HD HYUNDAI HEAVY INDUSTRIES

# Ship Technologies for Green Future

## 4th Korean-Hellenic Maritime Cooperation Forum

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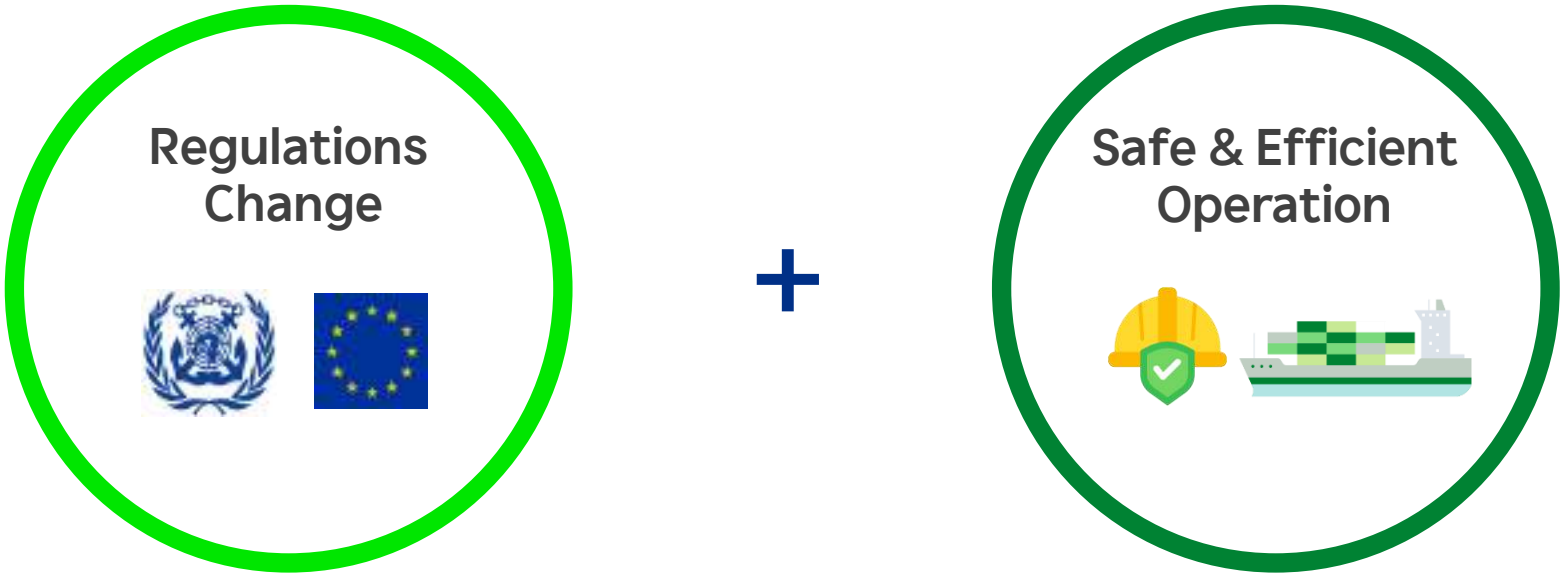
# Contents



# Drivers for Ship Technology Development

## What are driving the ship technology development?

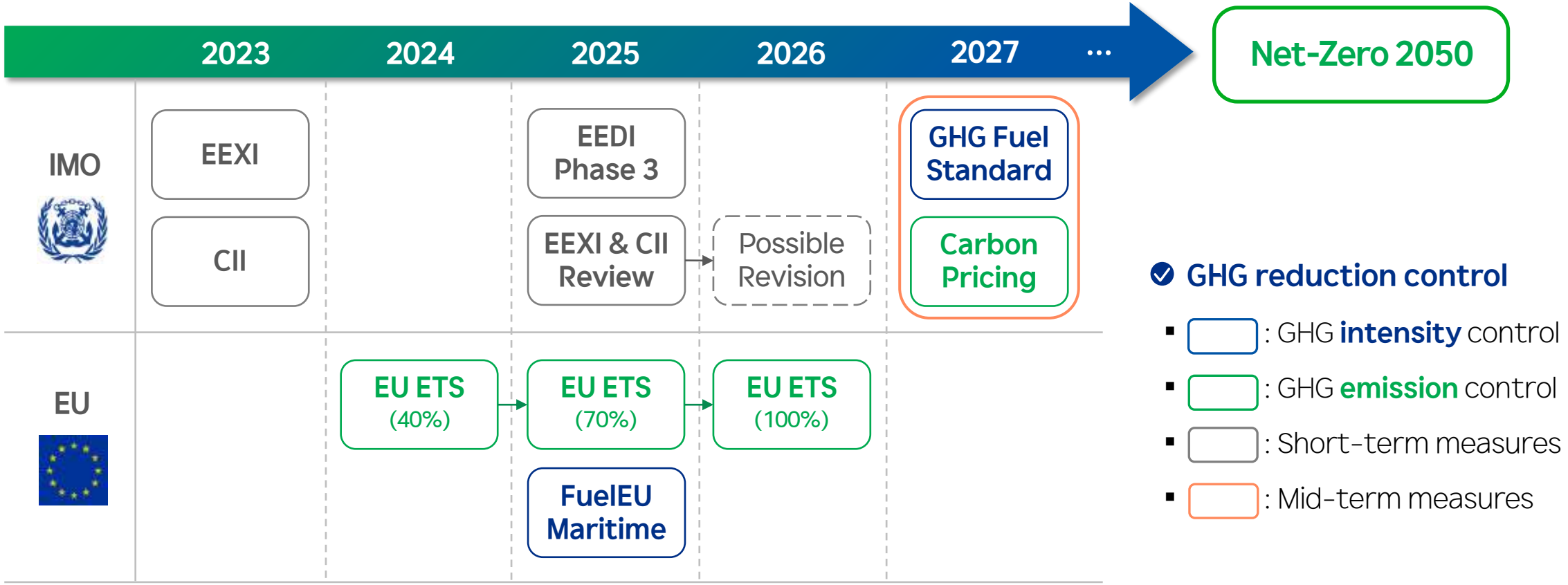



- IMO and EU regulatory changes
  - Alternative fuels, efficiency increase, carbon capture

- New technologies for safe & efficient operation
  - Digitalization support

# Global Regulations Change

## Environmental regulations are continuously strengthening




* EEDI : Energy Efficiency Design Index, EEXI : Energy Efficiency Existing Ship Index,
CII : Carbon Intensity Indicator, ETS : Emission Trading Scheme

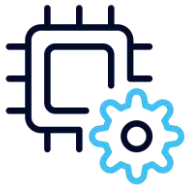
# Decarbonization Technologies

## We have three approaches for 'Net-zero 2050'

### Alternative Fuel

- LNG, LPG
- Methanol
- Ammonia
- Hydrogen

### Efficiency Increase



- Hull form optimization
- Energy saving devices
- Air lubrication system
- Wind assisted propulsion

### Carbon Capture


- $CO_2$ capture and storage
- $CO_2$ value chain

# Decarbonization Technologies - Alternative Fuels

## Fuel transition is already underway by regulatory development

**$CO_2$ → GHG reduction**

- $CO_2$
  - EEDI
  - EEXI, CII
- GHG ($CO_2$, $CH_4$, $N_2O$)
  - EU ETS
  - FuelEU Maritime

**Development for Alternative Fueled Ships**

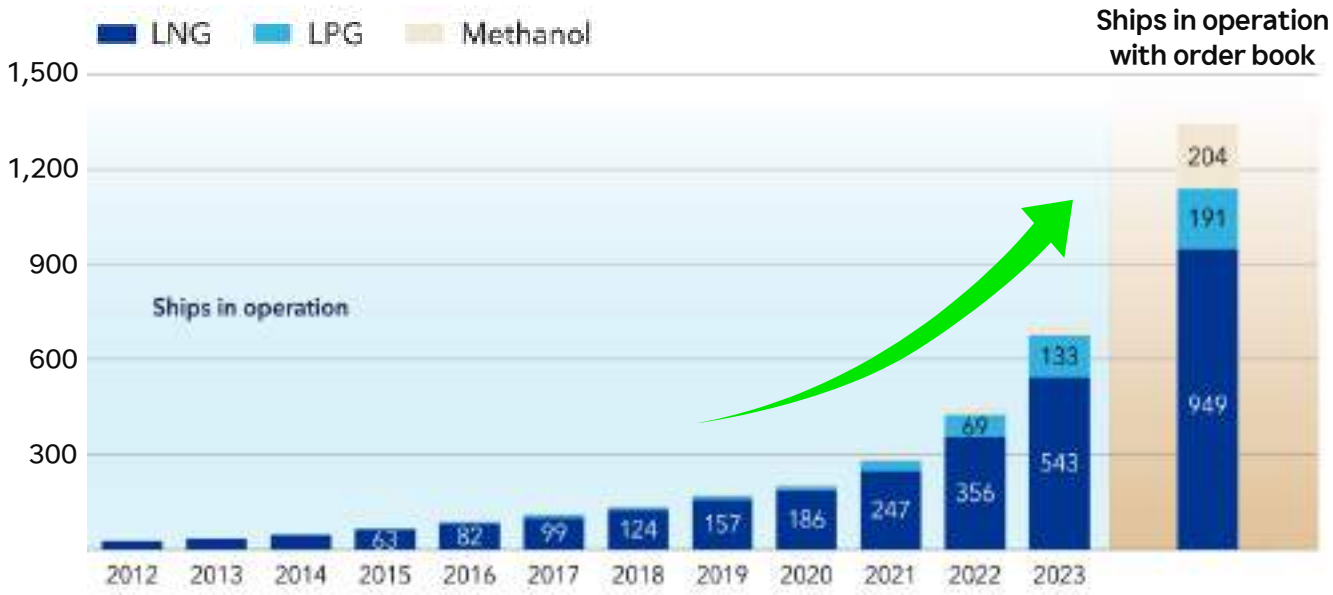
- **Low & Zero carbon fueled ships**
  - Low carbon : LNG, LPG, Methanol
  - Zero carbon : Ammonia, Hydrogen

| LNG Fueled Crude Oil Tanker | LPG Fueled Gas Carrier | Methanol Fueled Container Ship | Ammonia Fueled Ammonia Carrier | Hydrogen Fueled Vessel |
|---|---|---|---|---|
|  |  |  |  |  |

# Decarbonization Technologies - Alternative Fuels

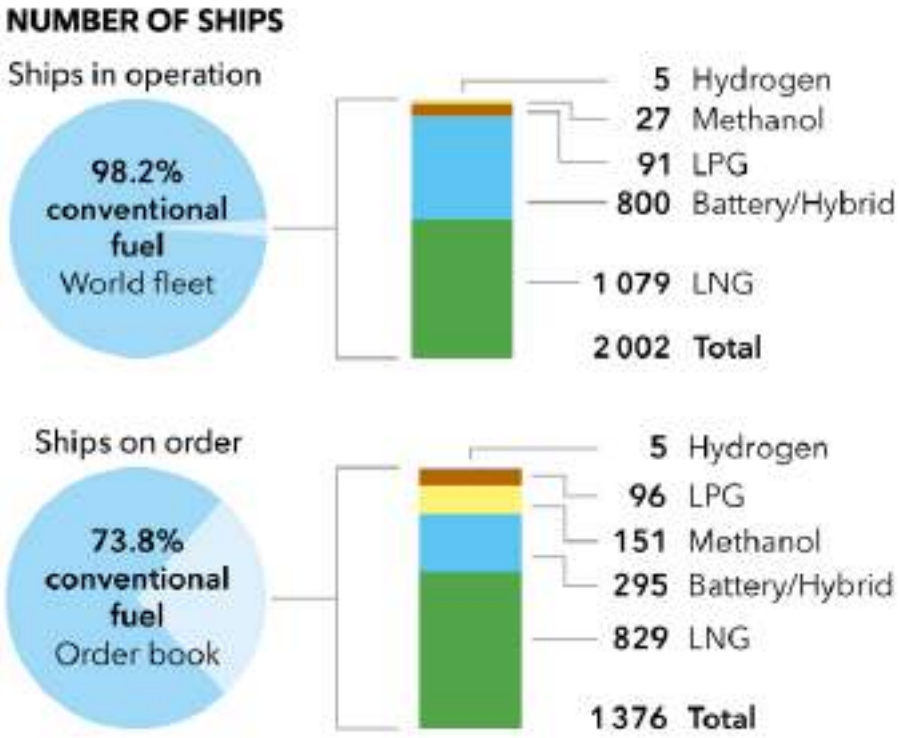
## More ship owners are ordering alternative fueled ships

### Growth of alternative fuel uptake




- **Alternative fueled ships in the world fleet** (as of July 2023)
  - Currently 2% in operation
  - 26% of ships on order (5%p increase compared to 2022)

### Alternative fuel uptake in the world fleet




* Sources : DNV Maritime Forecast 2050

# Decarbonization Technologies - Efficiency Increase

## Energy saving technologies for reducing GHG emissions

**Lifecycle GHG Emissions**
(Take to Wake → Well to Wake)

- **TtW**
  - EEDI
  - EEXI, CII
  - EU ETS
- **WtW**
  - FuelEU Maritime
  - IMO mid-term measures

**Development for Energy Saving Technologies**

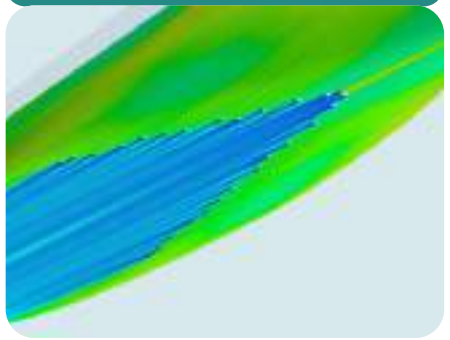
- Hull form optimization
- Energy saving devices
- Air lubrication system
- Wind assisted propulsion

**Hull form optimization**

**Pre-swirl duct**

**Shaft generator**
(power take-off)

**Air lubrication system**

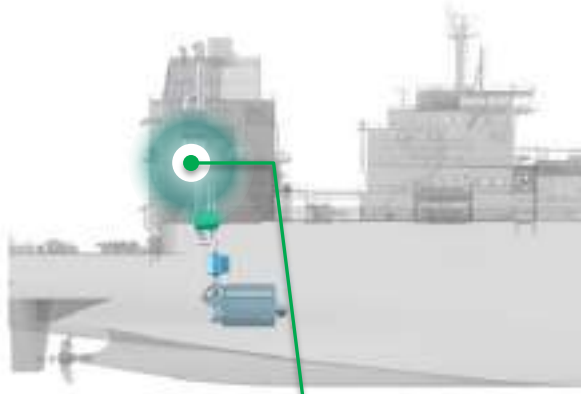


**Wind assisted propulsion system**

# Decarbonization Technologies - Carbon Capture

## Ship's $CO_2$ emission reduction for decarbonization pathway

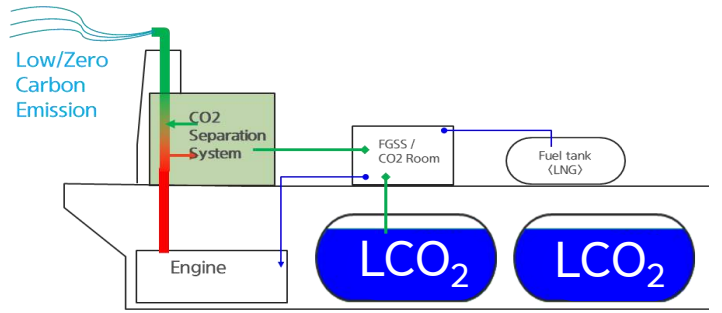
### Onboard carbon capture system

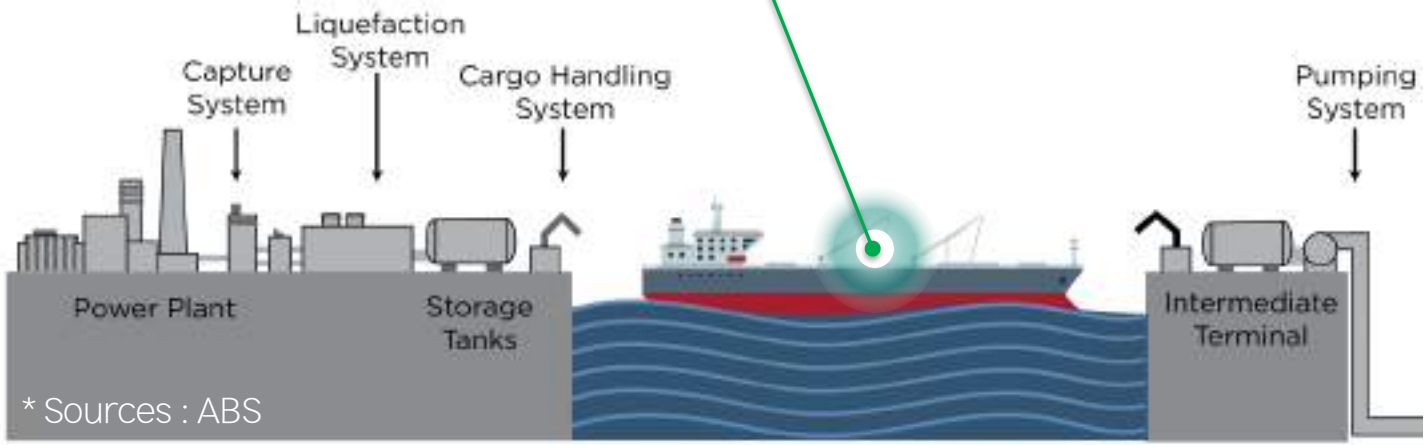


| $CO_2$ capture | $CO_2$ liquefaction |
|---|---|
|  |  |

### $CO_2$ value chain

**Liquefied $CO_2$ carrier :** safe and efficient transportation of $CO_2$



# Digitalization Technologies - Onboard Safety

## Digitalization solutions support the ship's safe operation

### Onboard Safety Management & Support

- Navigation assistant system
- Camera based alarm monitoring system
- Machinery performance / Structure monitoring

### Navigation assistant system


- Safe navigation, collision avoidance

### Camera based monitoring system


- Event detection using AI technology (fire, smoke…)

### Machinery performance monitoring

- Monitoring the status of machinery
- Quick response for maintenance

# Digitalization Technologies - Monitoring & Reporting

## Digitalization solutions support the ship monitoring & reporting

**Real-time Monitoring & Reporting**

- CII rating management
- IMO DCS reporting
- EU MRV data reporting

- CII : Carbon Intensity Indicator
- DCS : Data Collection System
- MRV : Monitoring, Reporting & Verification

### CII rating estimation

- AER (Annual Efficiency Ratio) monitoring

### Analysis & report

- Voyage monitoring (speed, weather effect, IMO DCS, EU MRV)

### Onshore service

- Real-time ship monitoring
- Fleet management

# Digitalization Technologies - Operation Assistance

## Digitalization solutions enhance the ship's operational efficiency

**Technical → Operational Measure**

- **Technical**
  - EEDI
  - EEXI
- **Operational**
  - CII, EU ETS
  - FuelEU Maritime

**Digitalization Solutions for Operation Assistance**

- **Integrated smart ship solution**
  - Voyage optimization
  - Trim optimization

### Voyage optimization

- Fuel saving by route optimization

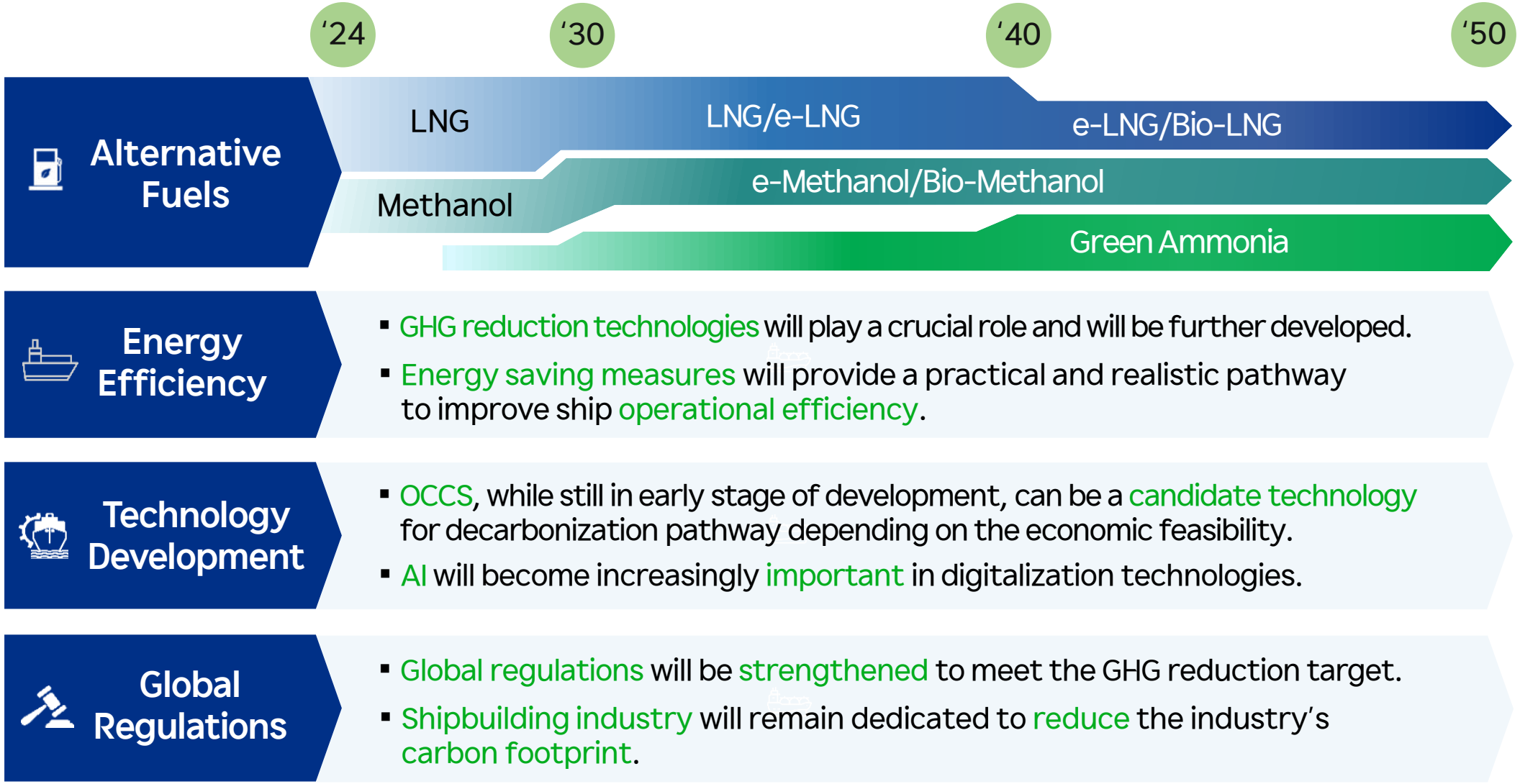
### Trim optimization


- Fuel saving by optimum trim setting

### AI-powered smart ship


- Route/trim optimization with AI by reflection of sailing experience

# Prospect for Green Future



# Thank you!