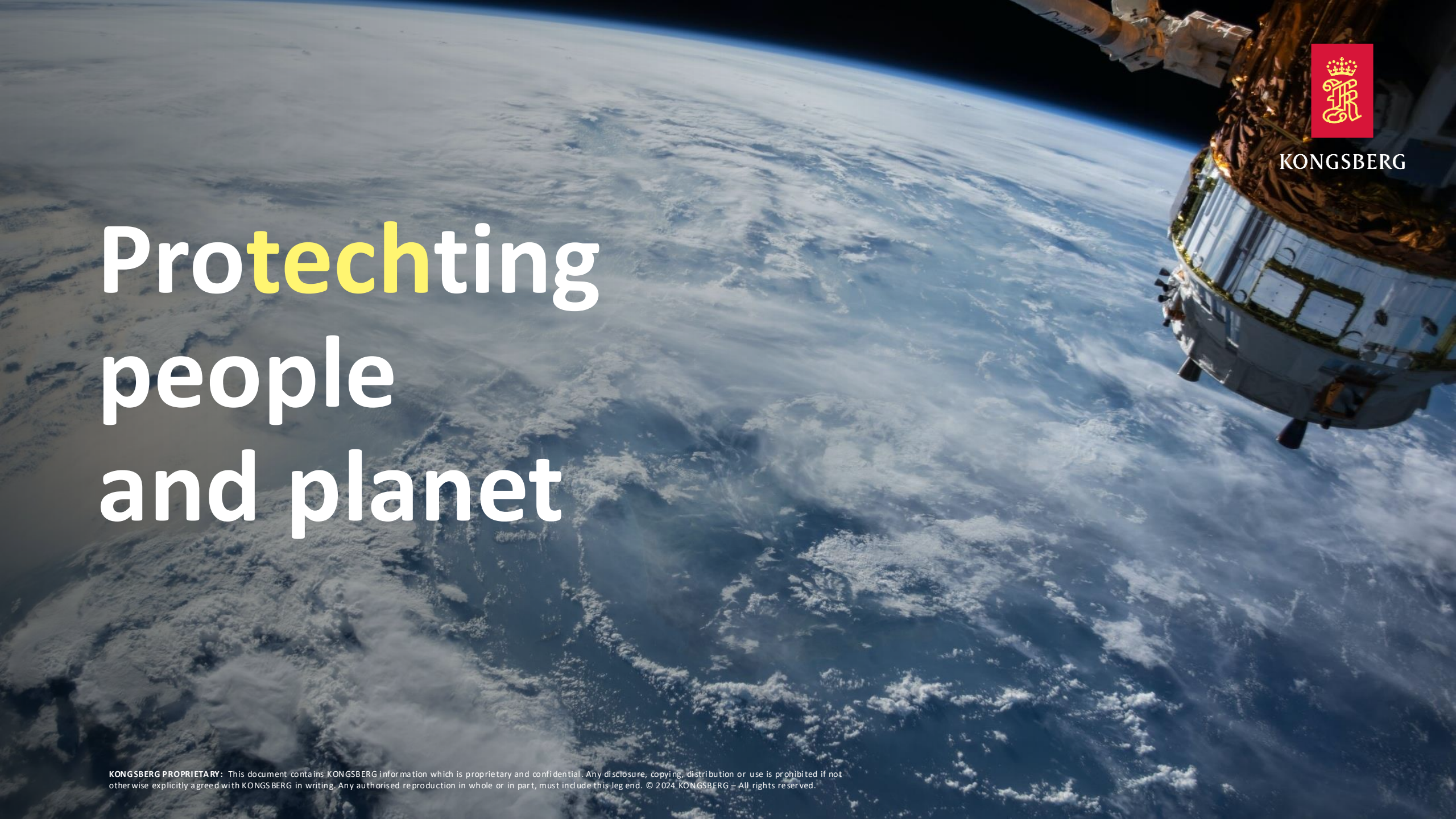

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PROPULSION AND FUEL ALTERNATIVES

IRSO BERGEN 2025

Einar Vegsund, VP Ship Design

Serving the entire ocean space

ENERGY | FOOD | TRANSPORTATION | RESEARCH | LEISURE TRAVEL | NAVAL

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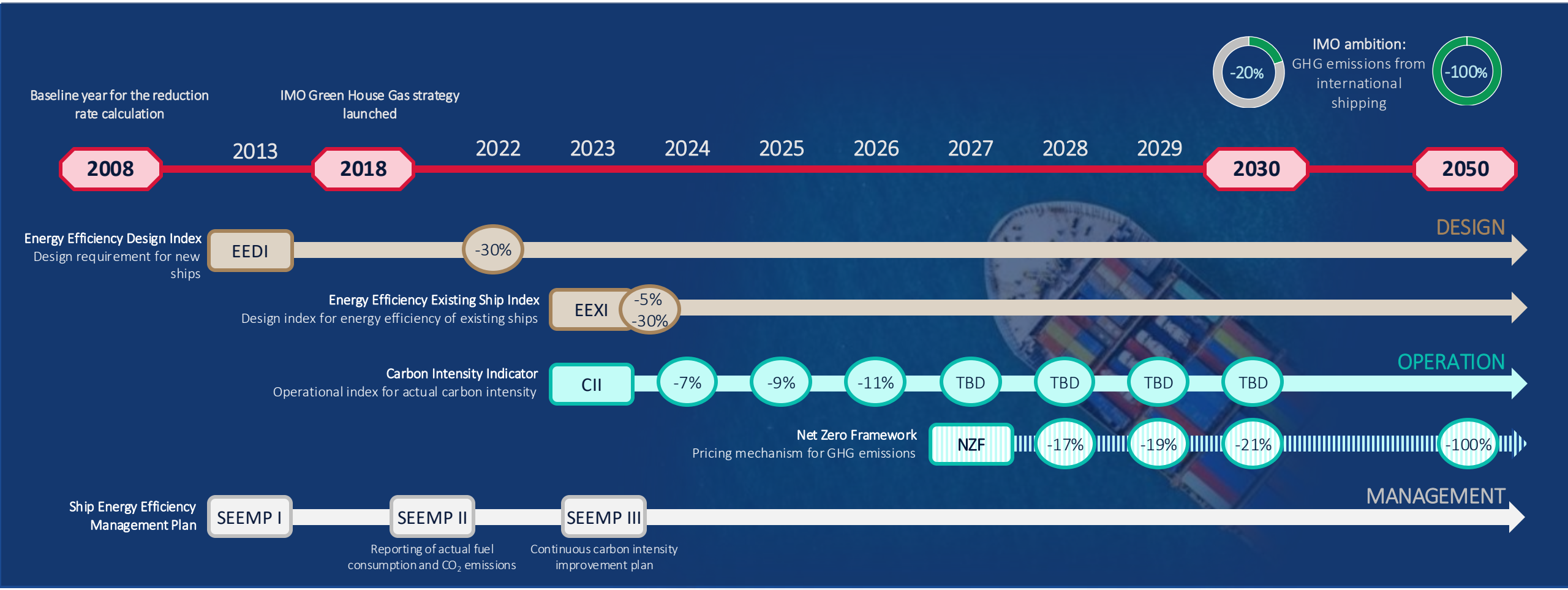
Propulsion and fuel alternatives

Content

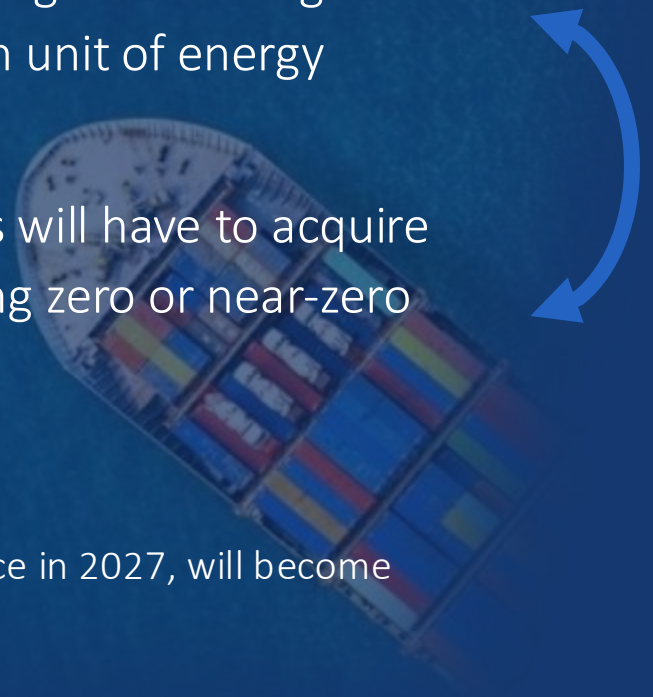
IMO GHG regulations



News from MEPC 83

IMO Net-Zero Framework

1. **Global fuel standard:** Ships must reduce, over time, their annual greenhouse gas fuel intensity (GFI) – that is, how much GHG is emitted for each unit of energy used.
2. **Global economic measure:** Ships emitting above GFI thresholds will have to acquire remedial units to balance its deficit emissions, while those using zero or near-zero GHG technologies will be eligible for financial rewards.



These measures, set to be formally adopted in October 2025 before entry into force in 2027, will become mandatory for large ocean-going ships over 5,000 gross tonnage,

Regulation Fuel EU Martitime, EU ETS and IMO NZF

Fuel EU Maritime

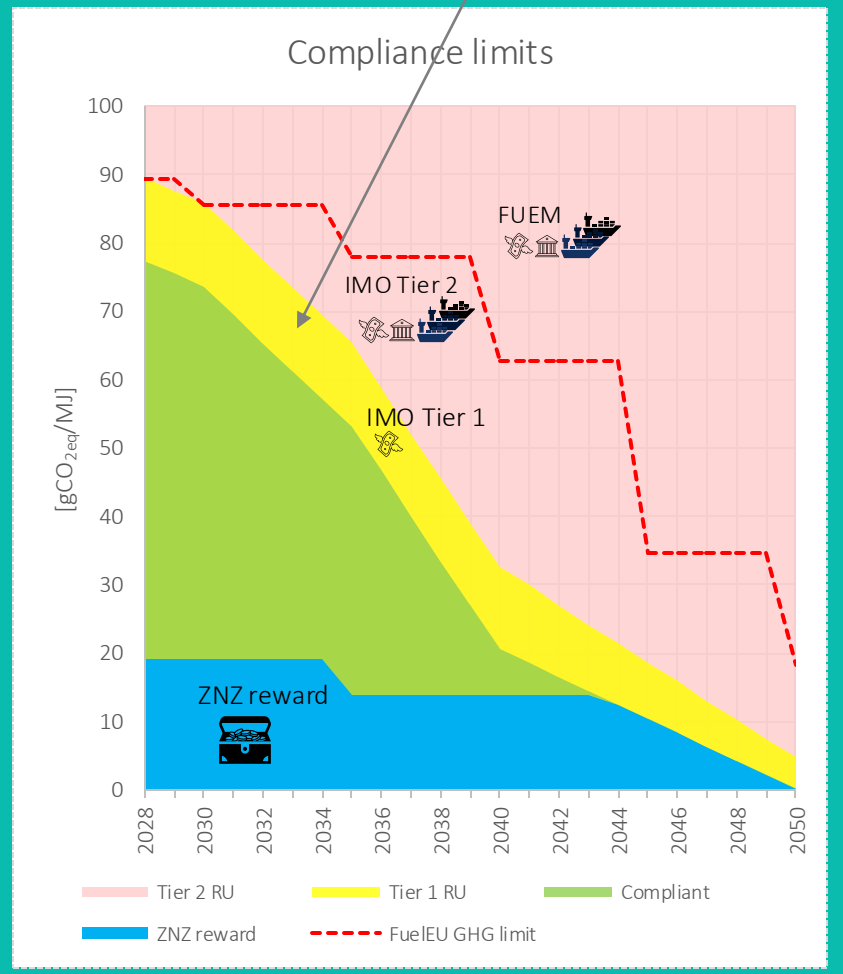
- Ships above 5000GT
  - Offshore vessels from 2027
  - Not decided yet to include ships 400-5000GT
- EU Ports
- Wind propulsion as a factor (EEDI)
- Shore power 0gCO_2/MJ as of now (will most likely be changed at some point)
- Costs (bank, pool or penalty)
  - Penalties 2400€/ton$VLSFO_{eq}$

Blend alt. fuel
Pool
Penalty

IMO Net Zero Framework

- Ships above 5000GT, excluding:
  - Drilling rigs, FPSO, FSU
  - Possibly extending to smaller ships
- Global
- Wind propulsion (and solar) actual contribution
- Shorepower based on national grid emissions
- Costs (bank, pool or penalty)
  - Remedial Unit 1 (IMO NZF fun)
    - 100$/tonCO2eq
  - Remedial Unit 2 Penalty or pool
    - 380$/tonCO2eq

Blend alt. fuel
Pool
Penalty



Note: IMO factors not fully defined

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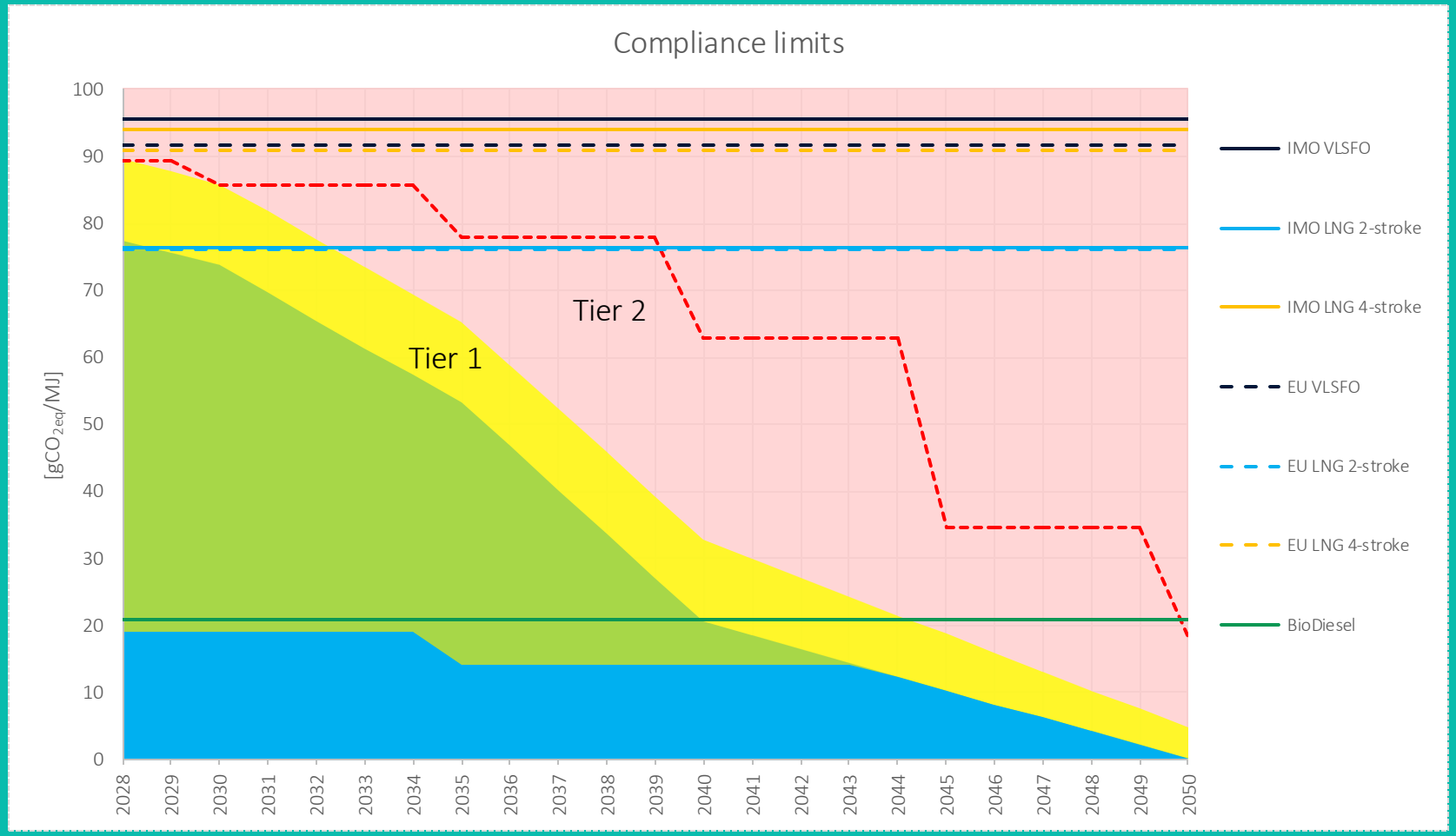
Gross ton (GT) = a ship's internal volume

Regulation Fuel EU Maritime, EU ETS and IMO NZF

Compliance limits

- The basis for the framework is the GHG intensity
- NZF has a stricter limit than FUEM, the limits not fully set
  - Direct target (Tier1) until 2035 30%
  - Base target (Tier 2) 65% at 2040 (not decided 2035-2039)
- Differences between NZF and EU in energy content of fuel and emission factors



Note: IMO factors not fully defined

Gross ton (GT) = a ship's internal volume

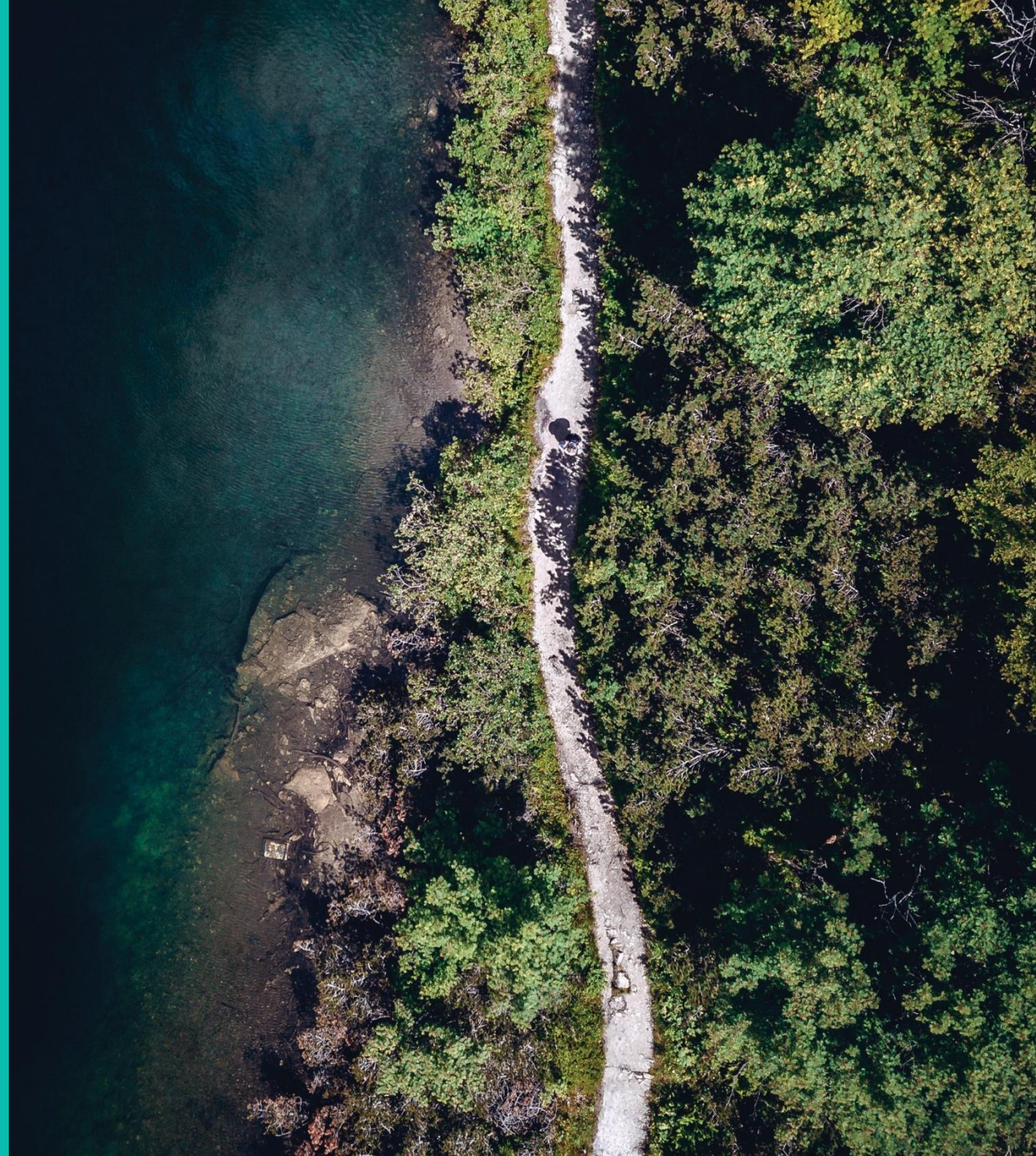
Assumptions

Uncertainties

- To understand the impact of the regulation it is not enough with the cost of penalties as that is a last resort
  - What is the impact of banking and pooling?

- Uncertainties
  - Future energy prices?
  - Future ETS market price?
  - With IMO NZF not fully defined:
    - Reduction factors after 2035/2040?
    - What will be the ZNZ reward be?
    - Tier 1 and Tier 2 RU values only set until 2030 ($100 and $380/ton)
  - What fuels will be available?

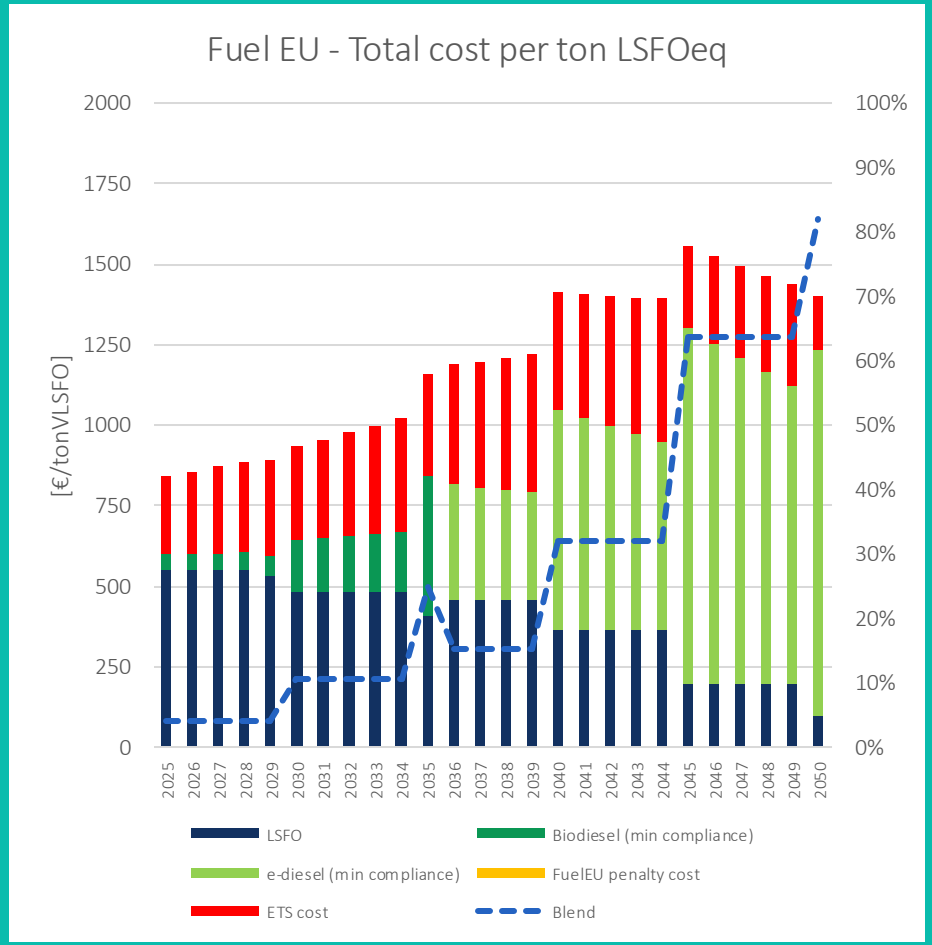
- The next slide will show how the pooling/surplus value can be calculated.

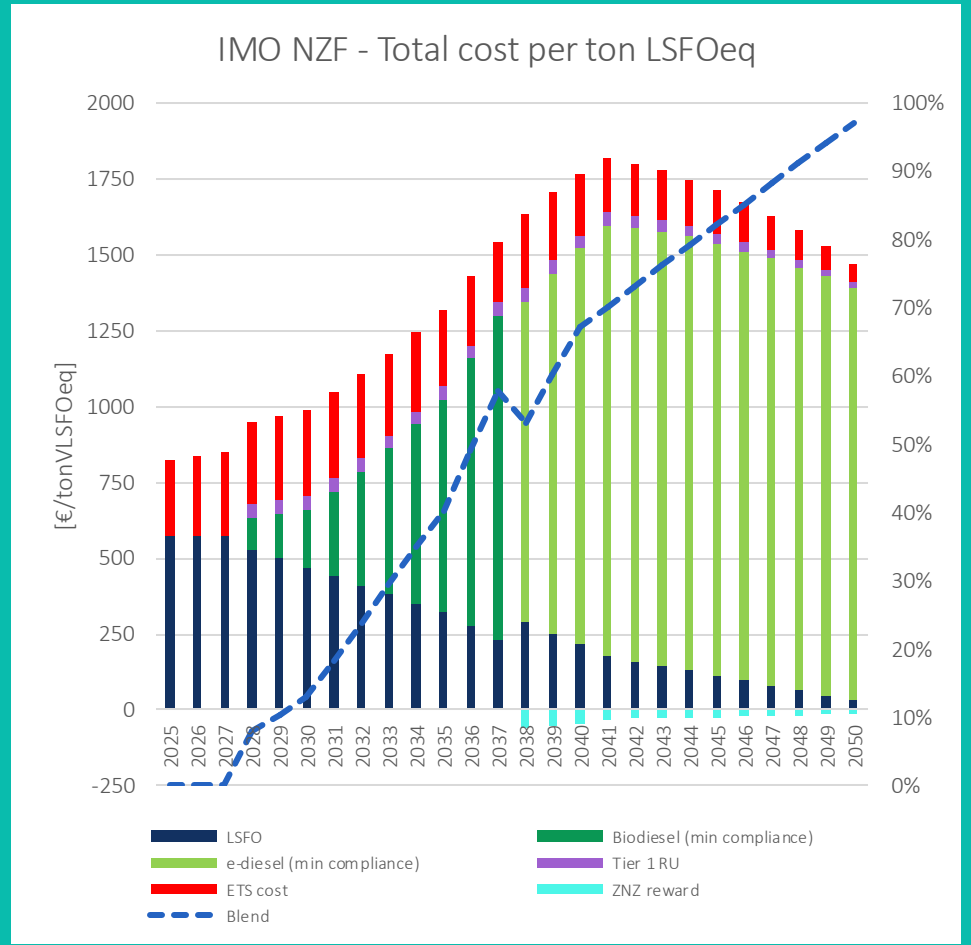


Assumptions

Cost for blending

- Example showing the cost of blending for Fuel EU and NZF, both including EU ETS
- GHG intensity limit gets stricter over time, increases amount of blending
- The cost of fuel will increase by a factor of 2-2.5x
- ETS is potentially a significant cost driver





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Sustainability by design

Some examples

The greenest energy is the energy you don't use

OFFSHORE

TAKING OFFSHORE TOWARDS ZERO CARBON OPERATIONS by AMMONIA as energy carrier. Received the first Approval in Principle (AiP) and Flag state Approval based on a risk based alternative design process.

Green fuel Solutions

80% - 100% CO2 reductions

Future proof EEDI and CII ratings

FISHERY

TAKING FUEL EFFICIENCY TO A NEW LEVEL by full picture delivery including Ship Design, PM technology, Vessel Insight, Energy and Control systems ++

Electrification and Hydrodynamics

25% - 40% Energy savings

Improved crew safety and comfort

DISRUPTIVE

TAKING OPERATIONAL COST TO A LOWER LEVEL by disruptive operation models and full picture delivery including Ship Design, Remote & Autonomy, ROV Handling, energy storage, automation and control ++

Operational model

90 % CO2 reductions

Eliminating personnel risk
Reduced operational cost

MARINE TRANSPORTATION

TAKING MERCHANT TOWARDS NET ZERO OPERATIONS by pushing the standard. Introduce methanol-powered engines, wind assisted propulsion, hybrid battery system and on-shore power.

Green fuel and WASP System

30%-90% CO2 reduction

CII 40% below requirements

Offshore Wind Service Operation Vessels

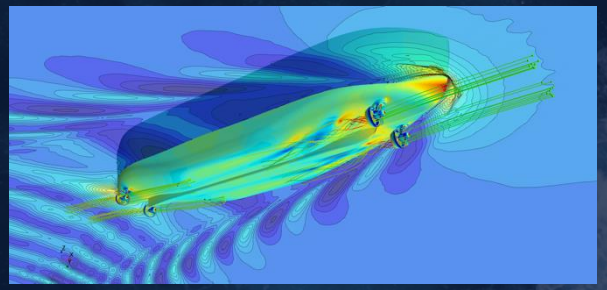
The greenest energy is the energy you don't use

Our road towards Net Zero operations

1 Reduce energy consumption → 2 Optimize power generation and distribution → 3 Application of alternative energy sources and fuels → 4 Zero emission

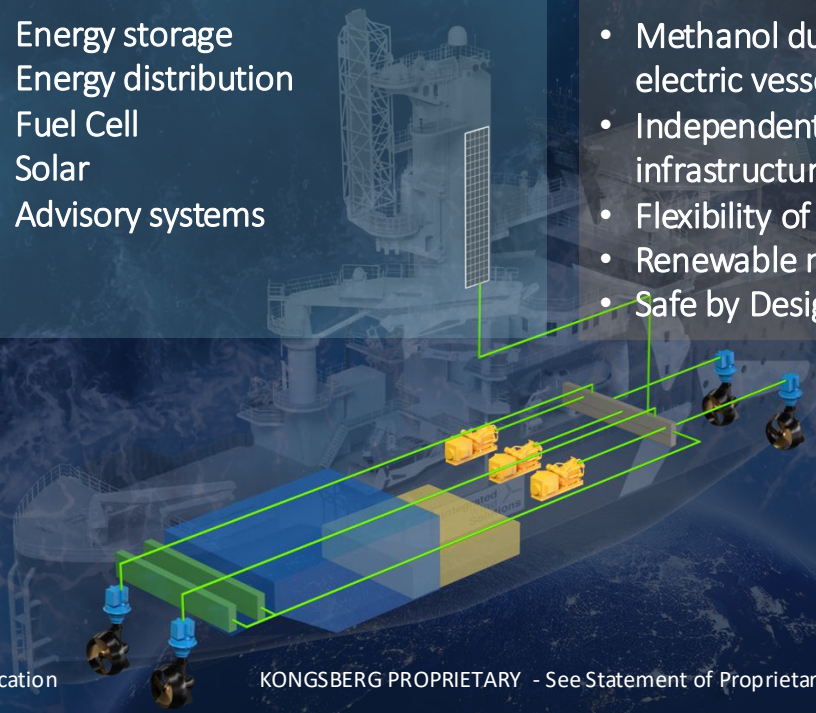
Utilizing our domain competence, mindset and computational power for continuous optimization.

- Multiparameter optimization
- Propulsion set-up
- Operational simulations and improvements
- Hull design



Utilizing our product portfolio and system integration competence

- Energy storage
- Energy distribution
- Fuel Cell
- Solar
- Advisory systems



Wind farm commissioning without local infrastructure available

- Methanol dual fuel hybrid electric vessel
- Independent of local infrastructure
- Flexibility of fuel type availability
- Renewable methanol and HVO
- Safe by Design

Offshore charging for Wind farm maintenance with local infrastructure available

- True zero-emission solution
- Use of local produced energy
- Very high "well-to-wake" energy efficiency
- Low efficiency losses

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Thank you — that concludes the presentation. Let’s open the floor to discuss what’s next.

einar.Vegsund@km.Kongsberg.com