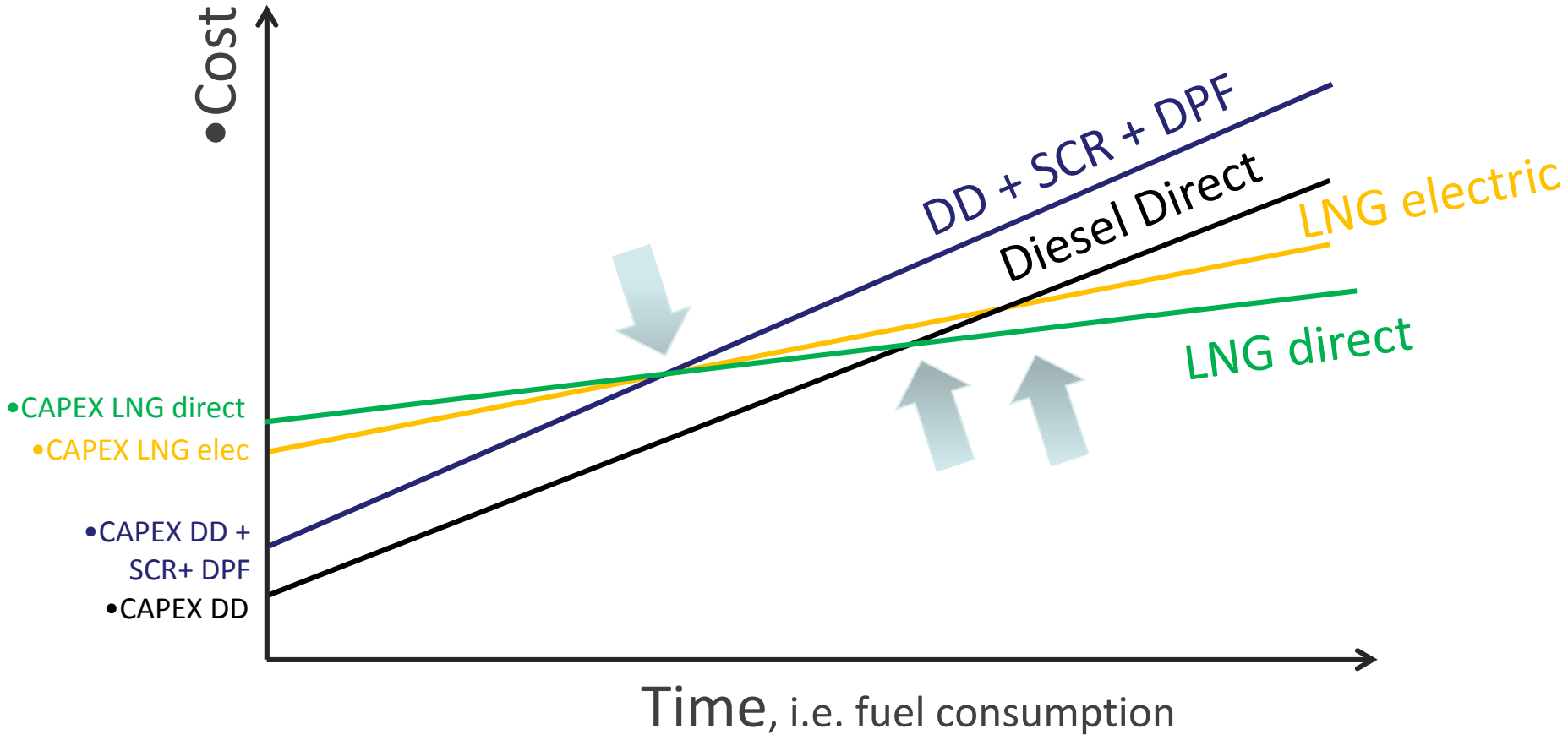
## Life Cycle Cost




- **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.**

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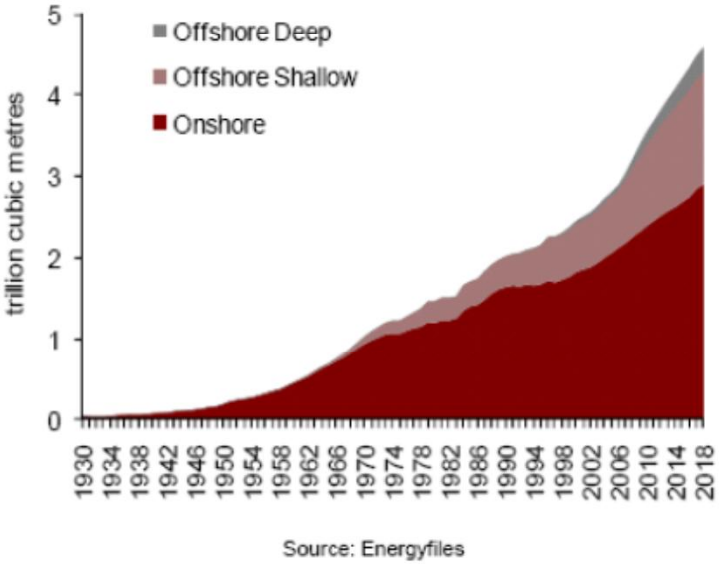
# Future of energy

## Introduction

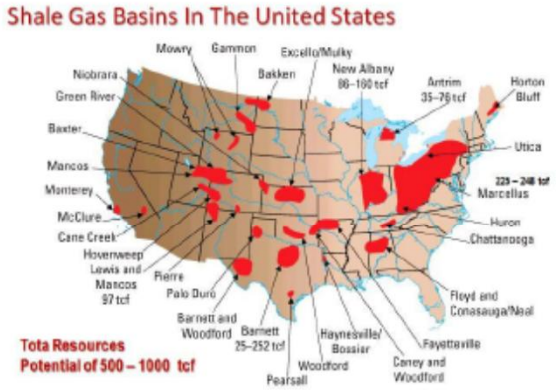
*What's the availability of gas?*

### Natural Gas Production




Source: Energyfiles

### Unconventional Gas:




### Flare gas

### Offshore gas FLNG:

### Bio-gas:

# conclusions

## *Think big*

- Fleet management (2 small vessels instead of 1 large)
- Reduce energy demand, decrease speed, decrease weight etc.
- Total vessel concept
- Fuel consumption and cost is key
- LNG direct drive

# conclusions

## *A lot of work to be done*

- LNG equipment needs further development
- LNG cost development(s) uncertain
- LNG infrastructure slowly developing but forward
- Significant gain can be reached with new ferry concepts that integrate shore logistics and water transport
- Electric power from shore supply & energy storage
- Battery developments including super capacitors
- Waste heat energy

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•CONTACT DETAILS:
•Damen Shipyards Gorinchem
•PO Box 1
•4200 AA Gorinchem
•The Netherlands

Phone +31 (0) 183 63 99 11
Fax +31 (0) 183 63 95 05
E-mail ferries@damen.nl
Website www.damen.nl