Autonomous vessels & Green and clean shipping

EUSBSR Seminar

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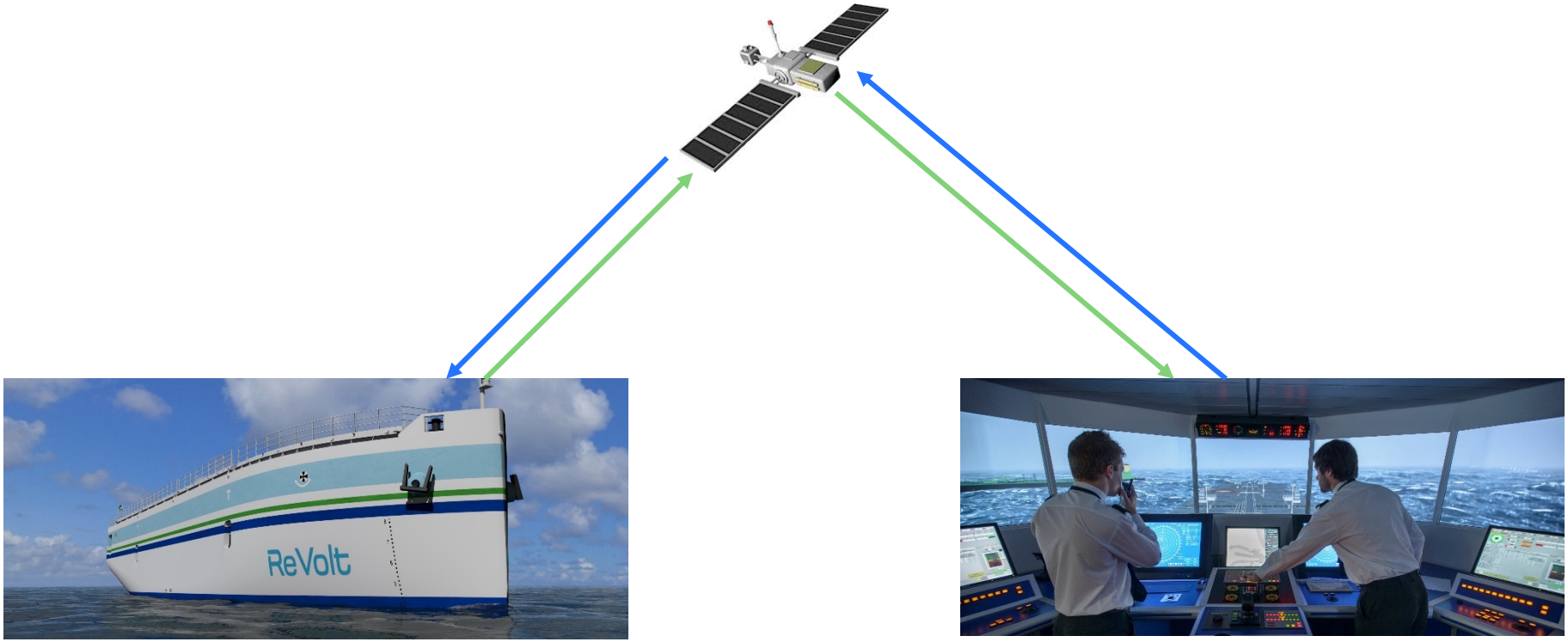
06 February 2018

The unmanned ship

The unmanned ship

- Remote Control
- Autonomy

Remote Control

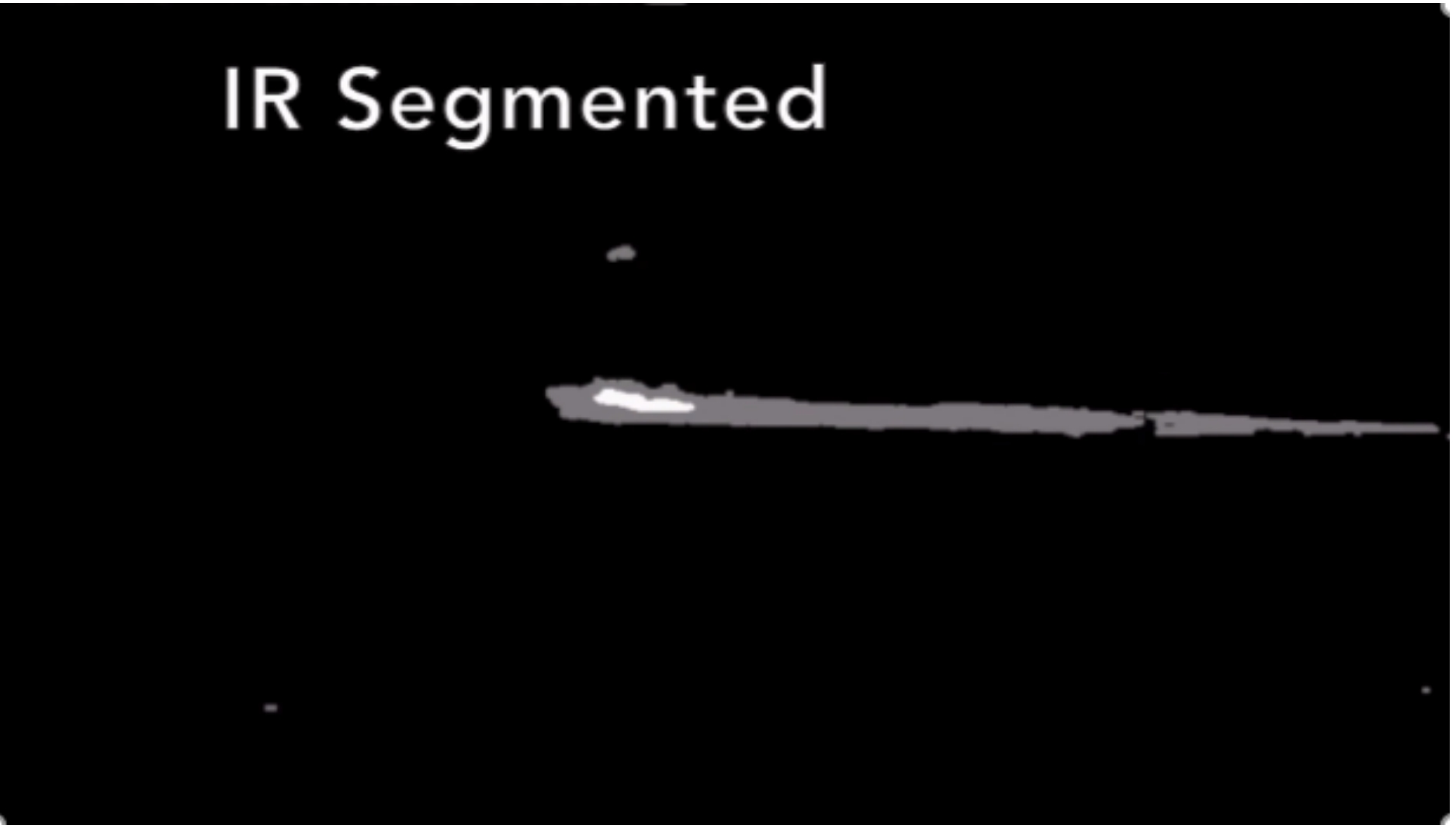


Remote control - Navigation

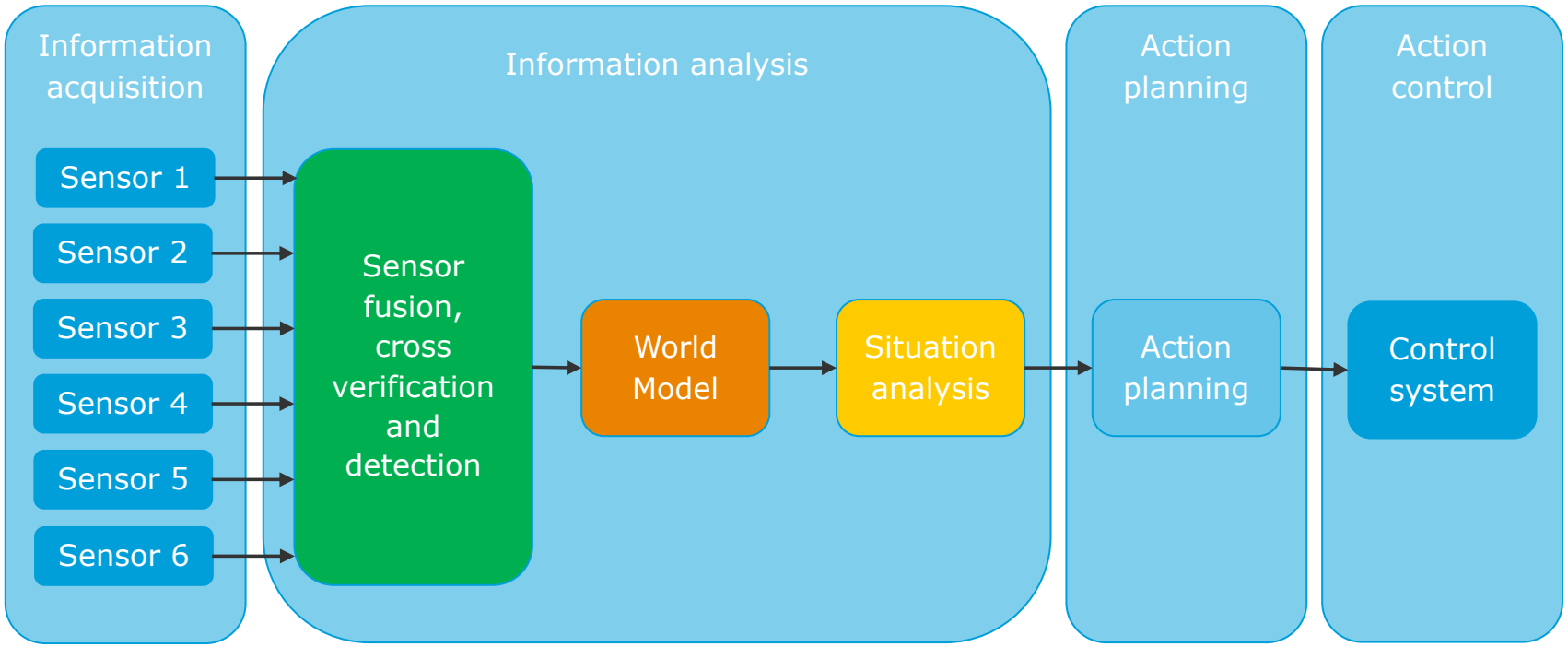
Remote control - Applications

Remote control - Navigation

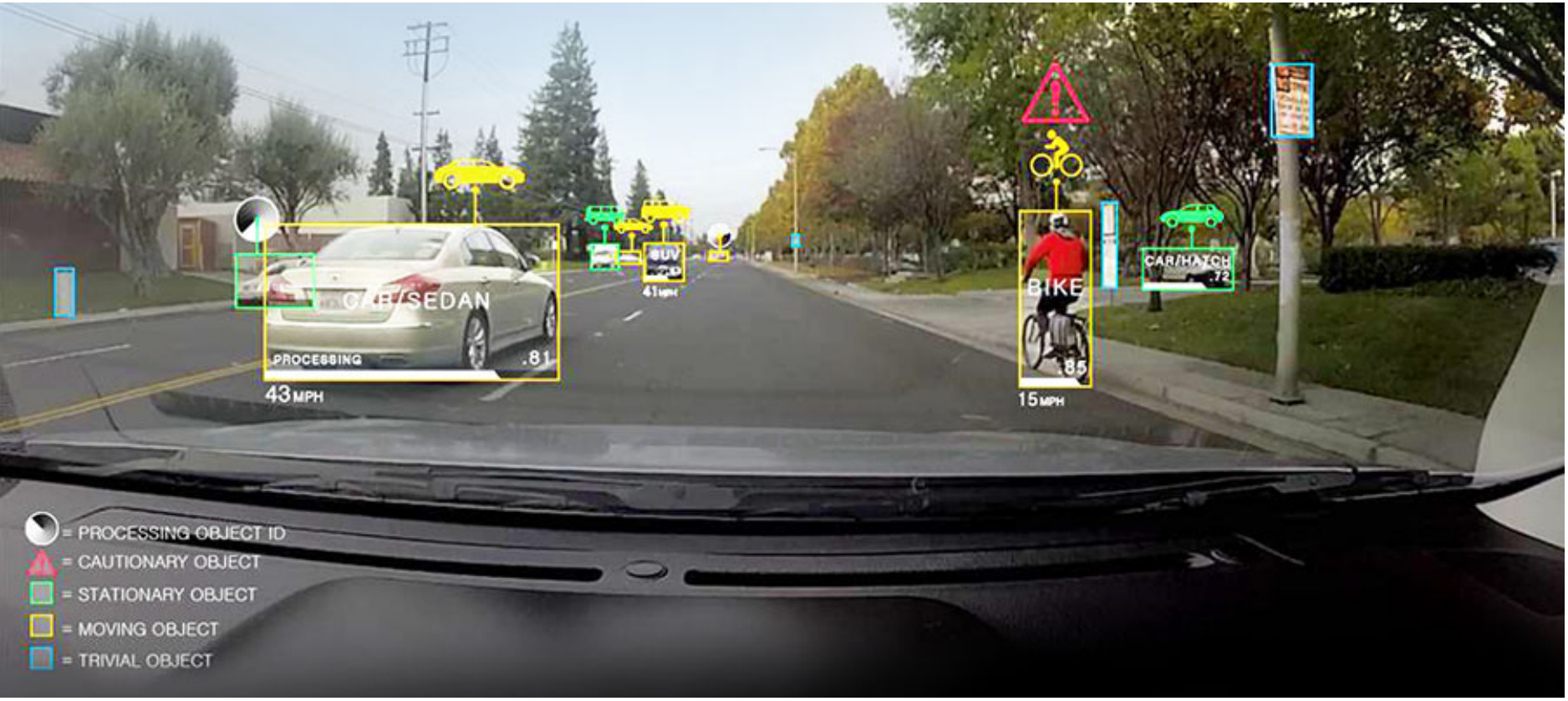
Remote control - Navigation



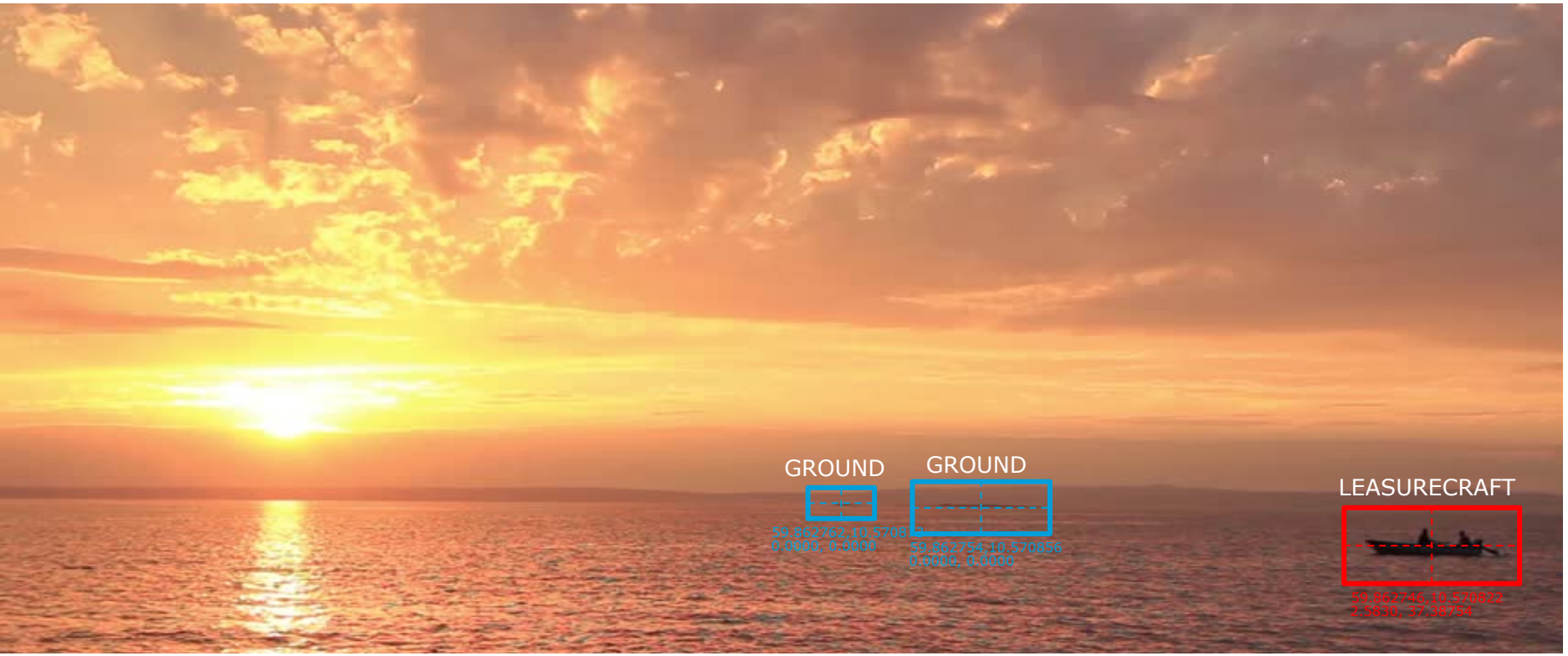
Main components of an autonomous function



Computer vision - cars



Information acquisition and analysis



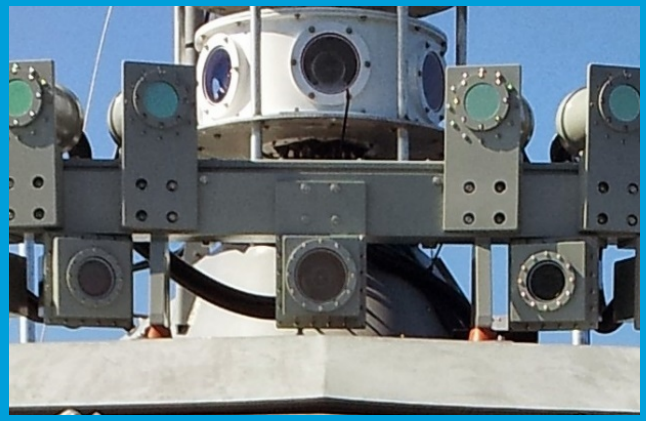
Action planning and control

Remote control/Autonomy

Remote Control

- Communication system capacity
- Communication system reliability
- Situational awareness of human operator
- Reliability and availability of human operator

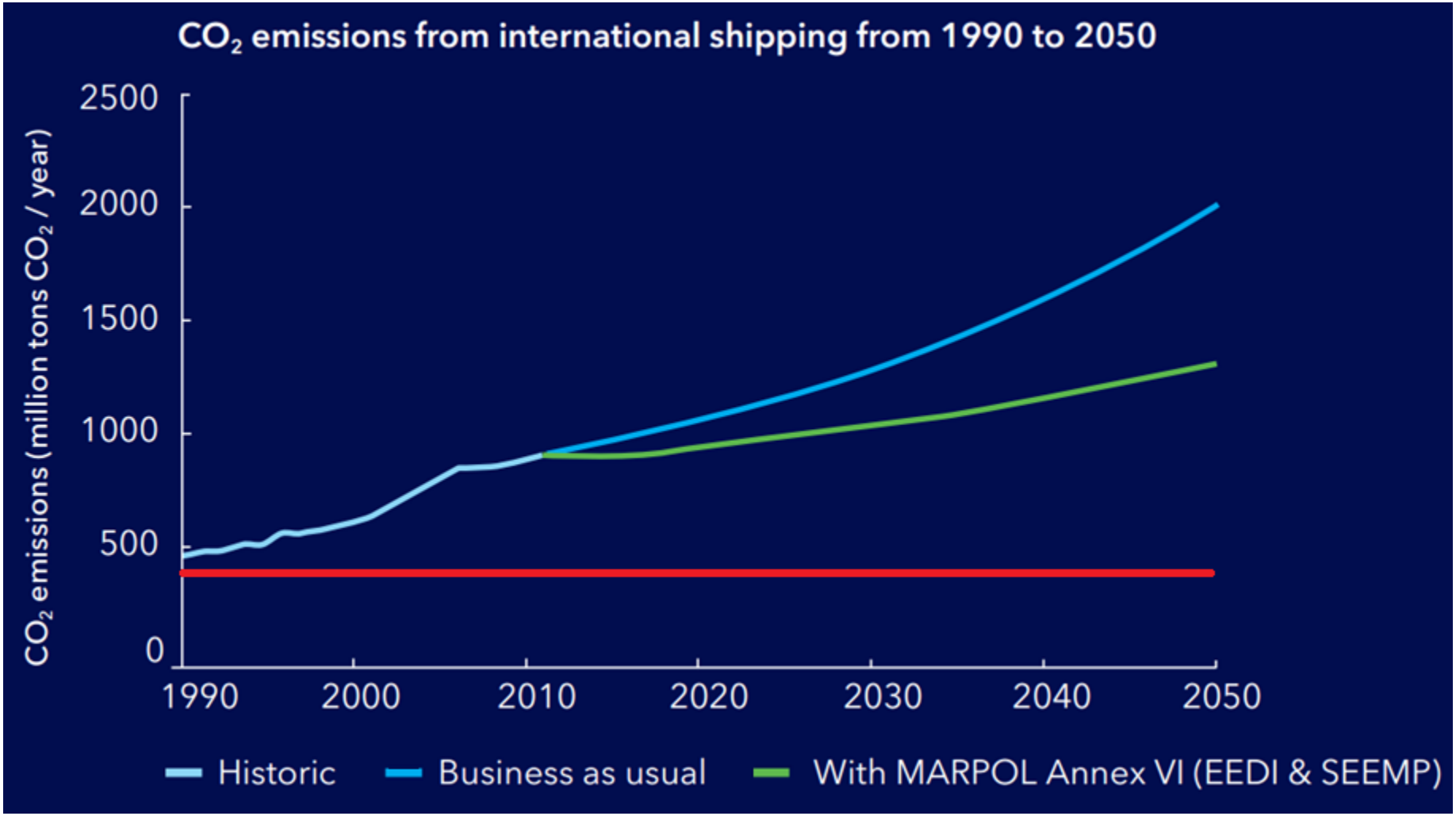
Autonomy



- Computer vision
- Situational awareness algorithm
- Autonomous planning and decision making

Green and clean shipping

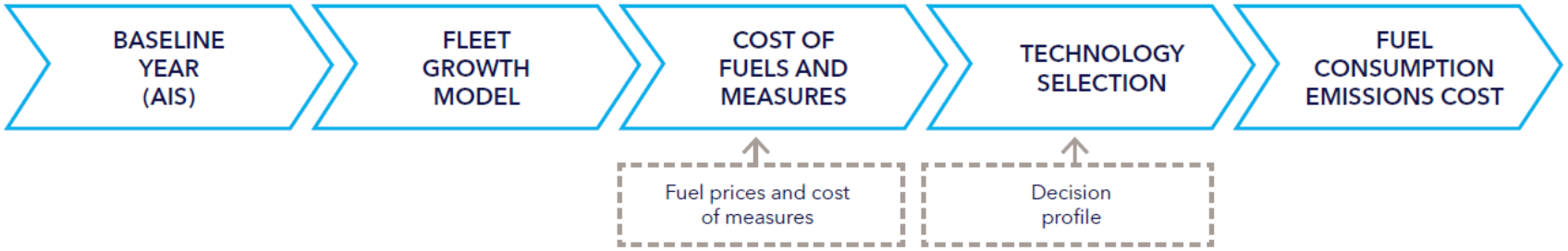
Emissions from shipping

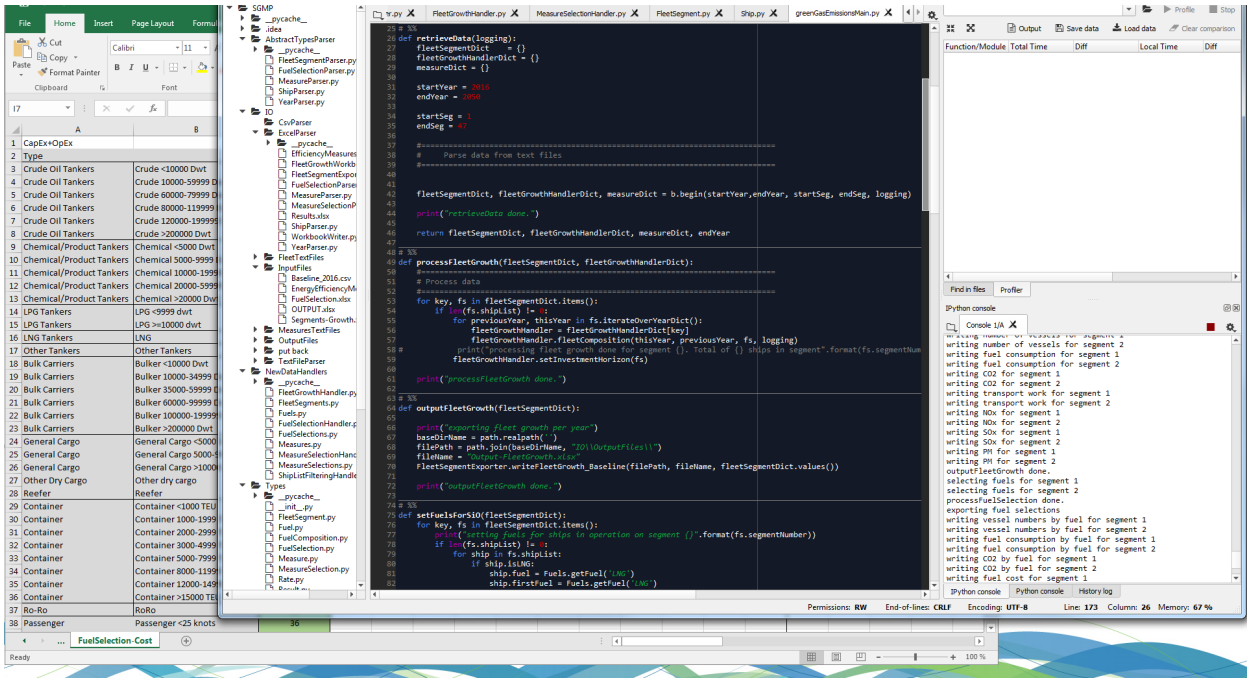


Objectives

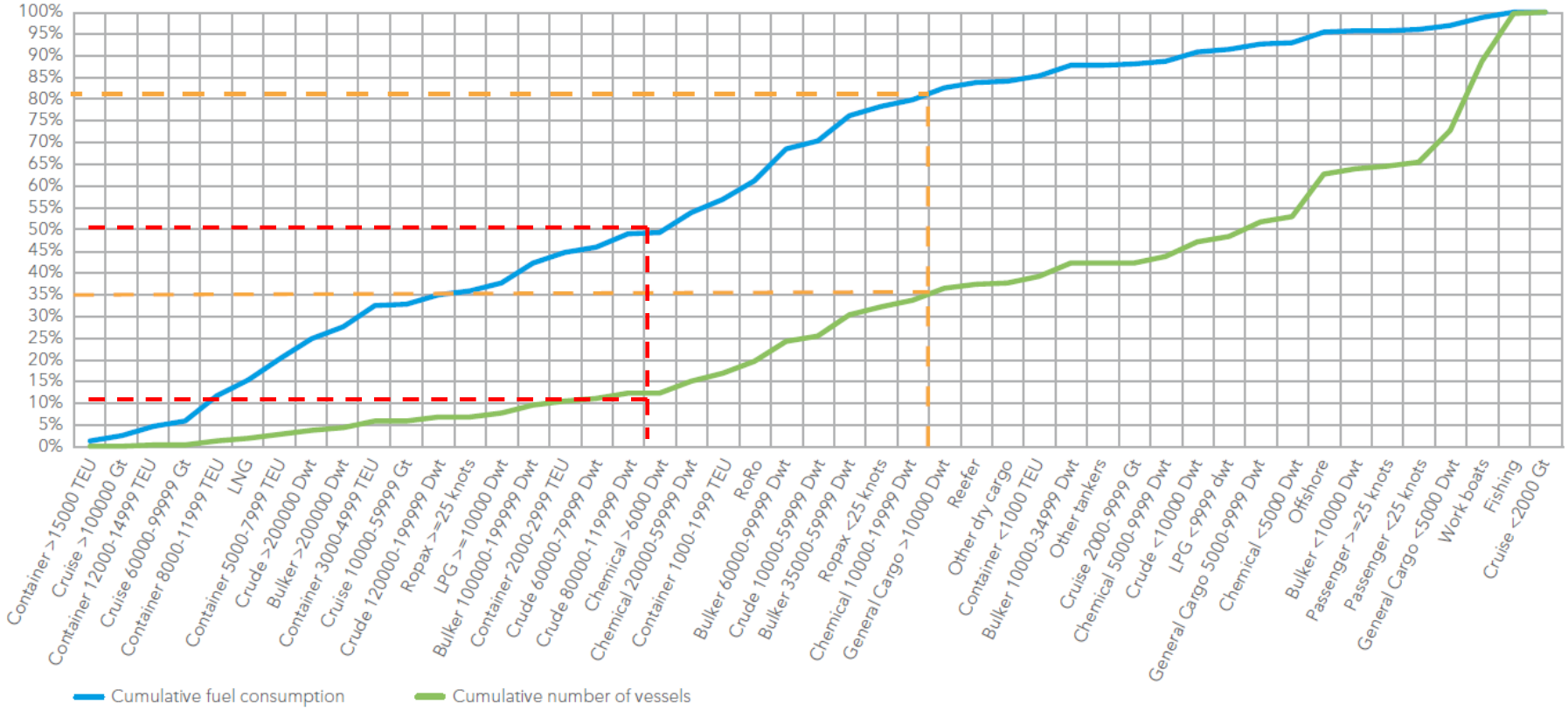

nuclear
hydrogen
biofuel
wind
LNG
HYBRID
HYBRID
10
CO2
LPG
LNG LPG
BATTERY
EEDI
15
NOx
LNG
SOx
HFO
SCRUBBER
MGO
HFO

Model overview





Analysis of existing fleet



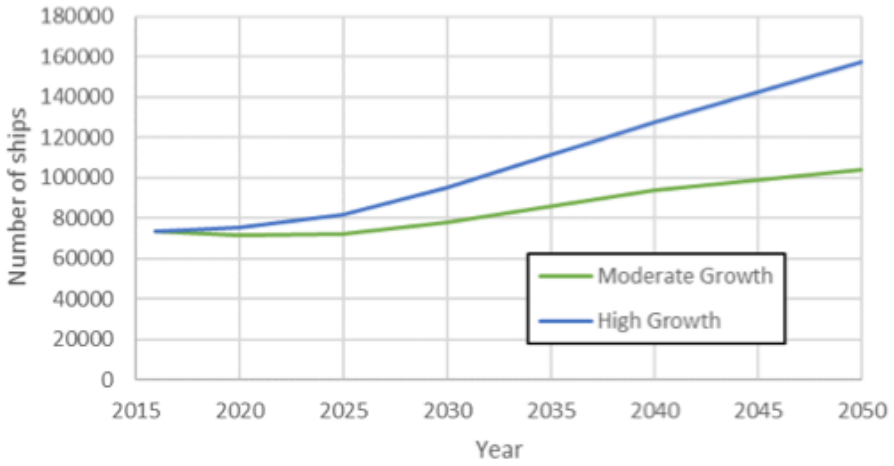
Annual fuel consumption: 233 million tonnes fuel oil

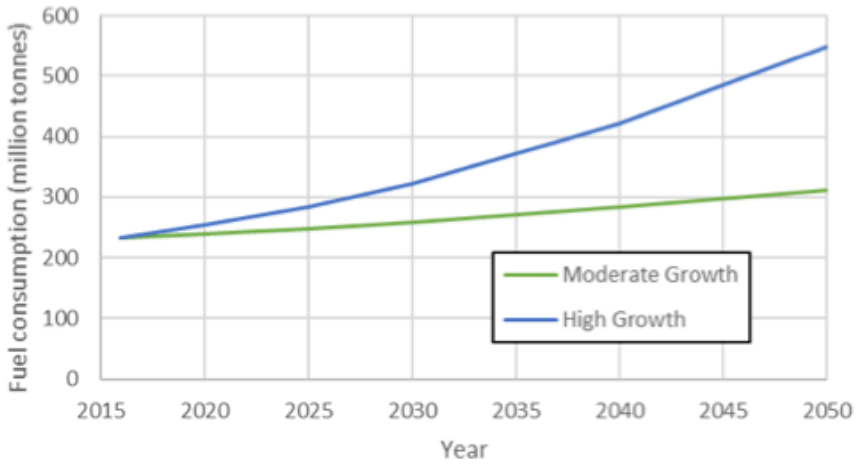
GHG emissions: 727 million tonnes of CO_2 equivalent

Fleet Growth Model

- Trade growth assumptions taking into account transport work

SEGMENT	ANNUAL TRADE GROWTH RATE	
	HIGH GROWTH	MODERATE GROWTH
Tankers	-1.7%	-1.7%
Bulk Carriers	2.5%	1.0%
Containers & RoRo	4.0%	1.0%
Short Sea Shipping	1.6%	1.0%
Offshore	2.0%	0.5%
Passenger	2.0%	1.0%





List of Fuel & Energy Efficiency Measures

- Fuels
  - MGO & LSFO
  - HFO & Scrubbers
  - LNG
  - LPG
  - Methanol
  - Biodiesel
  - Biogas
  - Biomethanol
  - Hydrogen
  - Electricity
  - Nuclear

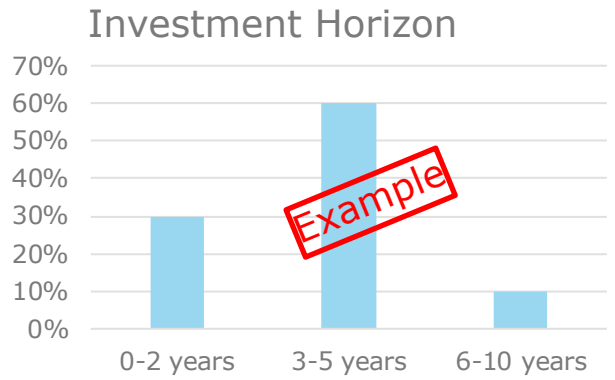
- Energy Efficiency
  - Machinery
  - Hydrodynamics
  - Operational
  - Cold Ironing
  - Wind/Solar

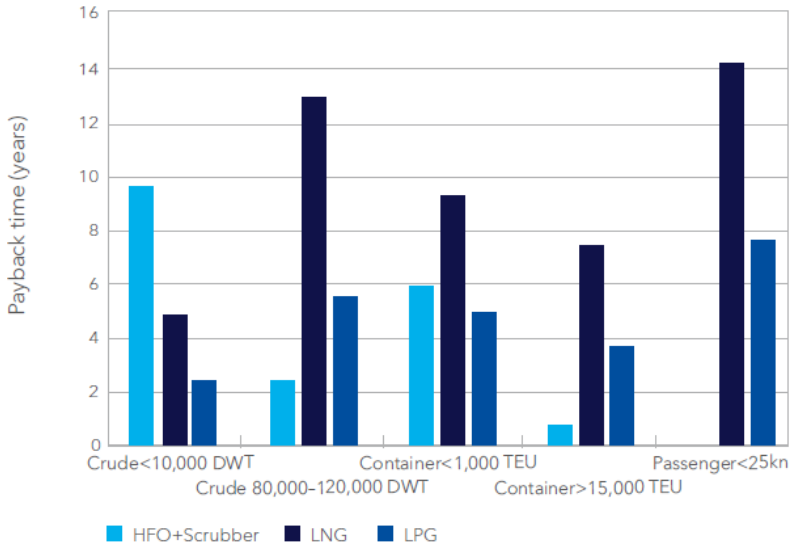
- Logistics
  - Speed Reduction

- Carbon Offset
  - Fuel price

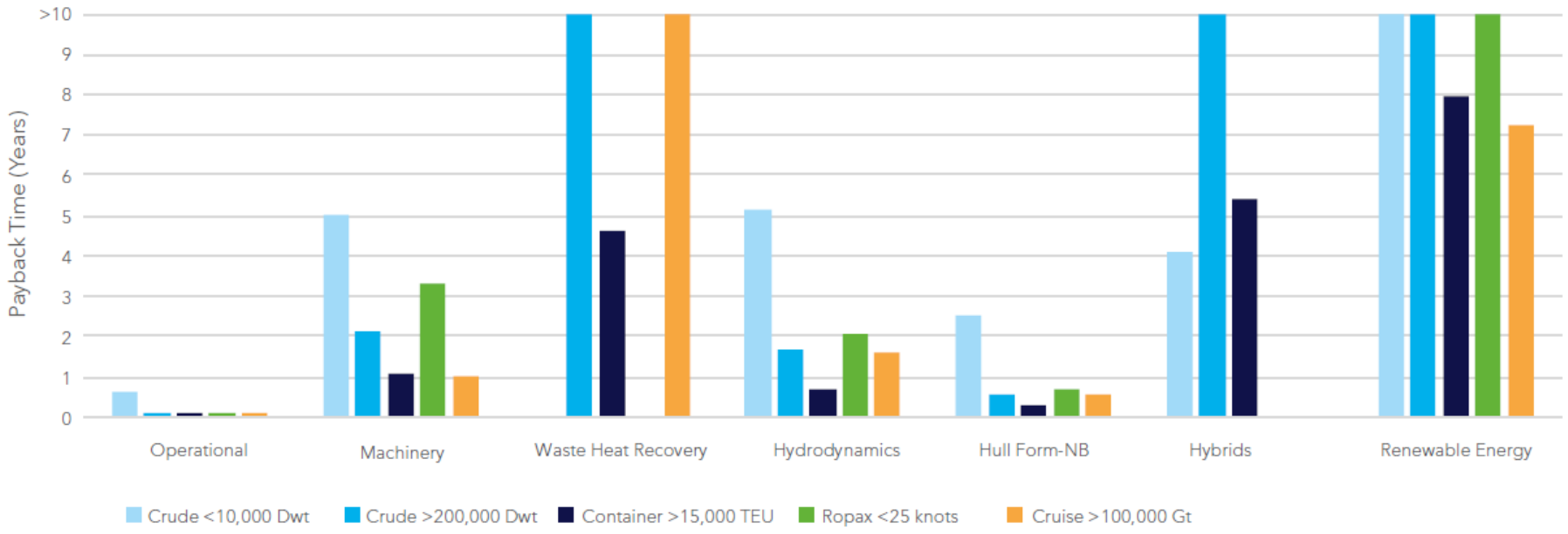
Fuel & Measures Selection

- Payback Time Calculation
- Only one fuel can be selected for each ship
  - Fuel cannot be changed later
- All applicable energy efficiency measures can be selected



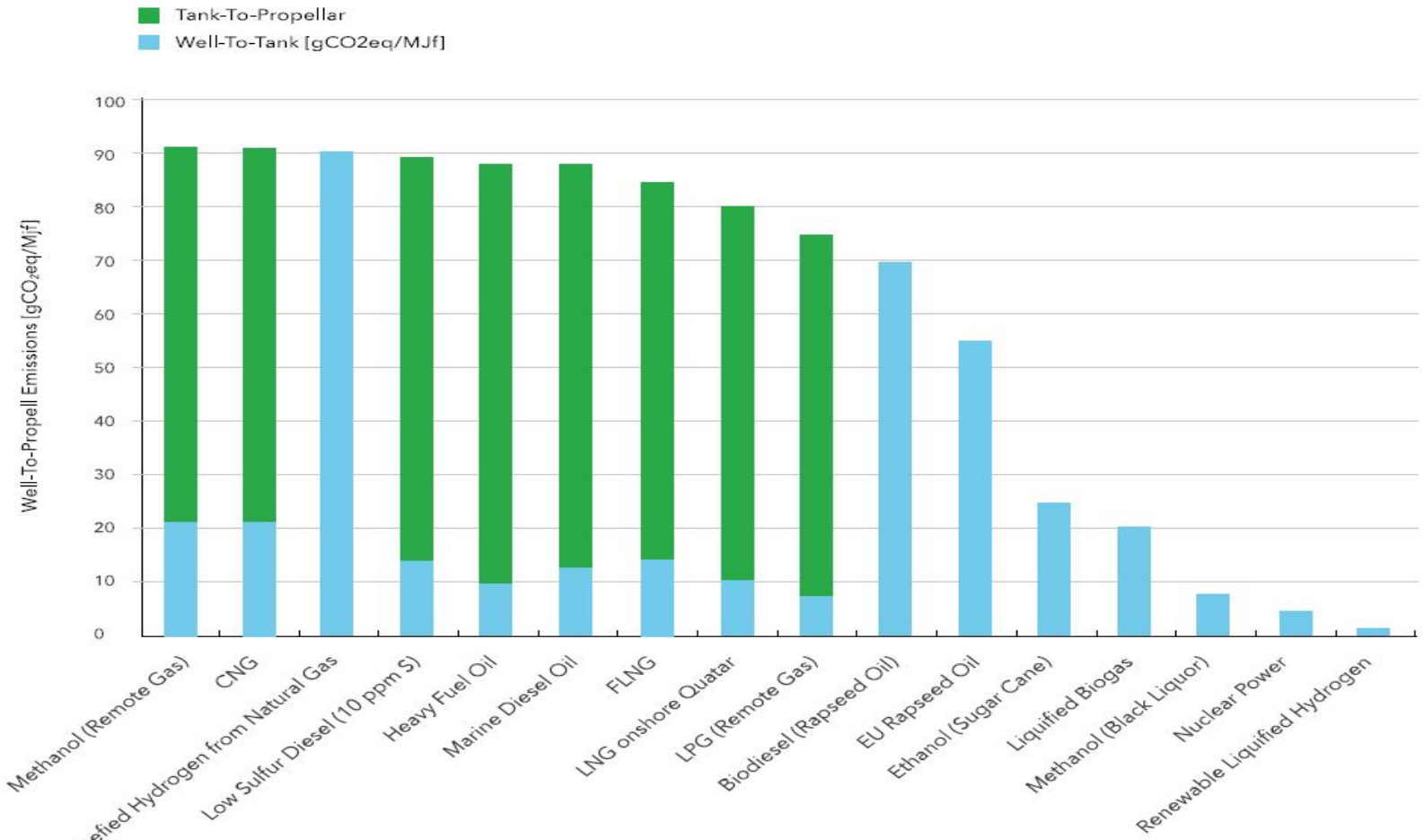


Fuel & Measures Selection



LCA Emissions

- Well-to-Propeller Greenhouse Gas Emissions

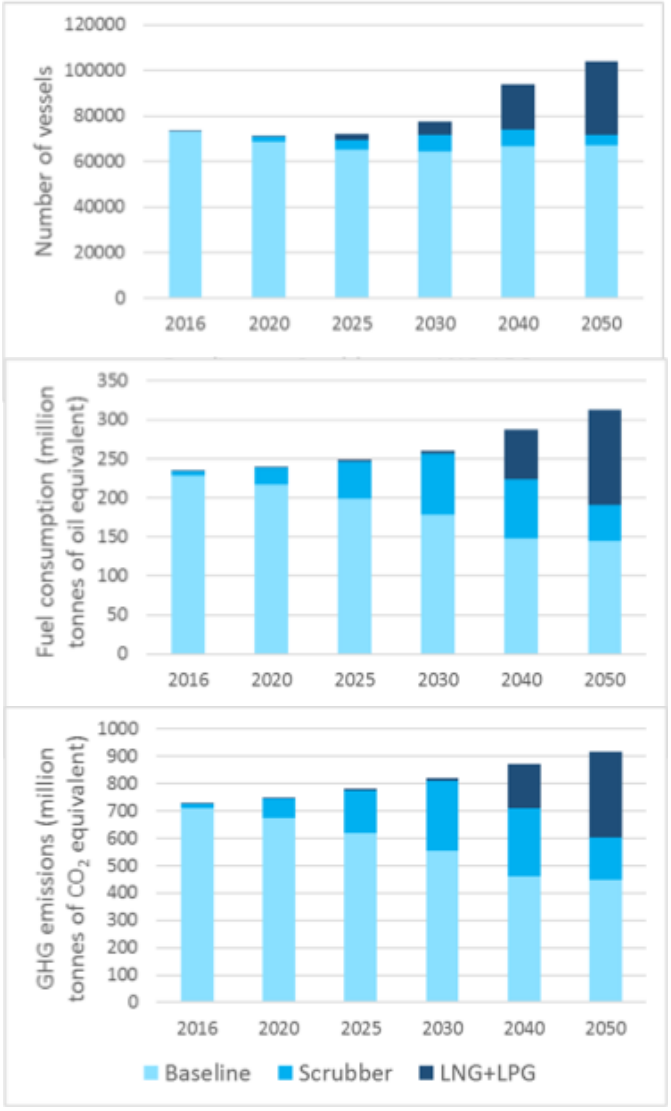


Tank-to-Propeller (combustion) emissions assumed to be equal to CO_2 absorbed by the plant during its lifetime

Impact of Scrubbers

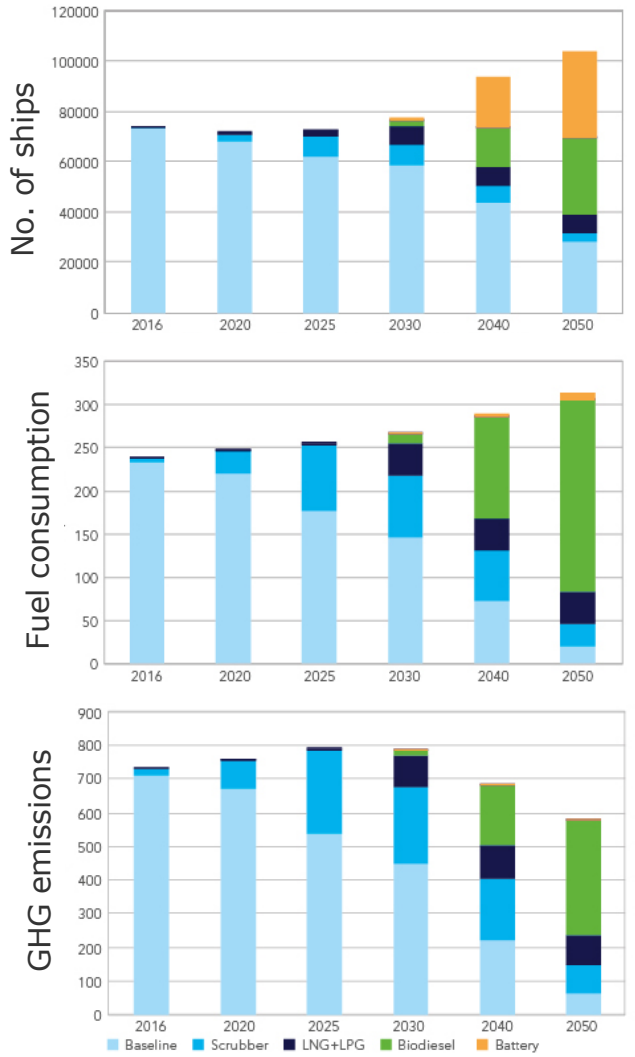
- Assumptions
  - Moderate trade growth
  - Scrubbers installed until 2030
  - No speed reduction
  - No energy efficiency measures
  - Short investment horizon
  - Low Carbon Fuels: high cost

- Scrubbers are attractive for large ships



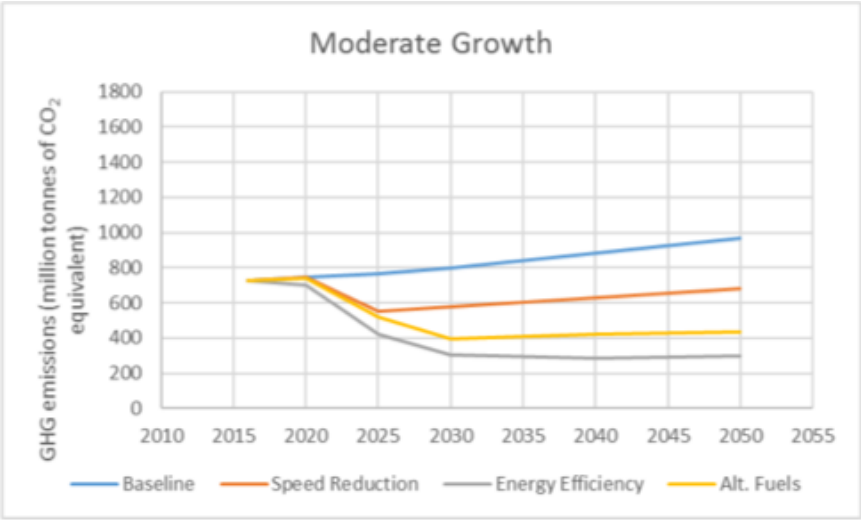
Impact of low carbon alternatives

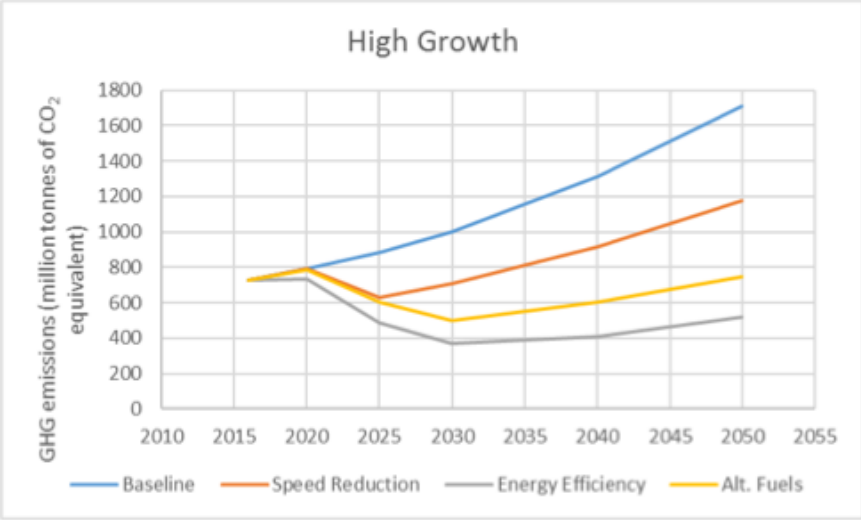
- Moderate trade growth
- Long investment horizon
- No speed reduction or energy efficiency
- Batteries and biodiesel introduced in 2030 by lowering their cost
  - Batteries only correspond to ≈2% of total fuel consumption
- Strong uptake of low carbon fuels is needed, in order to achieve significant reductions in emissions



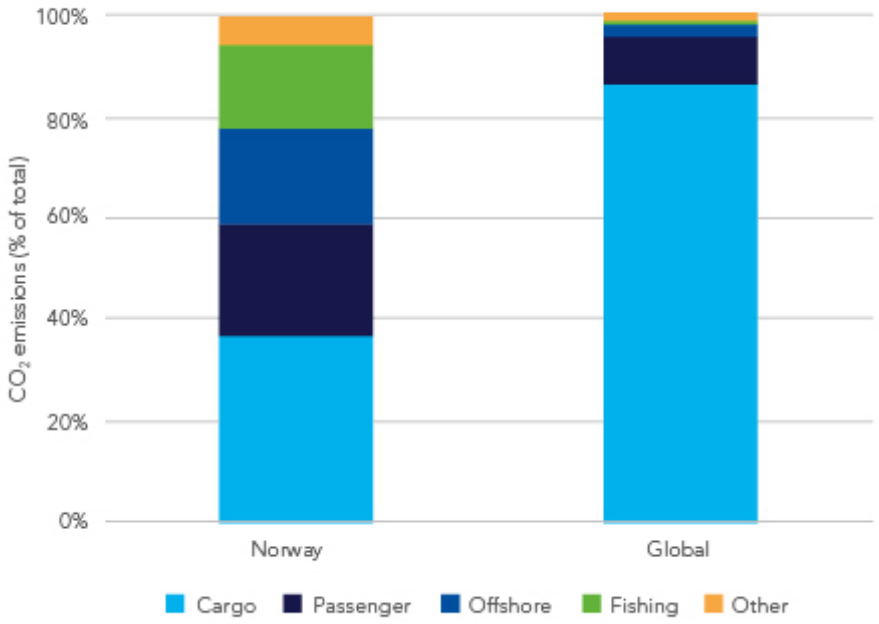
Theoretical potential

- Strong uptake of
  - Biofuels
  - Energy efficiency measures
- Speed reduction 30%





Local vs. Global Problem



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