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# Options and Trends in Propulsion of future River Cruise Vessels

Research & Development

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Modernisation of Danube Vessels Fleet

Vienna, March 8<sup>th</sup> 2019



  
**MEYER WERFT**  
PAPENBURG 1795

# MEYER Group



Modernisation of Danube Vessels Fleet

Propusion of Future River Cruise Vessels

March, 8<sup>th</sup> 2019

# Portfolio

Cruise Ships



River Cruise Ships



(Cruise) Ferries



Passenger Ships



Island Ferries



Gas Tankers



Research Vessels



Container Ships



# Emissions

## Pollutants

Harmful for health, “poisonous”, “dirty air”

- Soot, particulate matter (PM)
- Nitrogen oxides  $\text{NO}_x$
- Sulphur oxides  $\text{SO}_x$

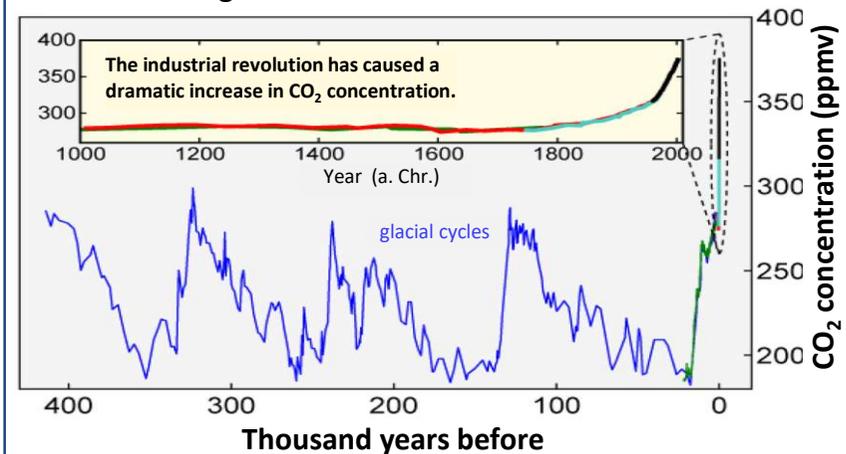


## Greenhouse gases

Harmful to the climate, Global warming

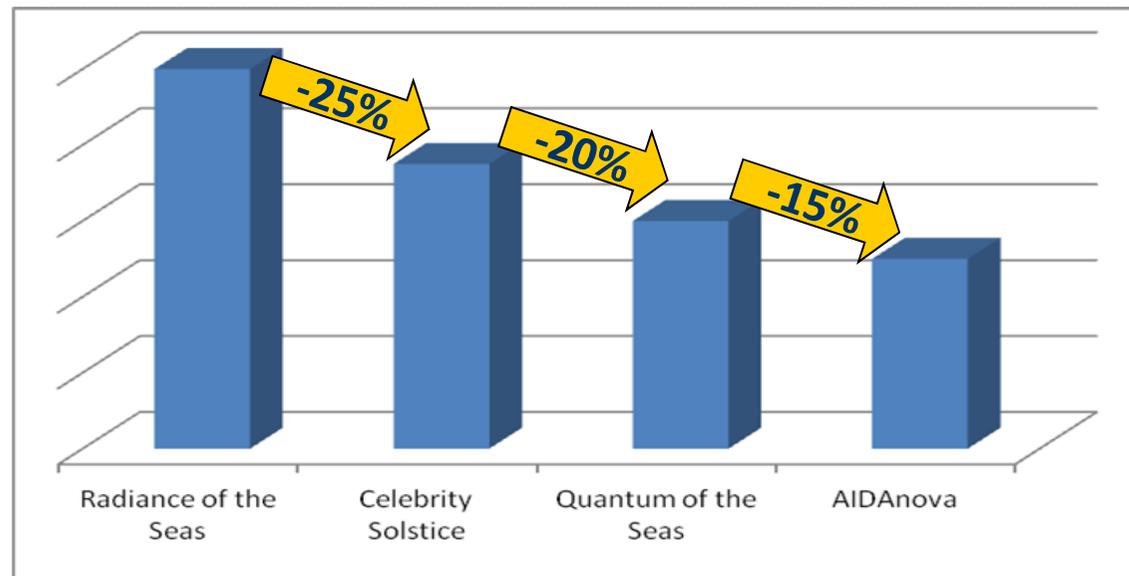
- Carbon dioxide  $\text{CO}_2$
- Unburned methane  $\text{CH}_4$

### Change of carbon dioxide content



# Energy Efficiency

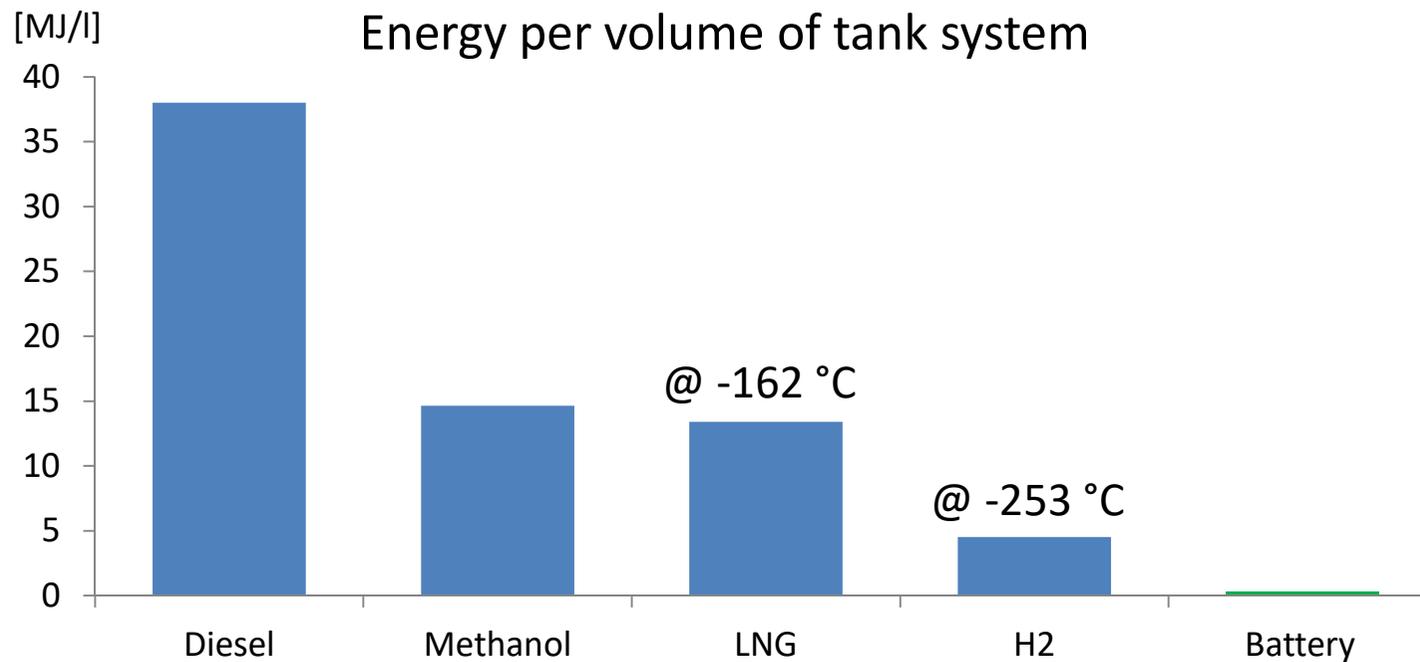
Less energy demand -> less effort:



... but efficiency alone  
is not enough

2001	2008	2014	2018
90.090 GT	122.000 GT	167.400 GT	183.900 GT
1.056 cabins	1.426 cabins	2.074 cabins	2.626 cabins
40.0 MW	41.0 MW	41.0 MW	37.0 MW

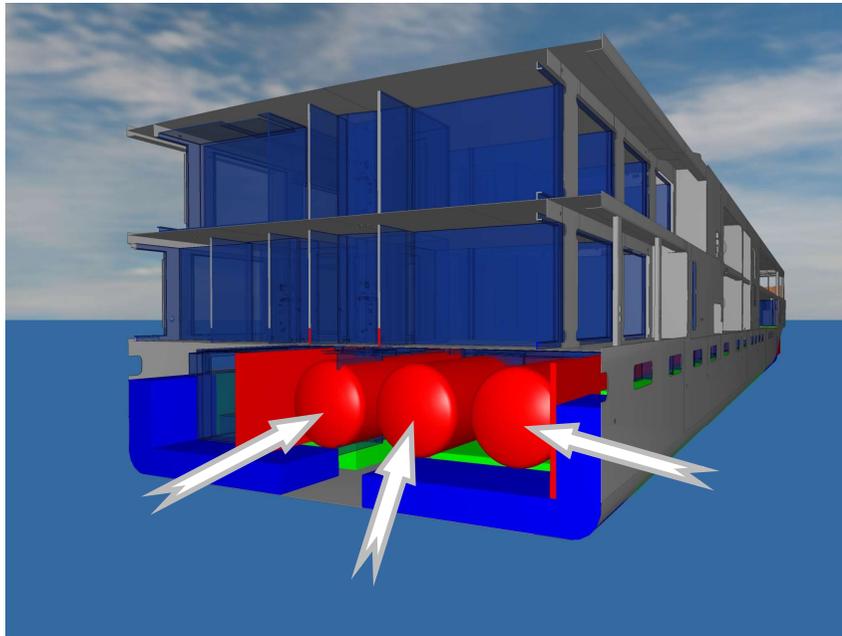
# Energy storage for seagoing vessels



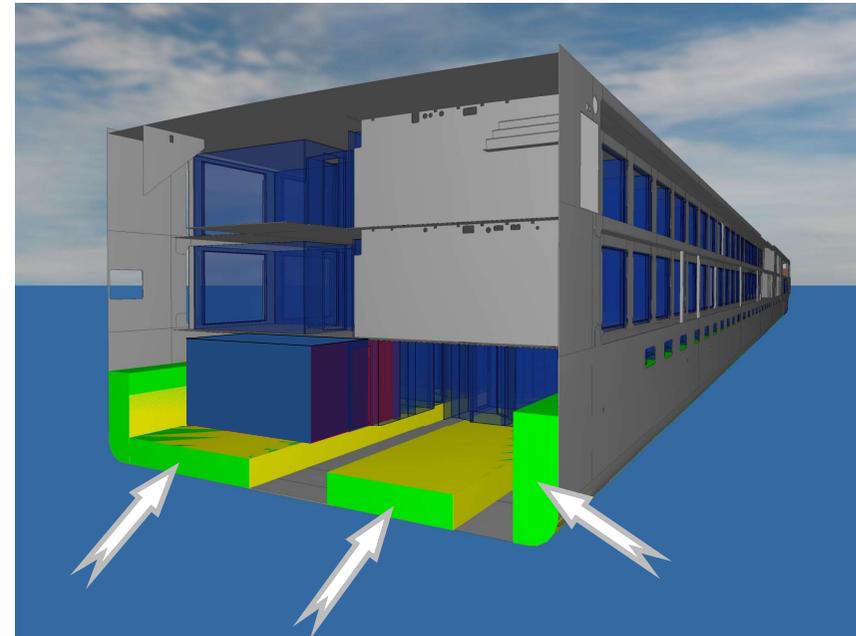
Battery and H<sub>2</sub> not suitable for long distances

# Energy Storage on Board

Methane (LNG)



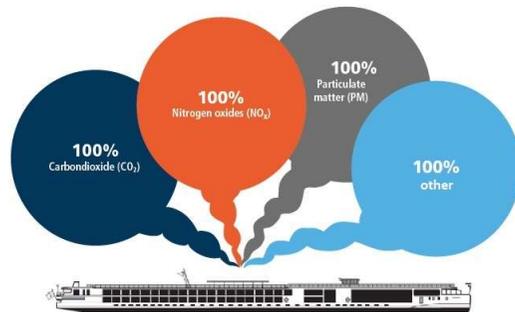
Methanol



Convenient integration required

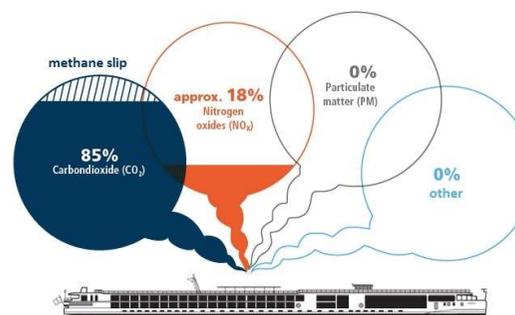
# Fossil Fuels

## Conventional



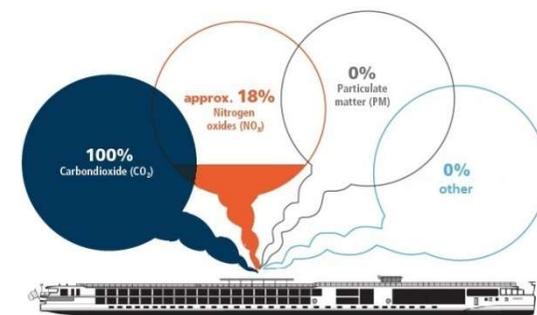
- exhaust gas treatment necessary

## LNG



- gas plant, complex integration
- high space demand

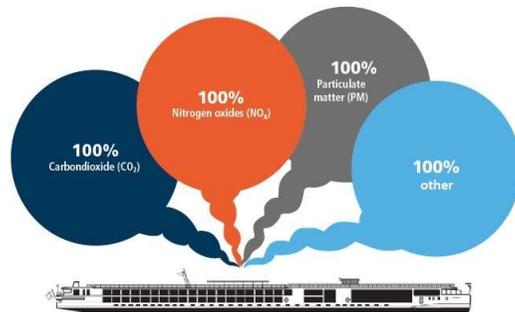
## Methanol



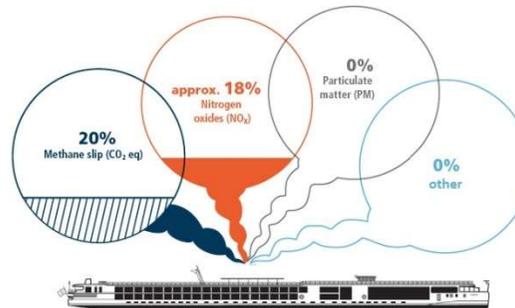
Reduce pollutants with clean fuels

# Renewable Fuels

## Fossil Reference

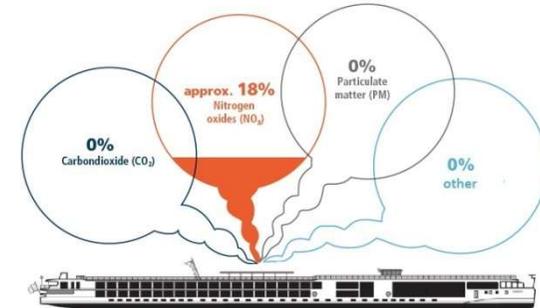


## LNG



- Methane slip  
-> not climate neutral

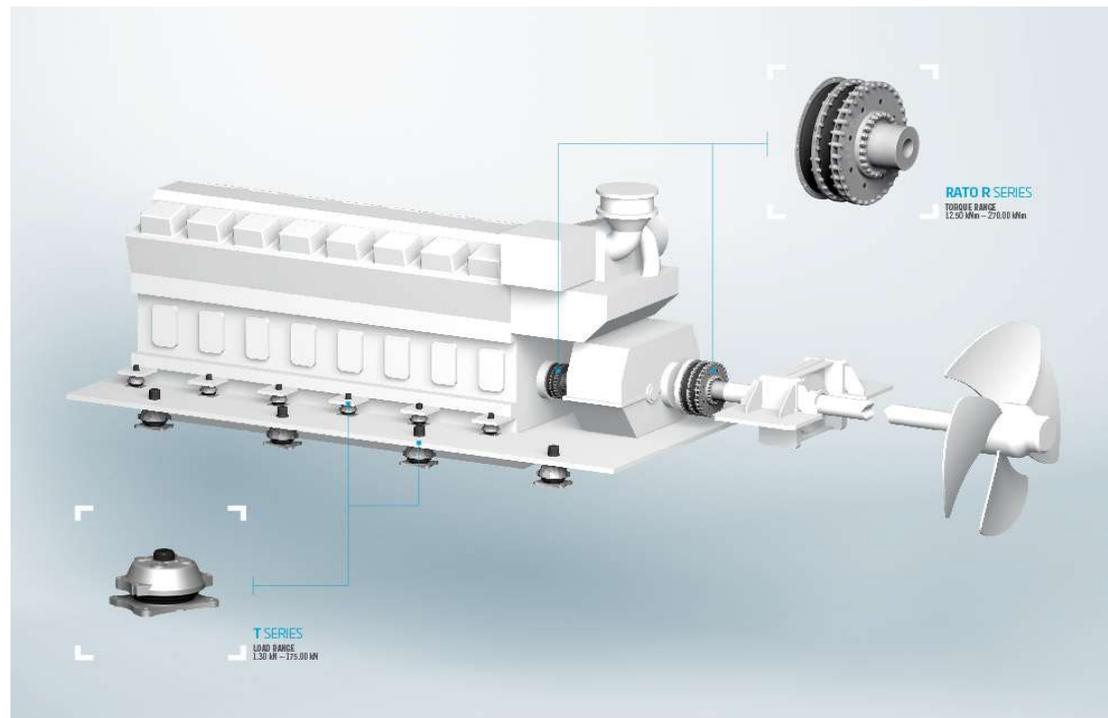
## Methanol



- climate neutral

Reduce Greenhouse gases with renewable fuel production

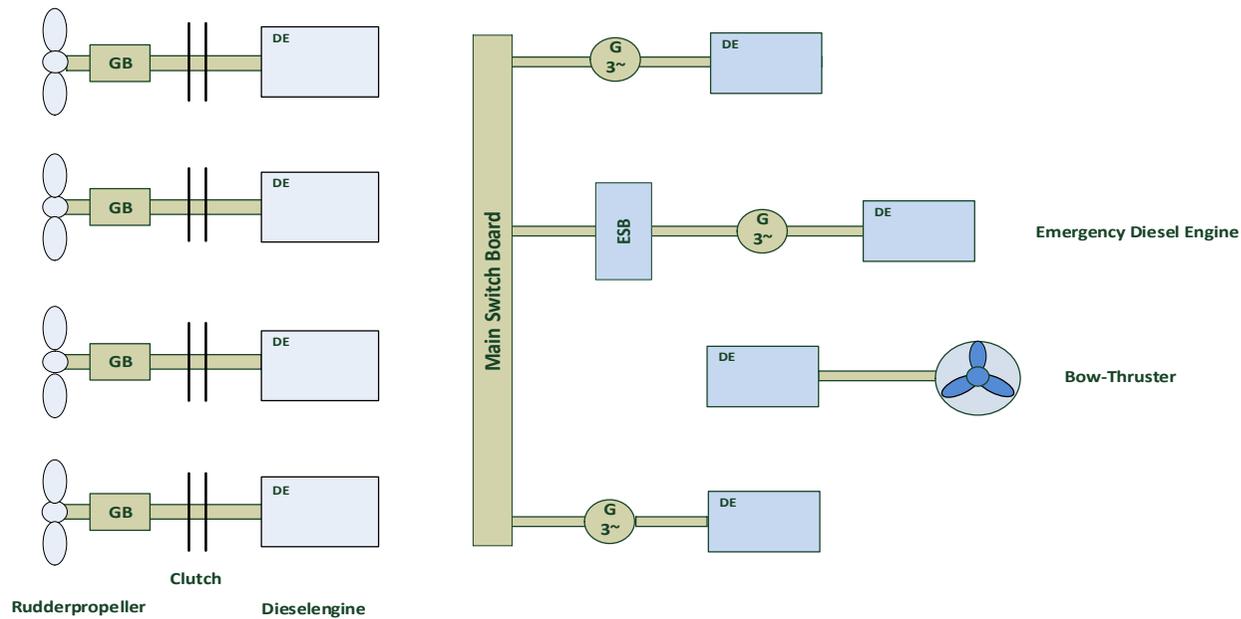
# Diesel-Mechanic Drive



Quelle: [www.vulkan.com](http://www.vulkan.com)

# Diesel-Mechanic Plant

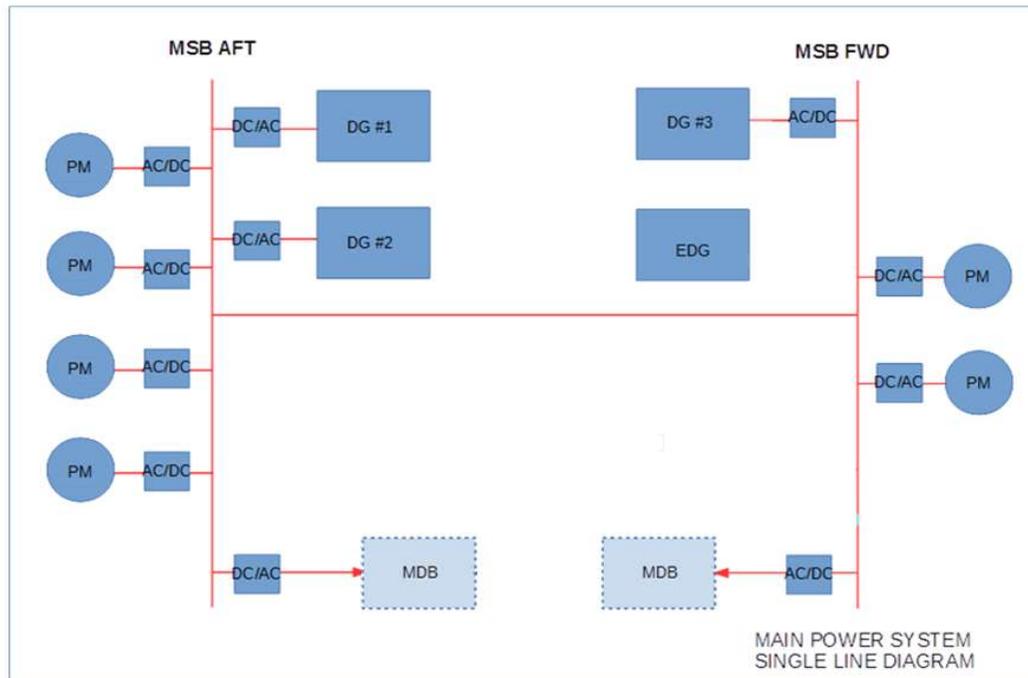
Engine/ Propulsion Concept



# Usual Propulsion

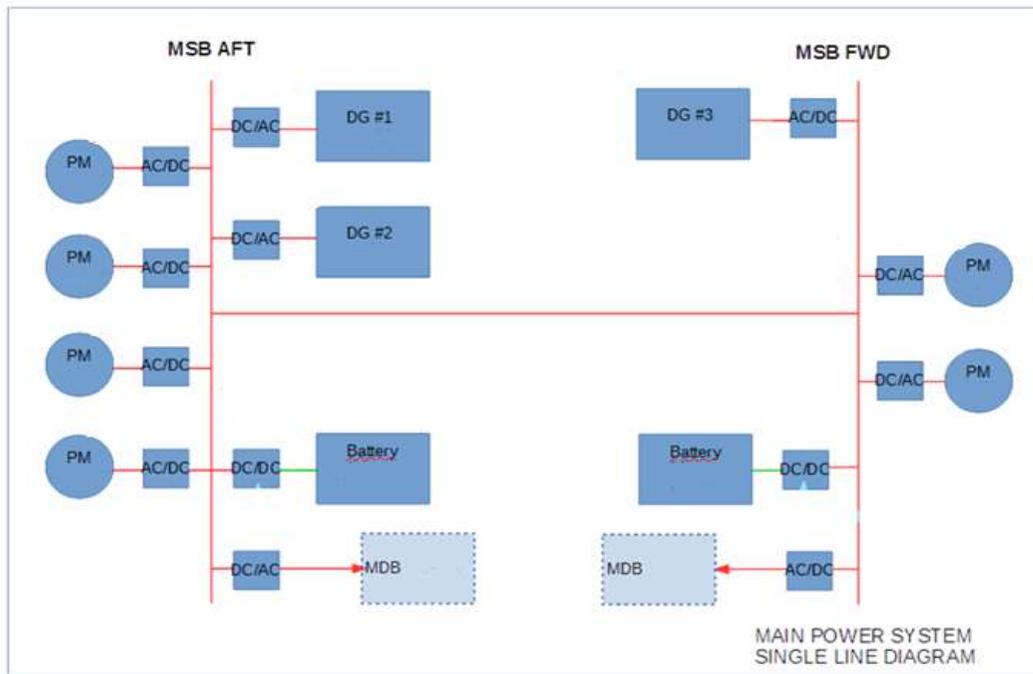


# Diesel-Electric Drive



- electric drive increases flexibility
- engine switch off in part load
- DC enables variable engine speed

# Direct Current Drive with Batteries



- integration of alternative sources (batteries, photovoltaics, fuel cells)

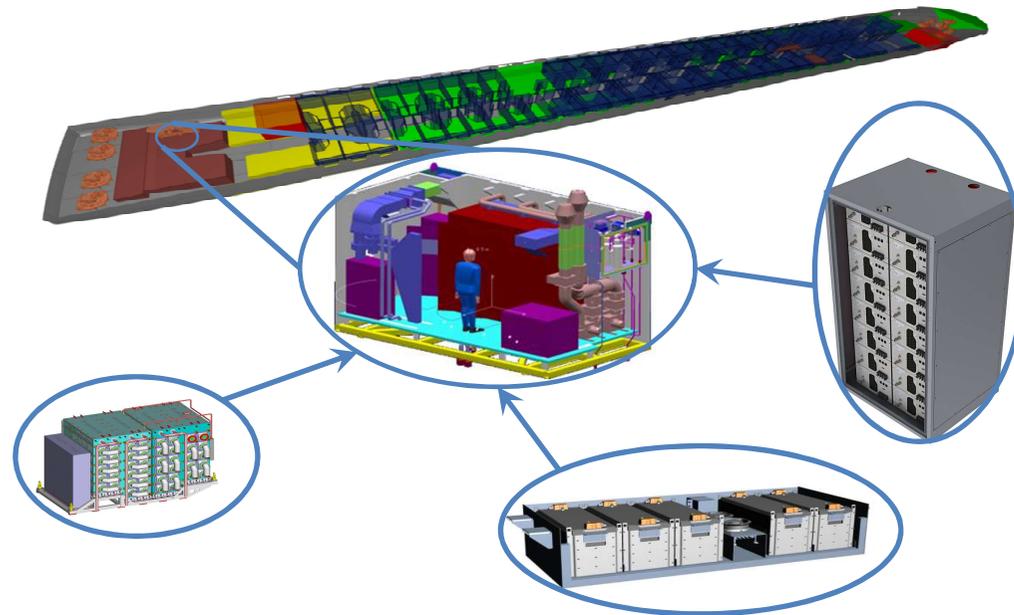


# The Concept

## Modular power generation

### The Fuel Cell Power Room:

- Scalable and autonomous power supply unit with minimal interfaces to ship
  - Fuel Cell plant
  - Battery plant
  - Independent aux. systems
  - Waste heat recovery
  - Safety systems
- Flexible arrangement in ship (no noise and exhaust issues)

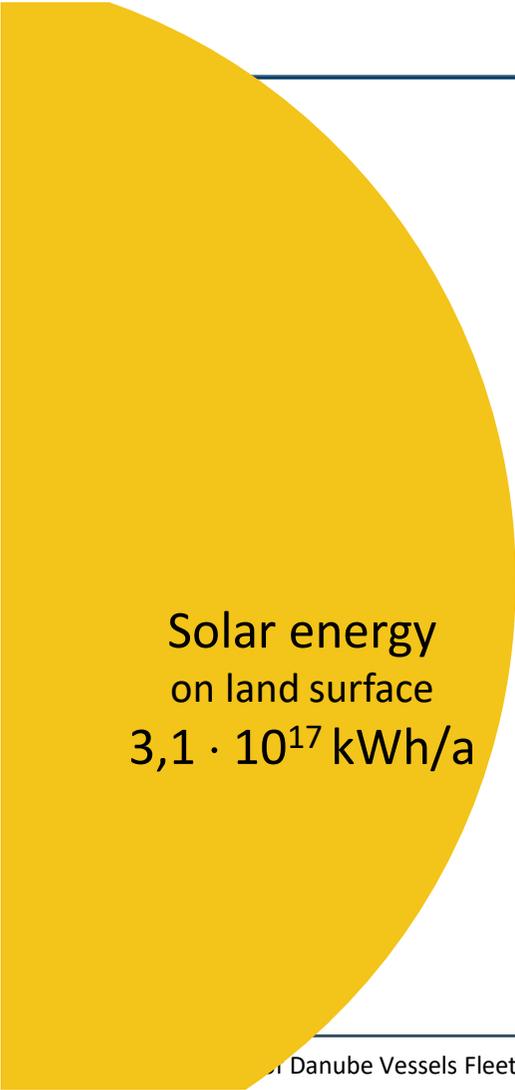


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# Summing-up

- **Sustainable and simple – from well to propeller**
- **higher efficiency – lower effort**
- **converters and systems required**
- **Clean fossil fuels as transition**

# Energy quantities



Solar energy  
on land surface  
 $3,1 \cdot 10^{17}$  kWh/a



World energy demand  
 $1,6 \cdot 10^{14}$  kWh/a

Sufficient renewable energy available

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A graphic illustration of two large ships, likely cruise ships, shown in silhouette against a light blue background. The ships are positioned on the right side of the page, with their reflections visible in the dark blue water below them.

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