

Autonomous vessels & Green and clean shipping

EUSBSR Seminar

Bjørn Johan Vartdal

06 February 2018

The unmanned ship

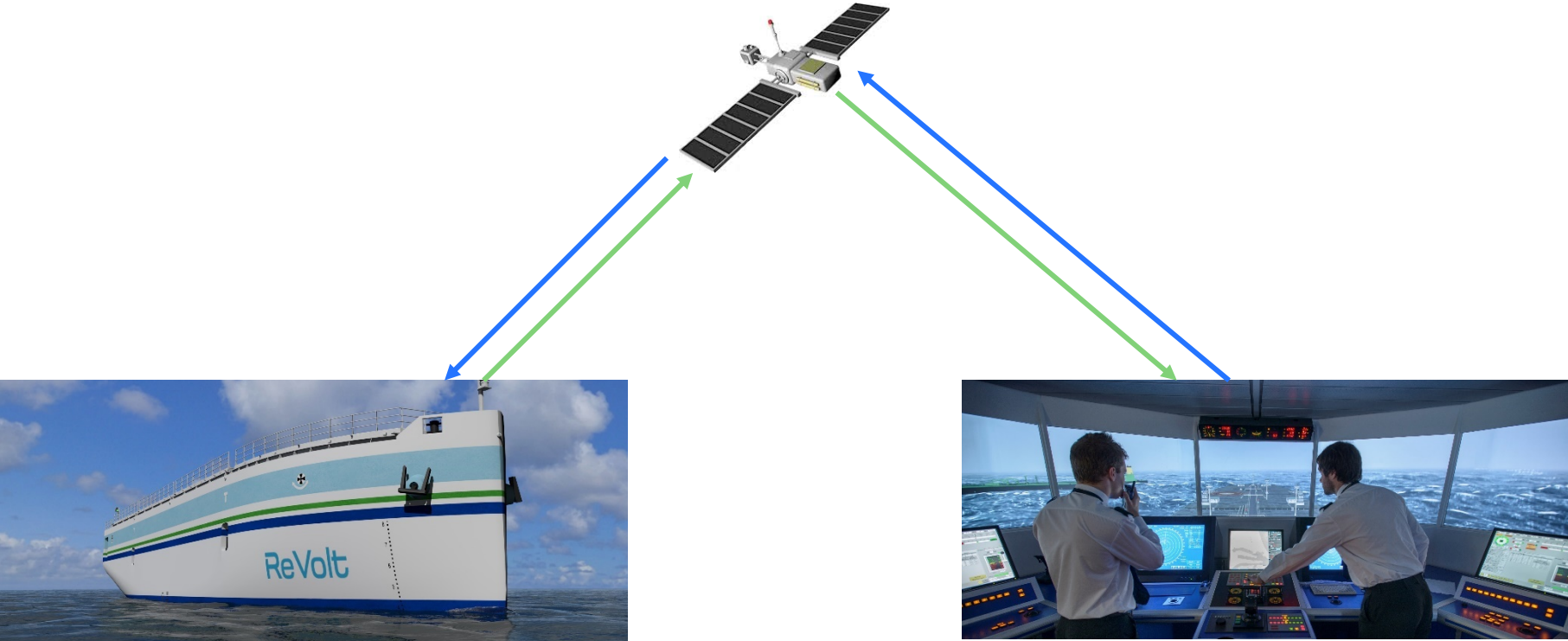


The unmanned ship

- Remote Control
- Autonomy



Remote Control



Remote control - Navigation



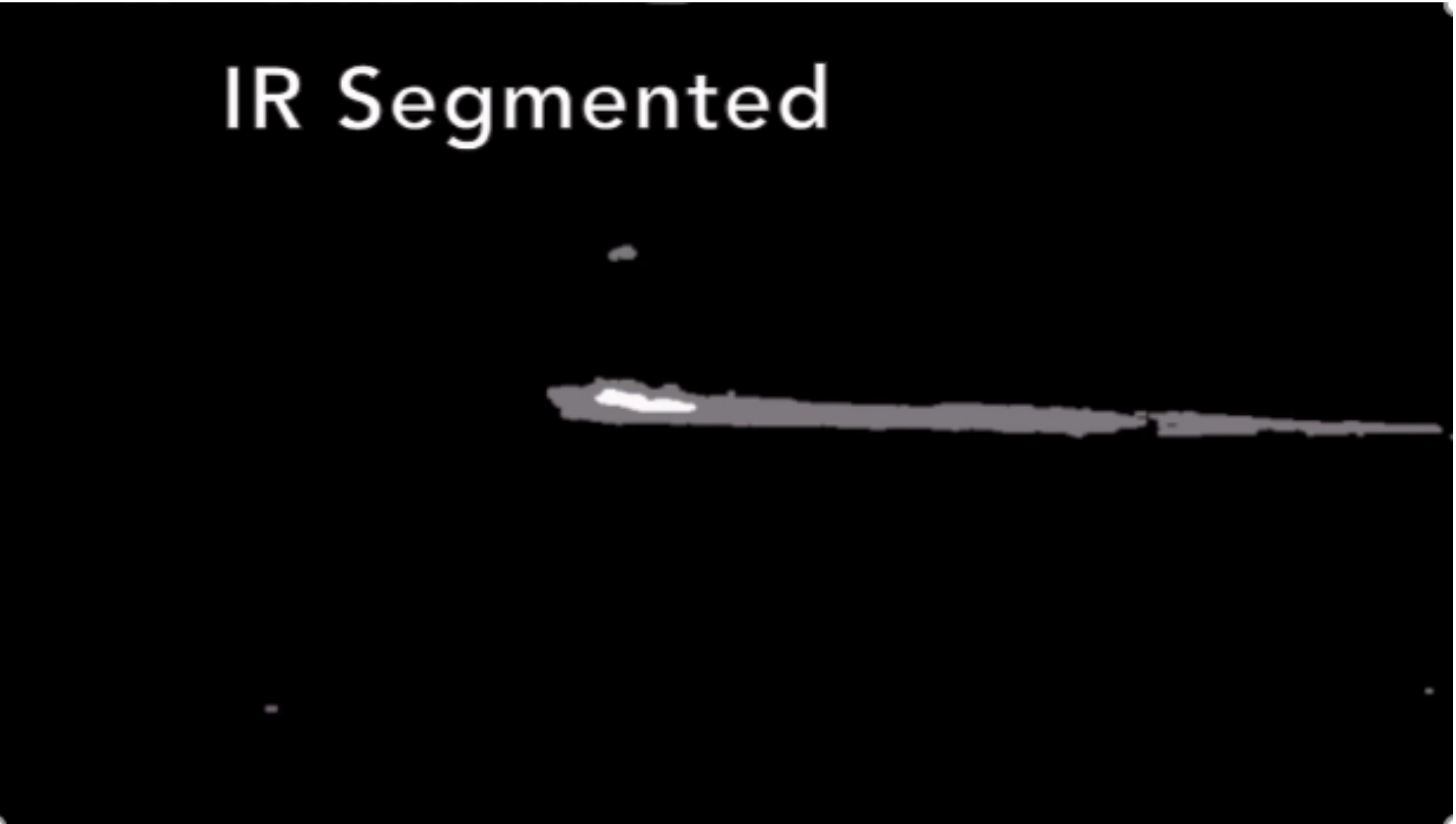
Remote control - Applications



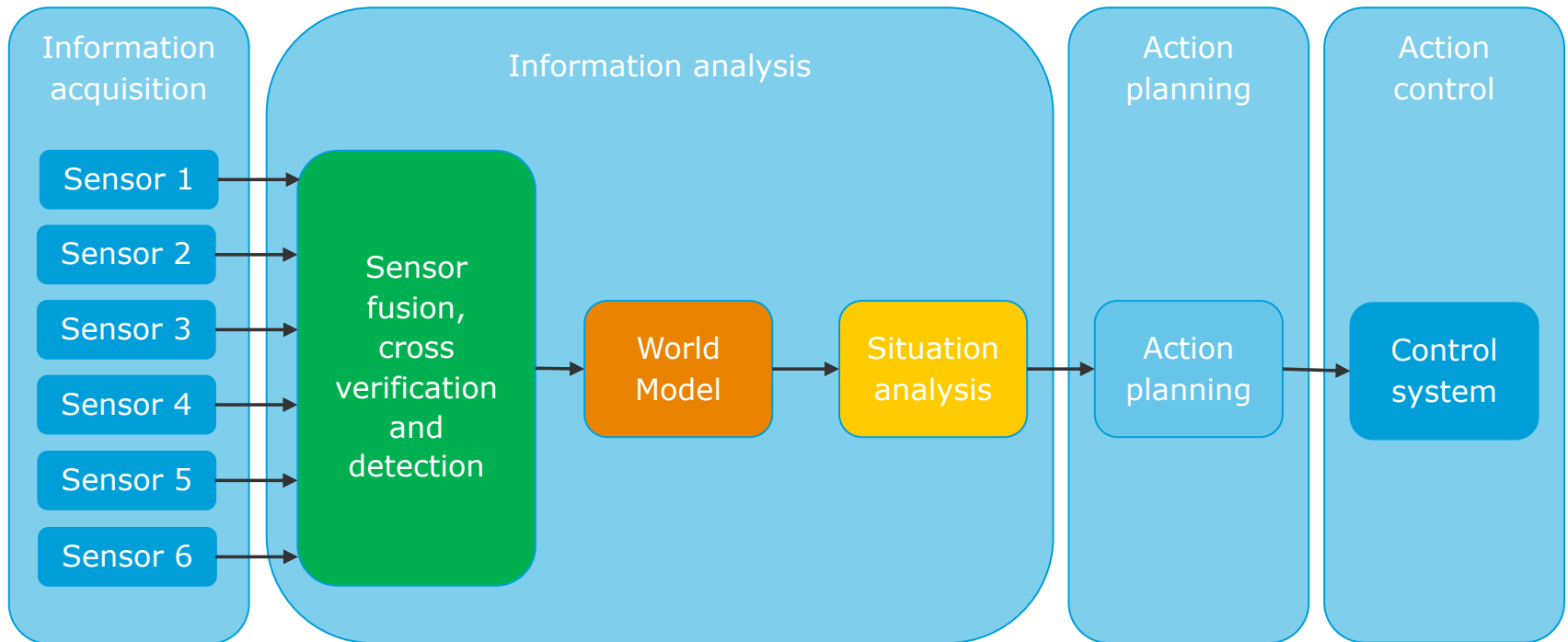
Remote control - Navigation



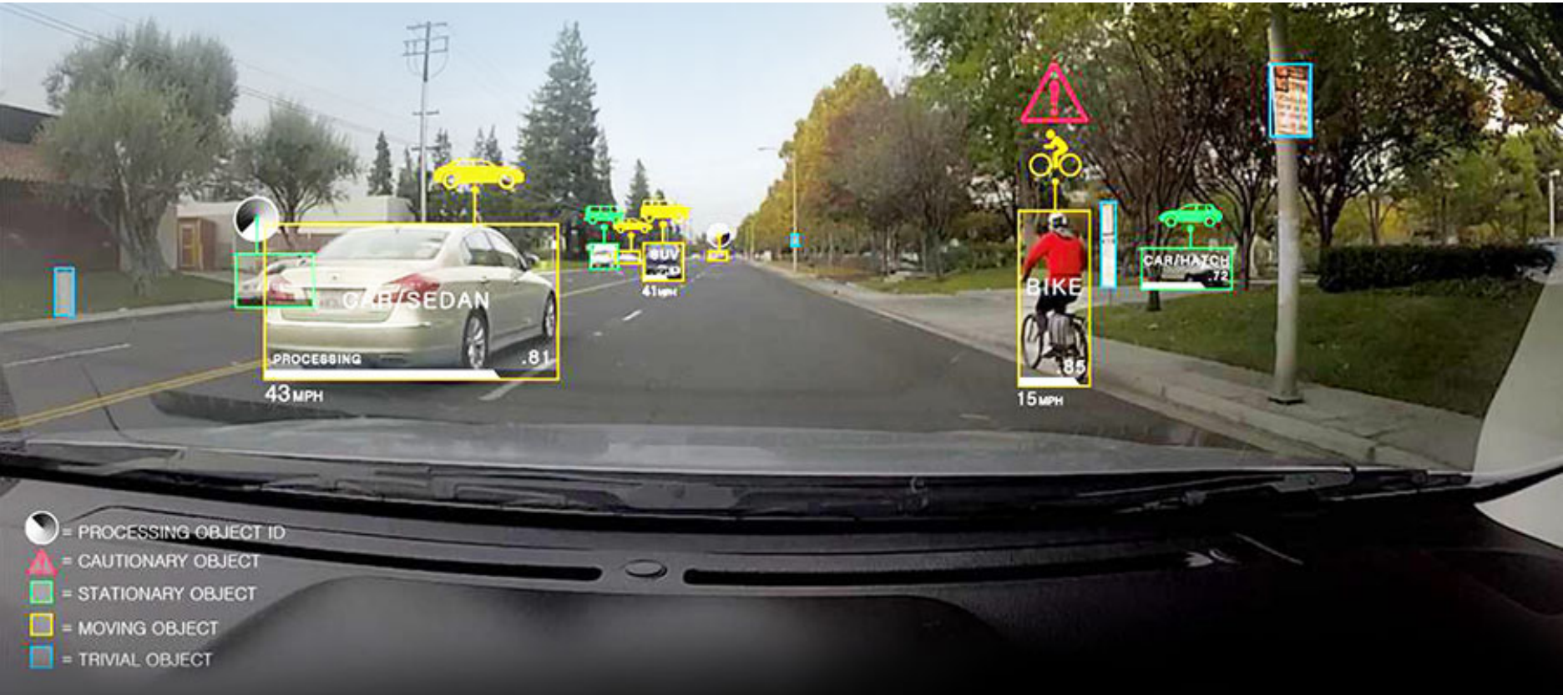
IR Segmented

The image shows a dark, almost black, rectangular area. In the center, there is a horizontal, elongated, light-colored shape that resembles a brushstroke or a segmented line. The shape is brighter in the middle and fades towards the ends. Above the shape, the text "IR Segmented" is written in a white, sans-serif font. The overall appearance is that of a processed infrared image where the background has been removed, leaving only the segmented object.

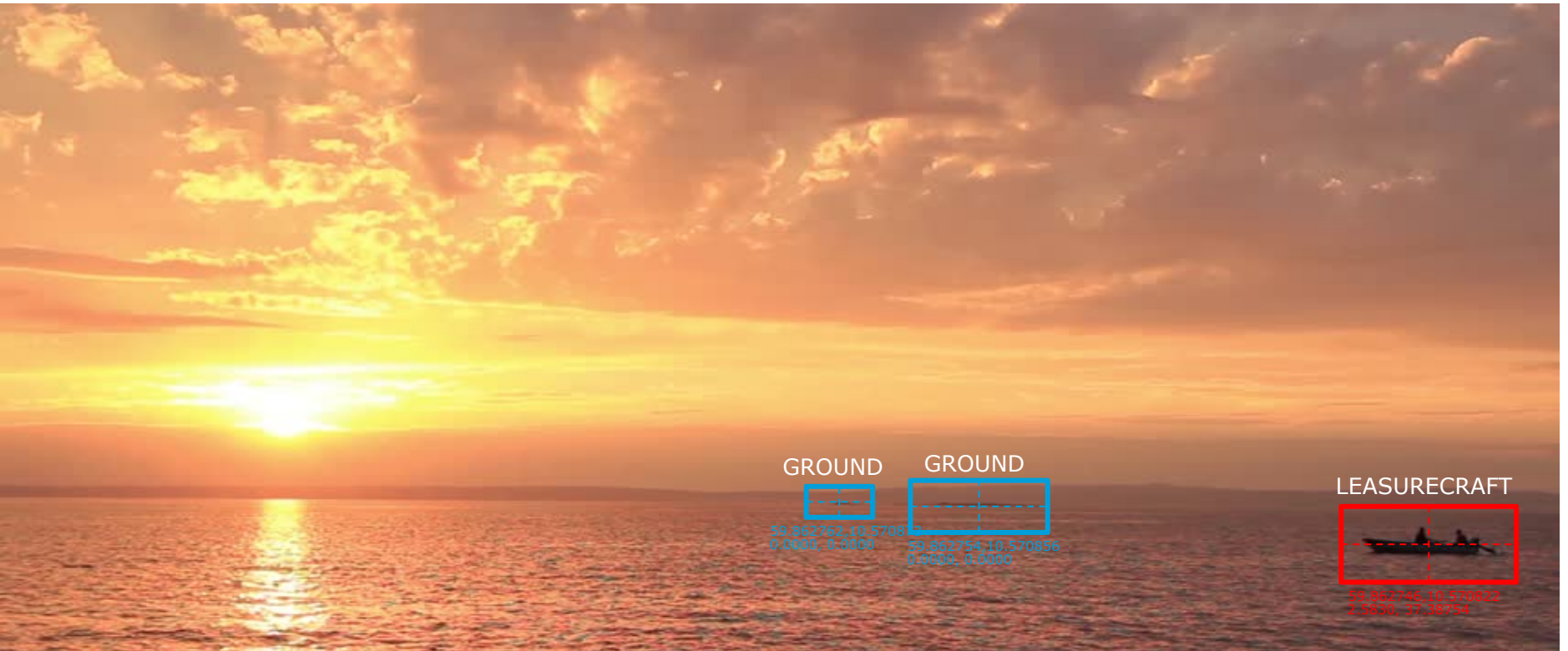
Main components of an autonomous function



Computer vision - cars



Information acquisition and analysis



Action planning and control

COLLISION AVOIDANCE

system for USV



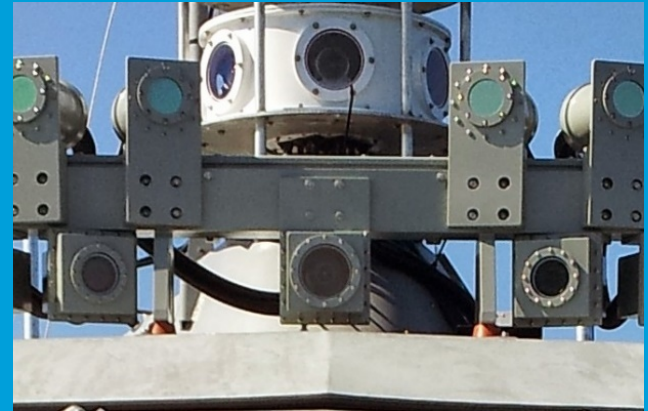
Remote control/Autonomy

Remote Control



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

Autonomy

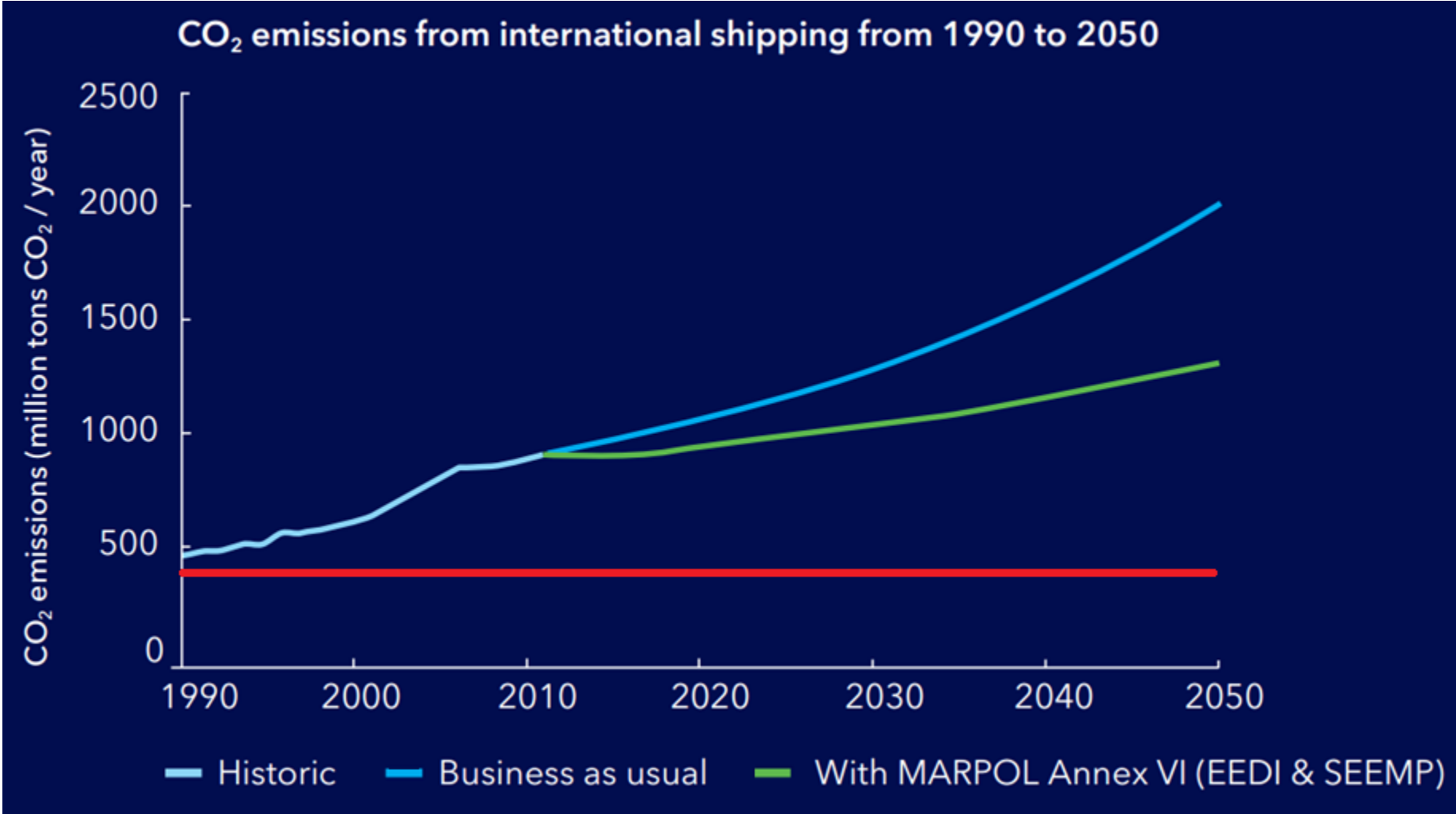


- Computer vision
- Situational awareness algorithm
- Autonomous planning and decision making

Green and clean shipping



Emissions from shipping



Objectives

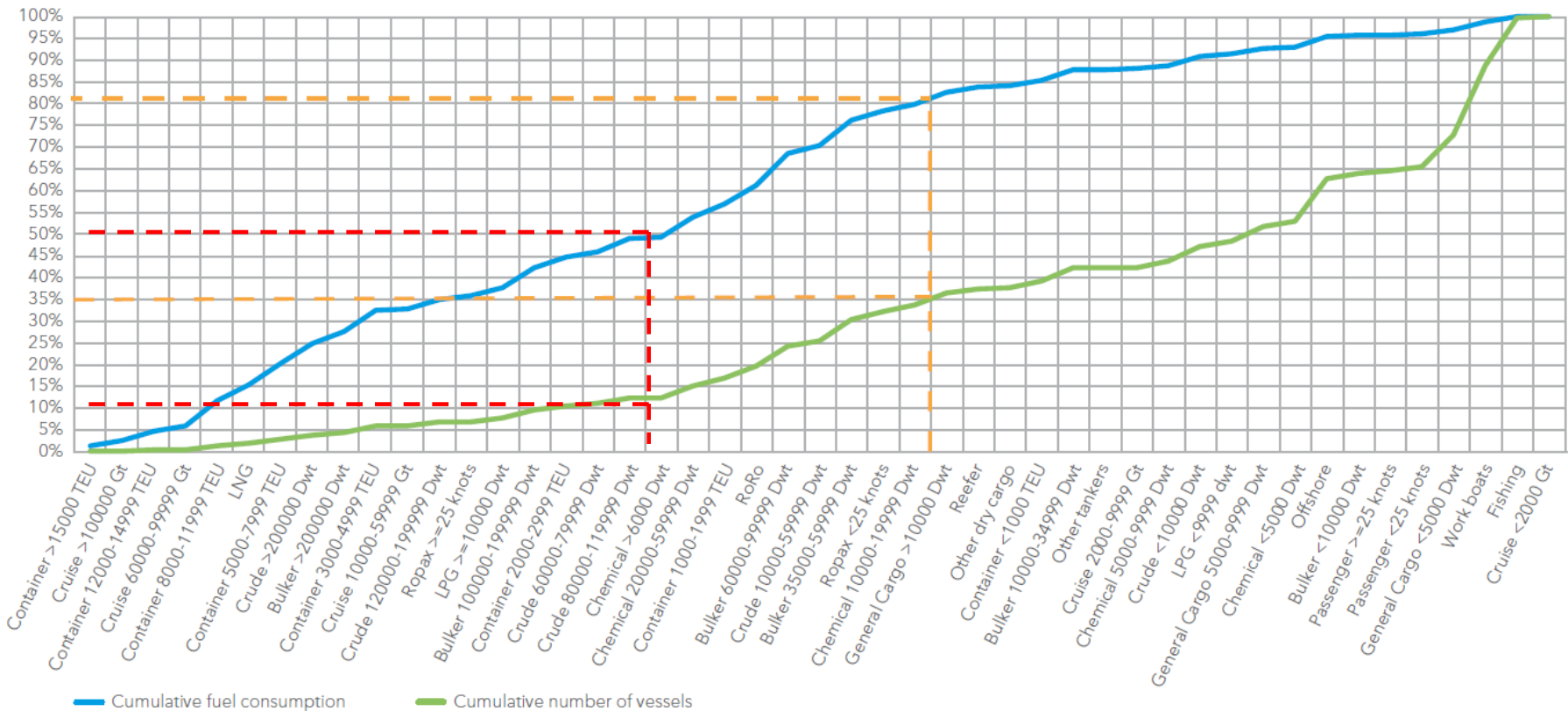


Model overview



The screenshot displays a multi-paneled software interface. On the left, a spreadsheet titled 'FuelSelection Cost' shows a list of vessel types and their associated costs. The central pane shows a file explorer with a project structure including folders like 'pycache_', 'AbstractTypeParser', and 'FleetGrowthHandler.py'. The right pane is a code editor showing Python code for 'FleetGrowthHandler.py', including functions like 'processFleetGrowth' and 'outputFleetGrowth'. The bottom right pane is a console window showing the execution output of the code, including messages like 'writing number of vessels for segment 1' and 'writing fuel consumption for segment 1'.

Analysis of existing fleet



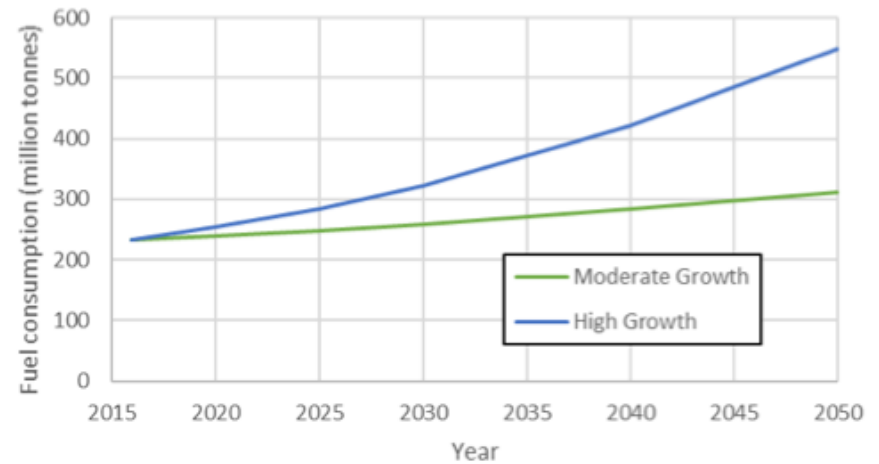
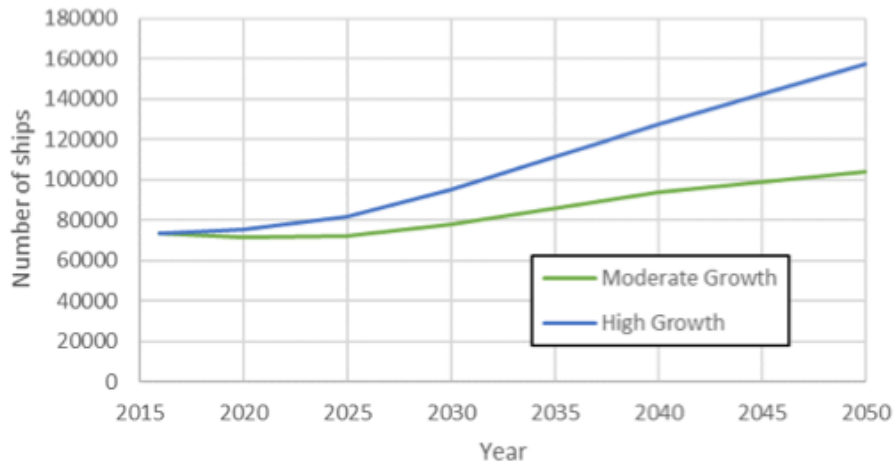
Annual fuel consumption: 233 million tonnes fuel oil

GHG emissions: 727 million tonnes of CO₂ 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

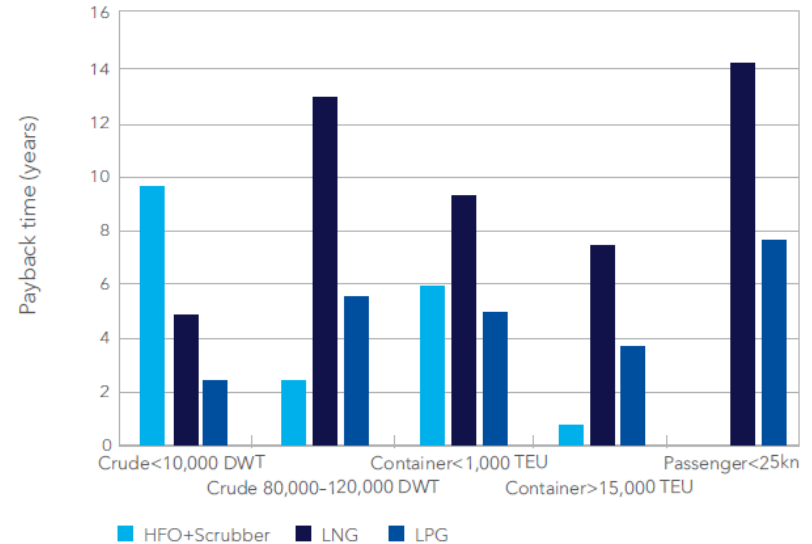
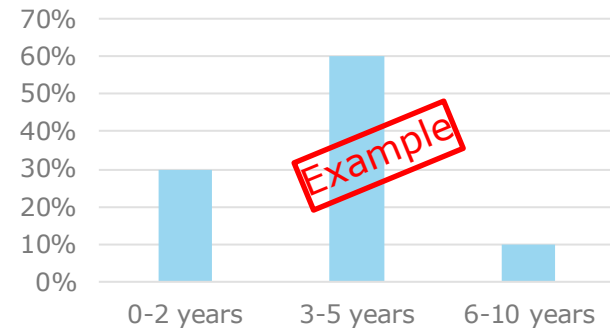
- Energy Efficiency

- Machinery
- Hydrodynamics
- Operational
- Cold Ironing
- Wind/Solar
- Logistics
 - Speed Reduction
- Carbon Offset
 - Fuel price

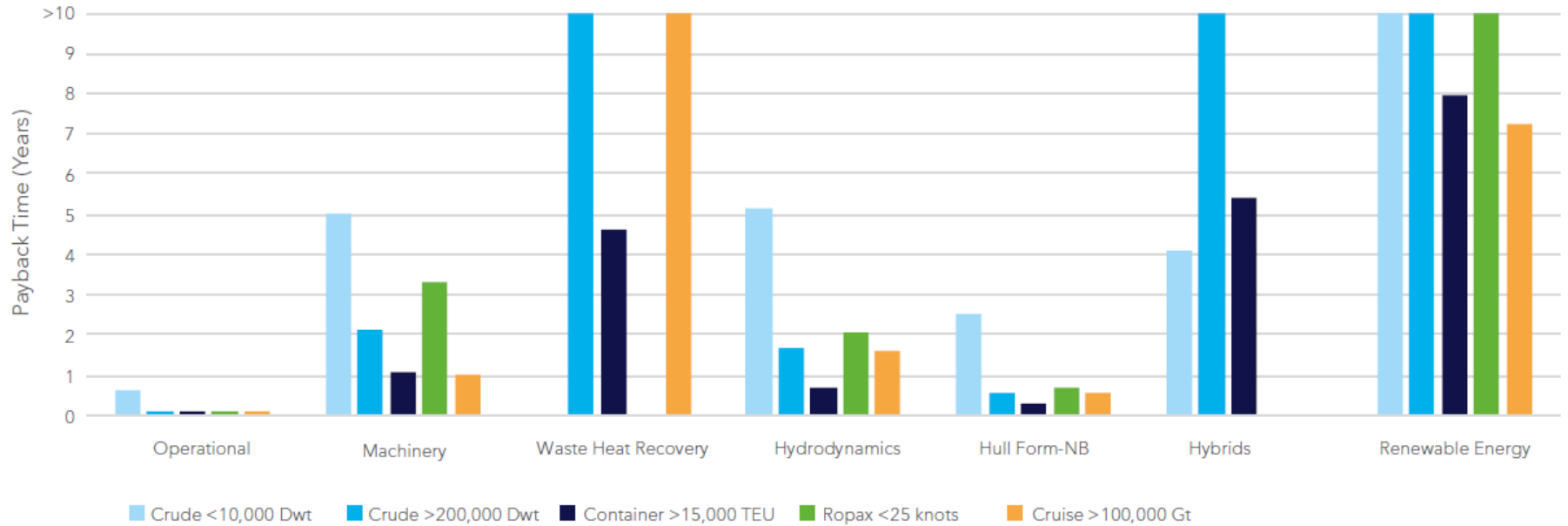
Fuel & Measures Selection

- 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

Investment Horizon

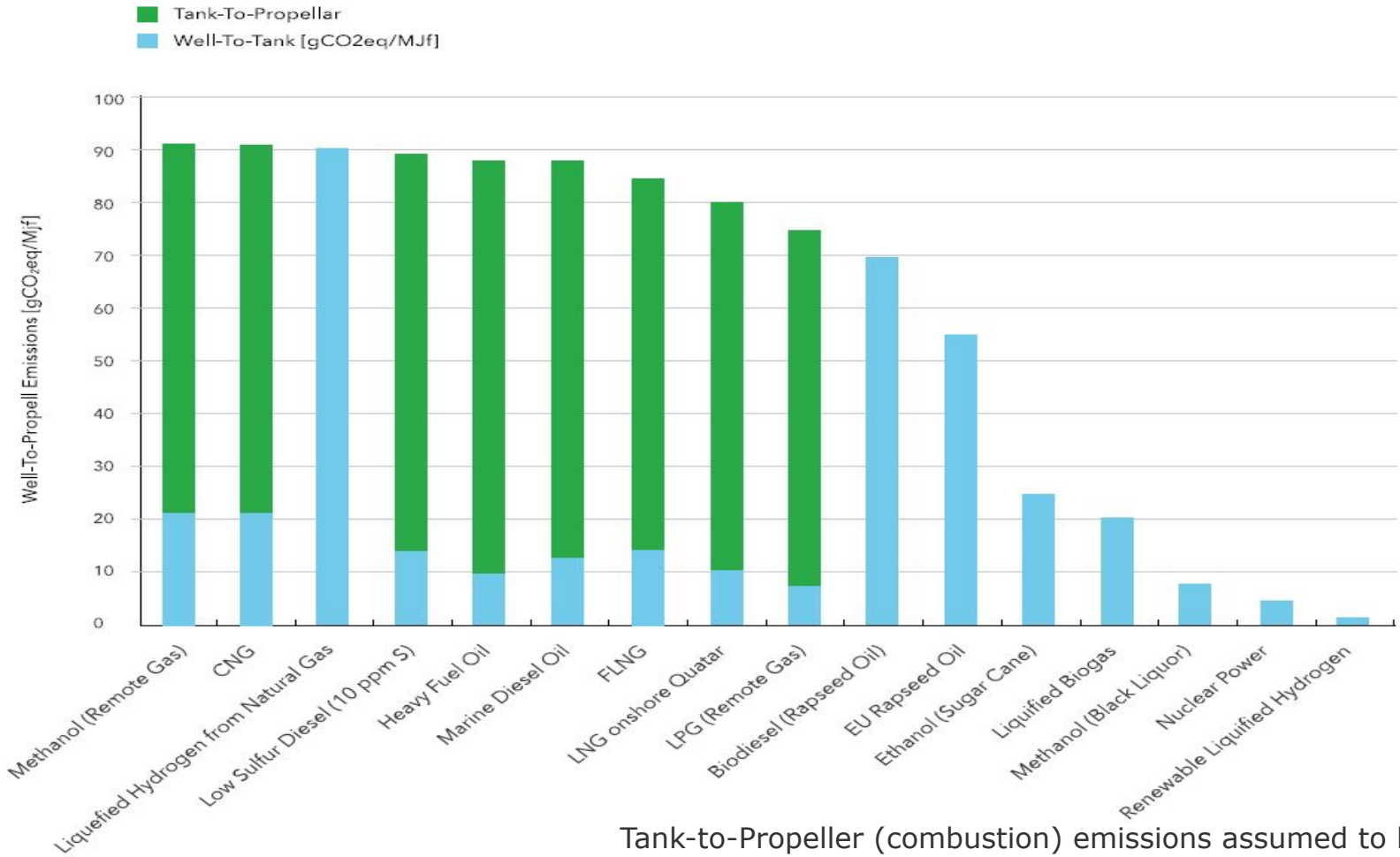


Fuel & Measures Selection



LCA Emissions

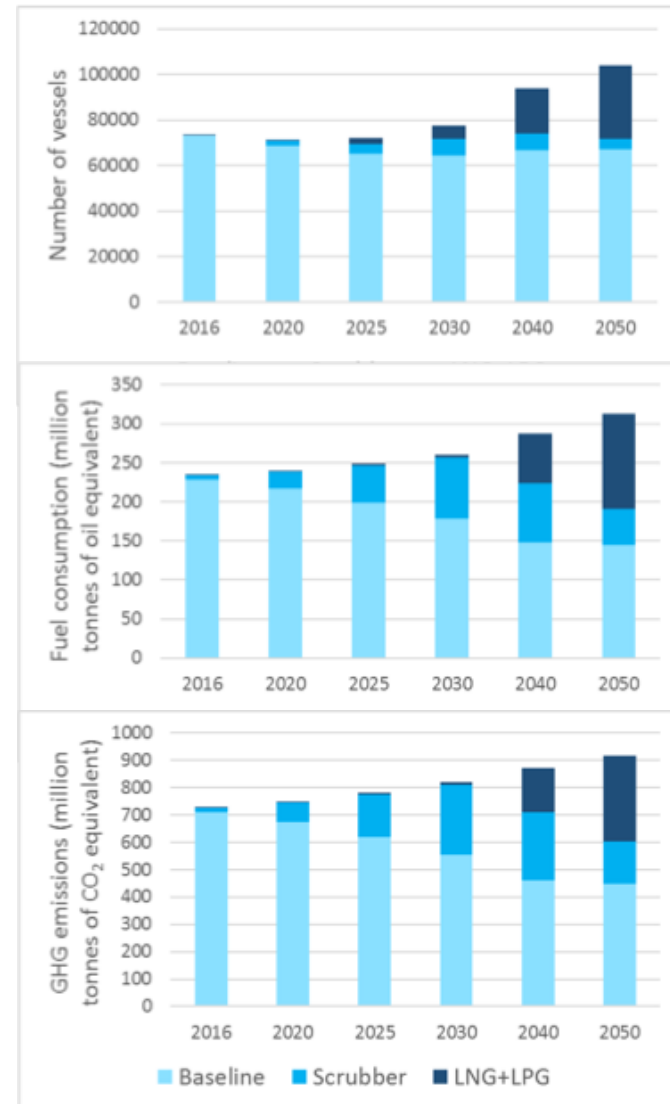
Well-to-Propeller Greenhouse Gas Emissions



Tank-to-Propeller (combustion) emissions assumed to be equal to CO₂ 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

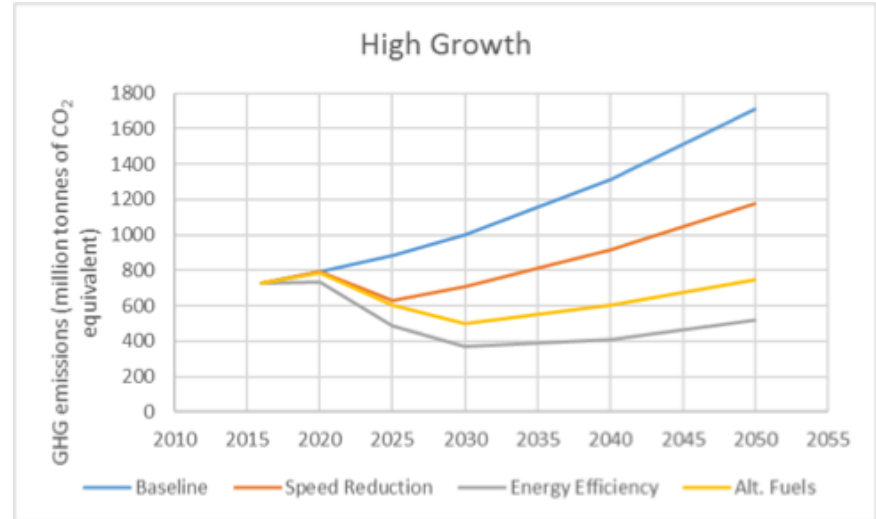
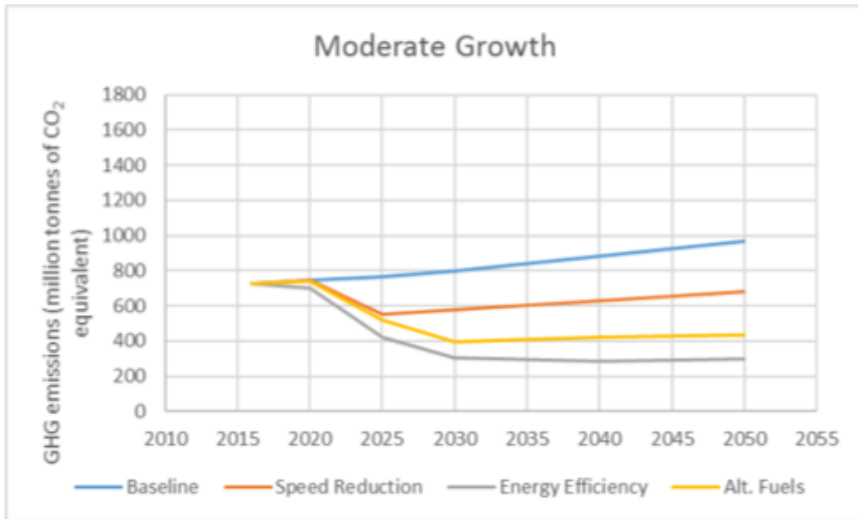
- Moderate trade growth
- Long investment horizon
- No speed reduction or energy efficiency
- Batteries and biodiesel introduced in 2030 by lowering their cost
 - Batteries only correspond to $\approx 2\%$ of total fuel consumption
- Strong uptake of low carbon fuels is needed, in order to achieve significant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

■ Baseline
 ■ Scrubber
 ■ LNG+LPG
 ■ Biodiesel
 ■ Battery

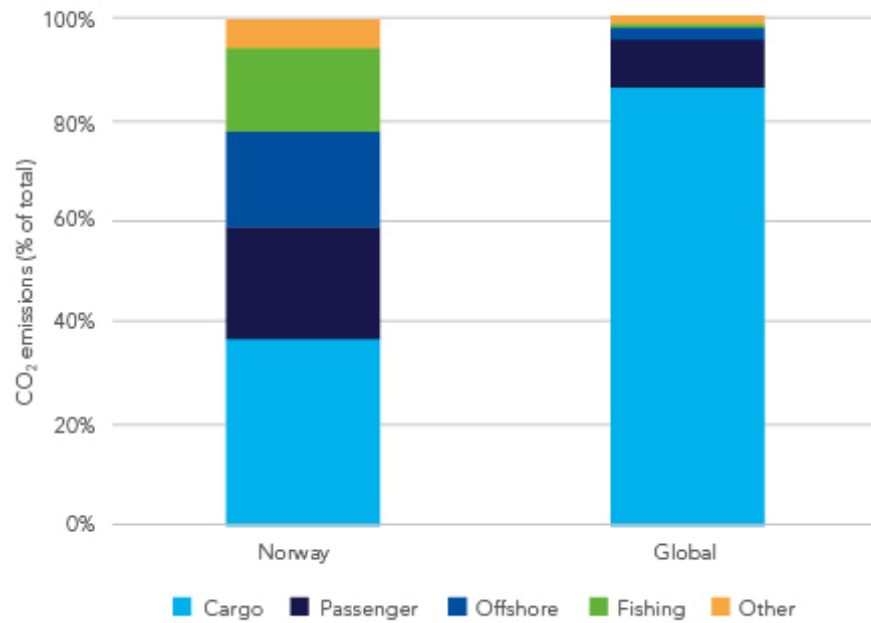


Theoretical potential

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



Local vs. Global Problem





Bjørn Johan Vartdal

bjorn.johan.vartdal@dnvgl.com

+4797682660

www.dnvgl.com

SAFER, SMARTER, GREENER