

Bengt Ramne

Presenterar

# ALKOHOLER SOM BRÄNSLE I SJÖFARTEN



# ALKOHOLER SOM BRÄNSLE I SJÖFARTEN

Varför, vad är problemet?

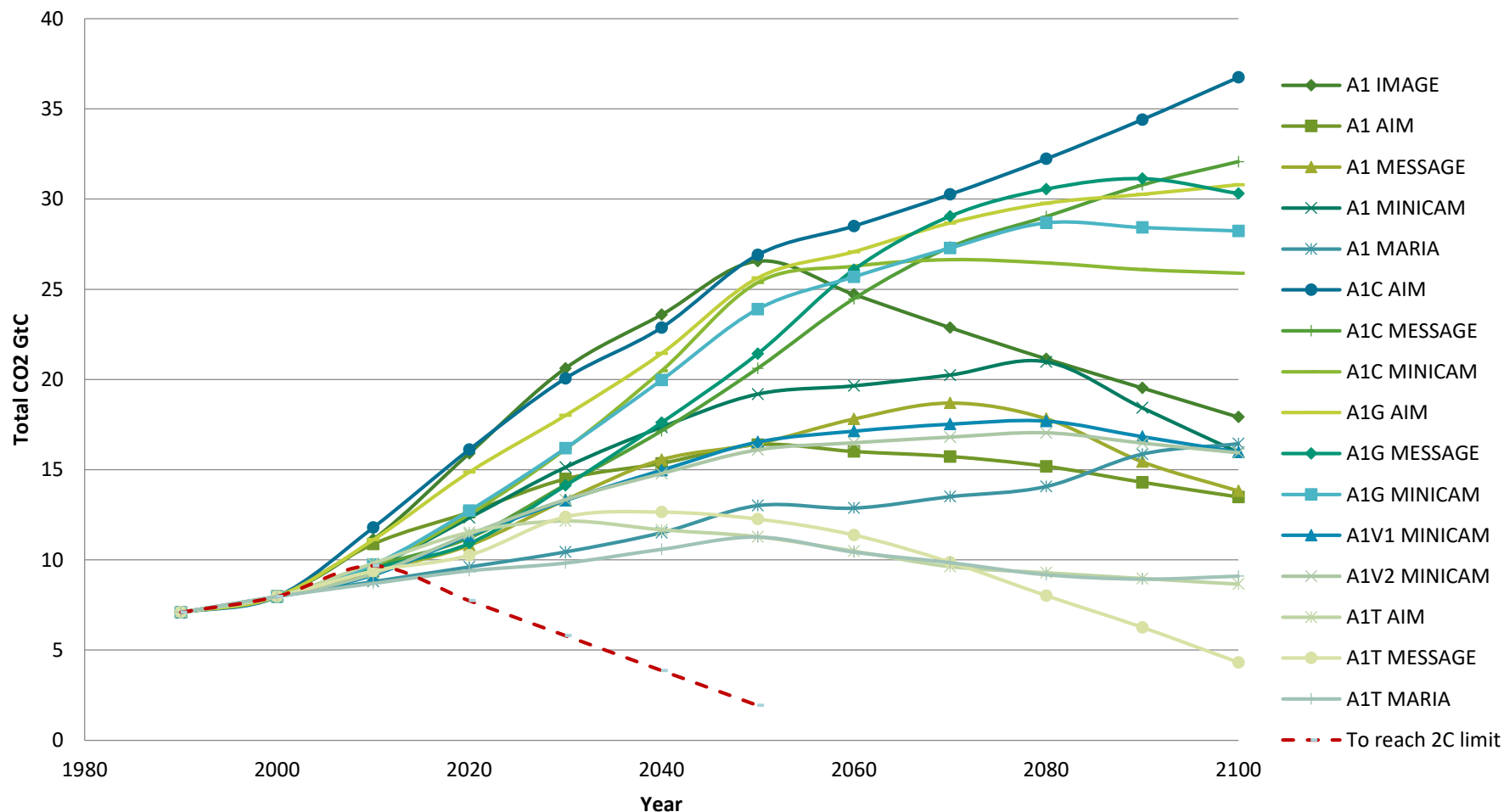
- Den omedelbara utmaningen
- Den stora utmaningen

# DEN OMEDELBARA UTMANINGEN

- SOx
  - Smog
  - Acid rain
  - Respiratory problems
- Nox
  - Poisonous (NO<sub>2</sub>)
  - Smog
  - Acid rain
  - Eutrophication
- Particles, PM
  - Carrier of harmful emissions
  - Cancerogenic
  - Cardiovascular disease

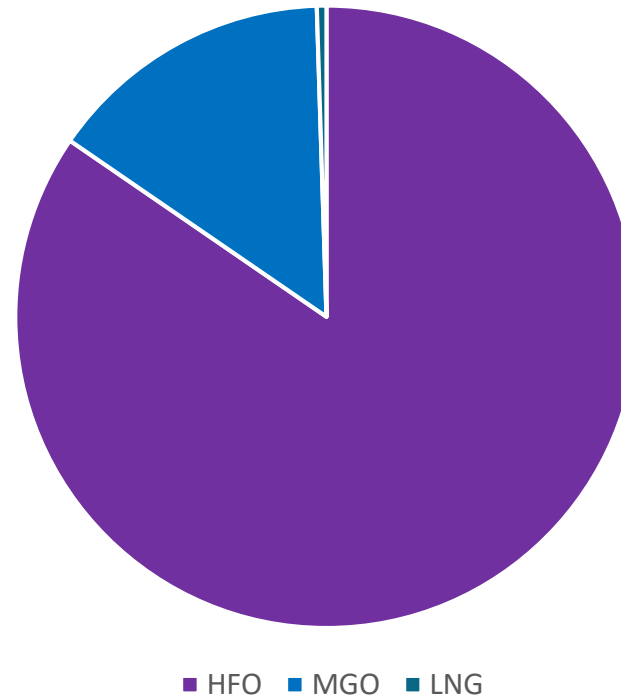
# DEN STORA UTMANINGEN

## IPCC CO2 emission scenarios

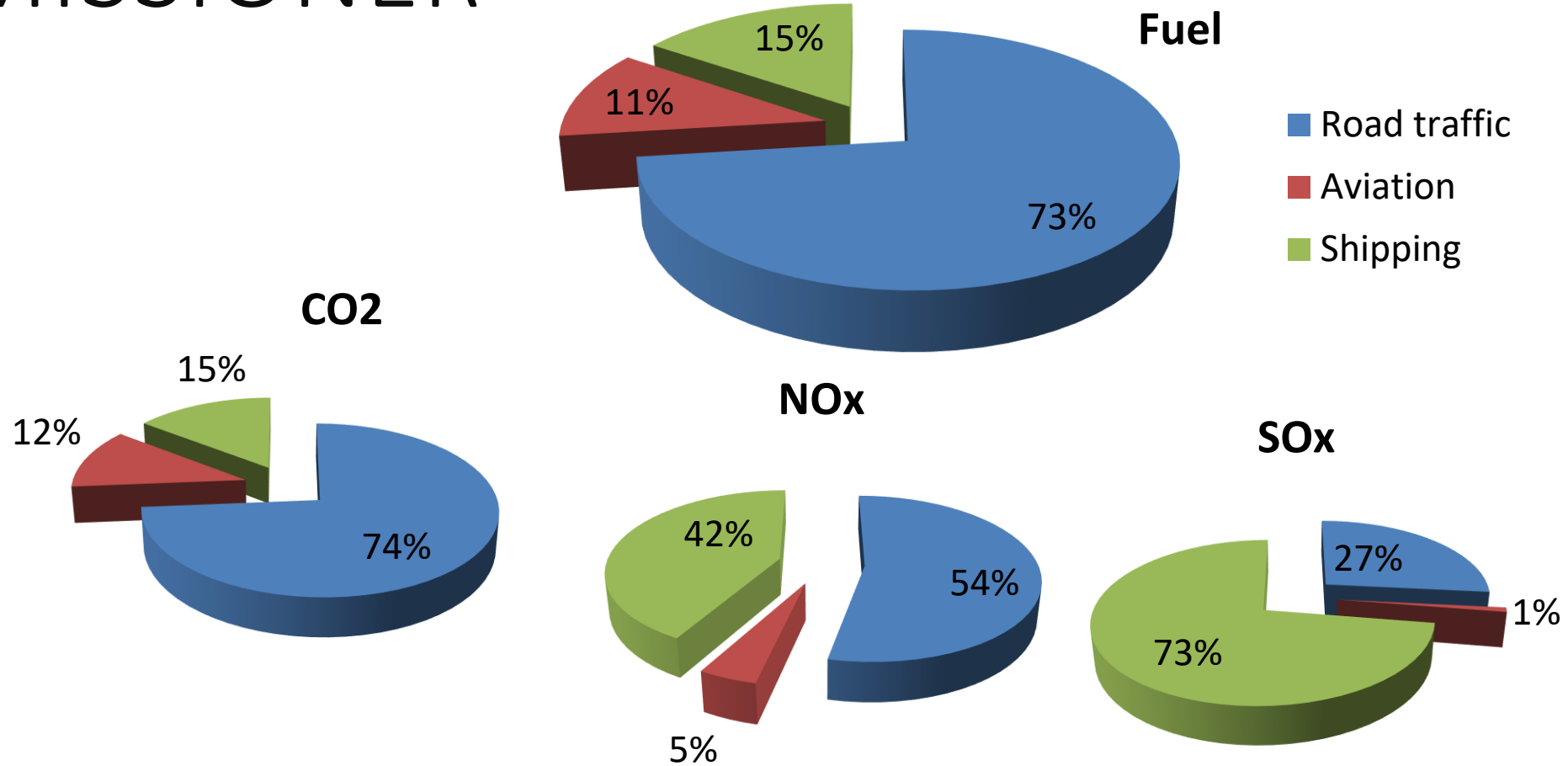


# MARINA BRÄNSLEN IDAG

- HFO – 170\* million tons Source: Wood Mackenzie
- MGO – 30\* million tons
- LNG - less than 1 million ton



# EMISSIONER



Data from Eyring et al. J Geophys Res 110 (2005) - Presented by Erik Fridell

# WHAT ABOUT ELECTRICITY

## Light weight and cost estimate 3100 LM, 1000 pax RoPax vessel - example

Best guess, Bengt Ramne/ 2019-09-12

### MAIN DIMENSION

|                                            |                        |                      |                     |            |
|--------------------------------------------|------------------------|----------------------|---------------------|------------|
| LOA=                                       | 214                    |                      |                     |            |
| LBP=                                       | 200                    |                      |                     |            |
| B=                                         | 27,8                   |                      |                     |            |
| Depth to upper deck                        | 16,4                   |                      |                     |            |
| Design draft                               | 6,4                    |                      |                     |            |
| Scantling draft                            |                        |                      |                     |            |
| Installed power                            | 25 200                 | kW                   |                     |            |
| Design speed (90% MCR, 20% margin)         | 22                     | knots                |                     |            |
| Main Engine                                | 2 x MaK M43C           |                      |                     |            |
| Lane meters                                | 3 100                  | m                    |                     |            |
| Passengers                                 | 1 000                  | RoPax factor         | 5,0                 |            |
| Bunker fuel capacity                       | 1 000                  | ton MGO              |                     |            |
| Specific fuel oil consumption              | 200                    | g/kWh                |                     |            |
| Lower heating value MGO                    | 42 700                 | kJ/kg                |                     |            |
| Mechanical efficiency                      | 42%                    |                      |                     |            |
| Stored mechanically usefull energy         | 5 000                  | MWh                  |                     |            |
| Range                                      | 220                    | h                    |                     |            |
|                                            | 4 850                  | NM                   |                     |            |
| <b>Lightweight</b>                         | <b>14 000</b>          | <b>ton</b>           |                     |            |
| <b>New bulding price</b>                   | <b>€ 125 000 000</b>   |                      |                     |            |
| <b>Battery capacity compared to diesel</b> | <b>100%</b>            | <b>10%</b>           | <b>1%</b>           |            |
| Range                                      | 4 850                  | 485                  | 49                  | NM         |
| Orca Energy battery pack, capacity each    |                        | 125                  |                     | kWh        |
| Unit weight                                |                        | 1,5                  |                     | ton        |
| No of units                                | 40 000                 | 4 000                | 400                 |            |
| <b>Weight</b>                              | <b>60 000</b>          | <b>6 000</b>         | <b>600</b>          | <b>ton</b> |
| Specific, battery cost                     |                        | 500                  |                     | €/kWh      |
| <b>Total battery cost</b>                  | <b>€ 2 500 000 000</b> | <b>€ 250 000 000</b> | <b>€ 25 000 000</b> |            |
|                                            | 2000%                  | 200%                 | 20%                 |            |

# WHAT ABOUT ELECTRICITY

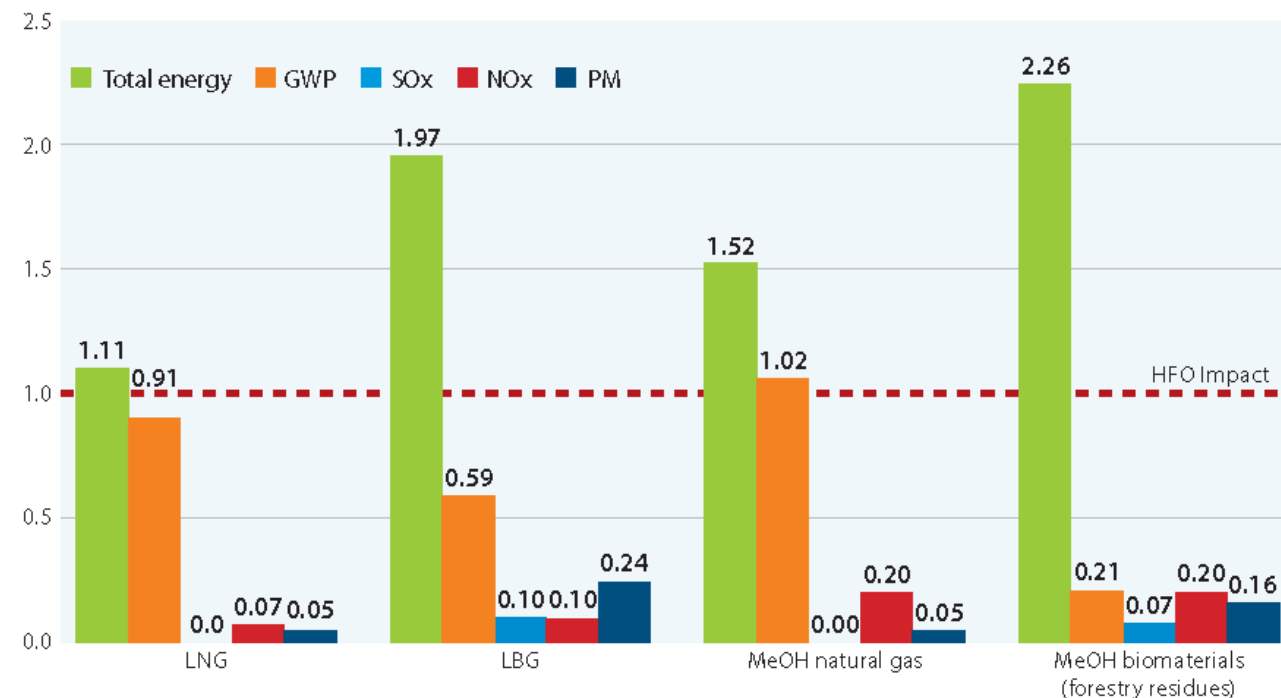
## Light weight and cost estimate 3100 LM, 1000 pax RoPax vessel - example

Best guess, Bengt Ramne/ 2019-09-12

|                                            |          |                        |                      |                   |            |
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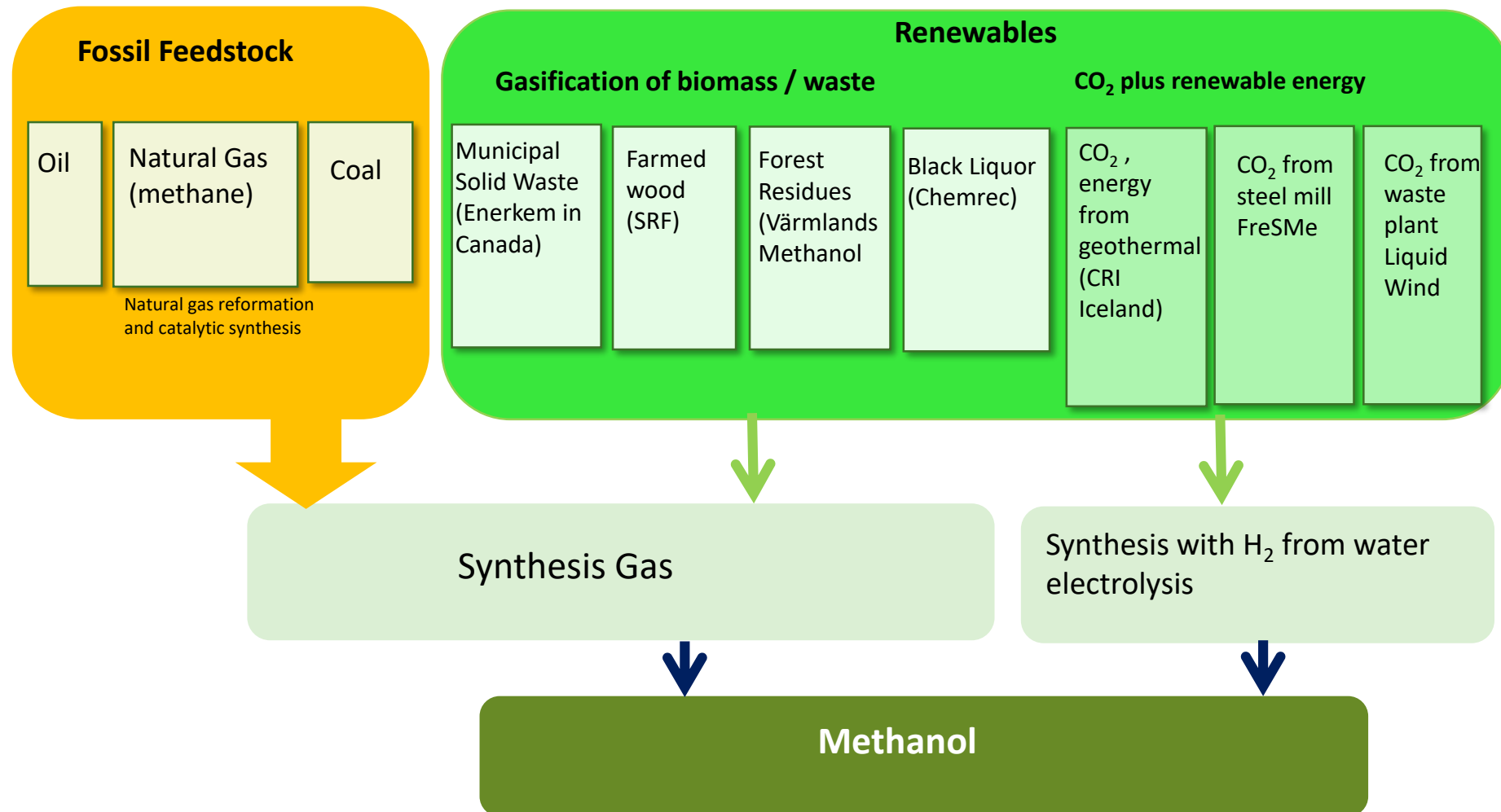
# LIFE-CYCLE ENERGY USE AND ENVIRONMENTAL IMPACT

Figure 10: Life-cycle energy use and environmental impact from LNG and methanol as compared with HFO (HFO = 1 in diagram for all impacts\*)



\*Energy input and impacts are considered from a well to propeller perspective and apply to the fuel used for transporting one ton for one km with a RoRo ship.  
 LNG figures assume 4% methane slip, as reported by the manufacturer.  
 Source: Brynolf et al, 2014

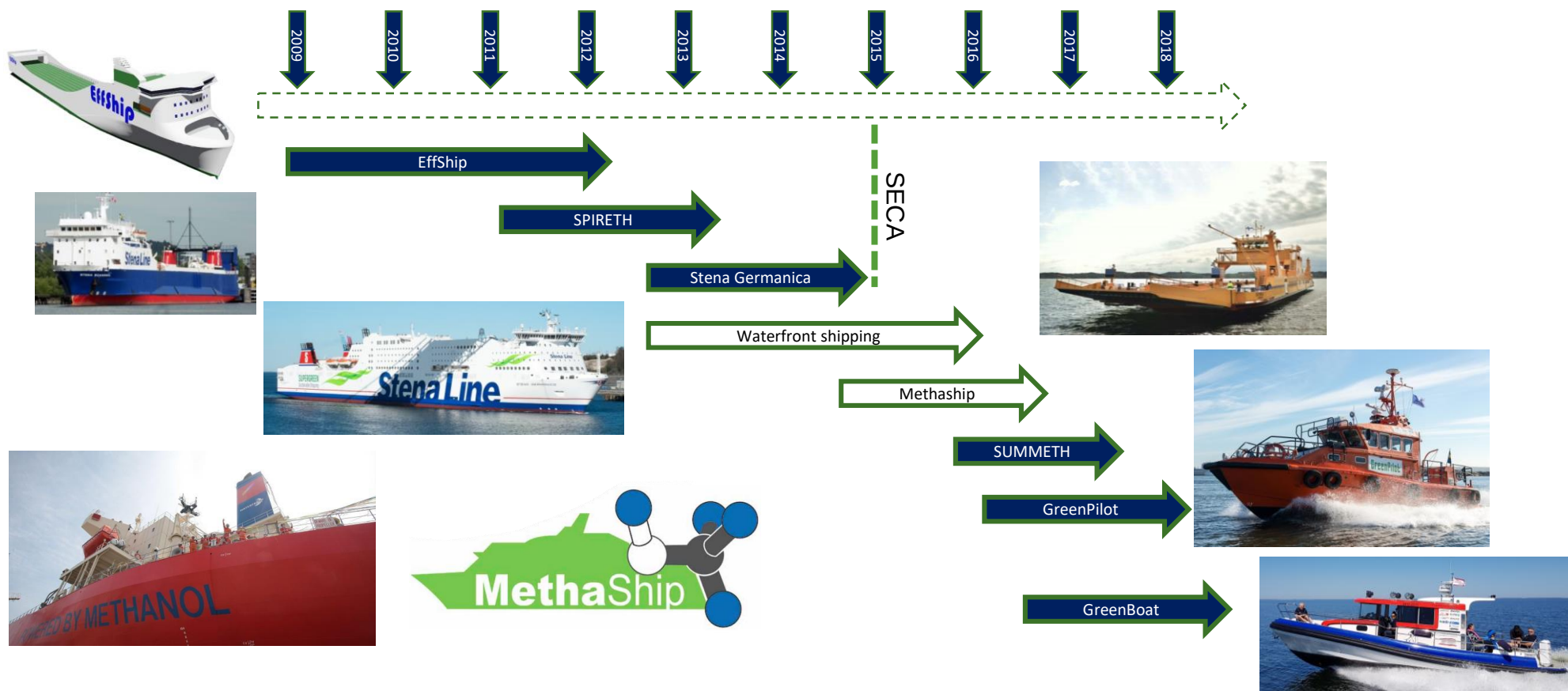
# METHANOL CAN BE PRODUCED FROM A LARGE VARIETY OF FEEDSTOCK



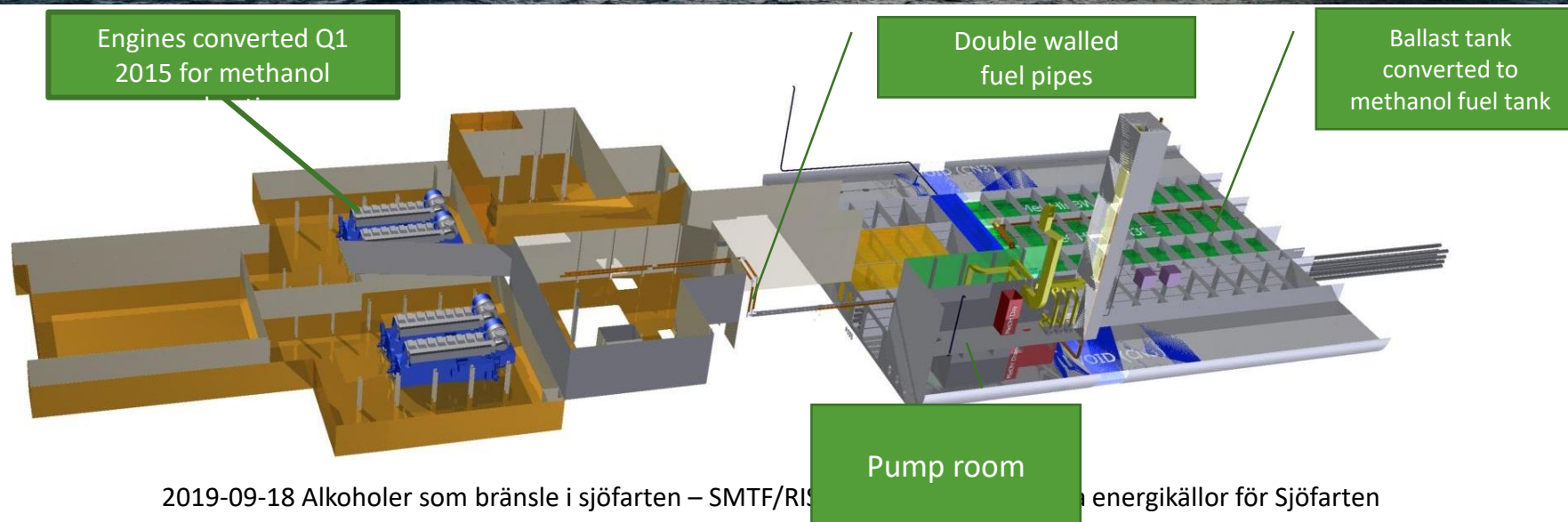
# VARFÖR METANOL?

- Metanol kan produceras kostnadseffektivt i stora volymer från ett mycket stort antal råvaror och kan produceras 100% förnybart.
- Liksom etanol ger metanol väsentligt mindre mängd skadliga utsläpp vid förbränning och är ett kostnadseffektivt lösning för att uppfylla kommande strängare utsläppskrav
- Befintlig infrastruktur för bränsle kan utnyttjas och kräver bara mindre modifiering
- Konverteringskostnaden är väsentligt lägre än t.ex. konvertering till LNG/LBG
- Bra bränsle för bränsleceller i framtiden

# METHANOL PROJECTS

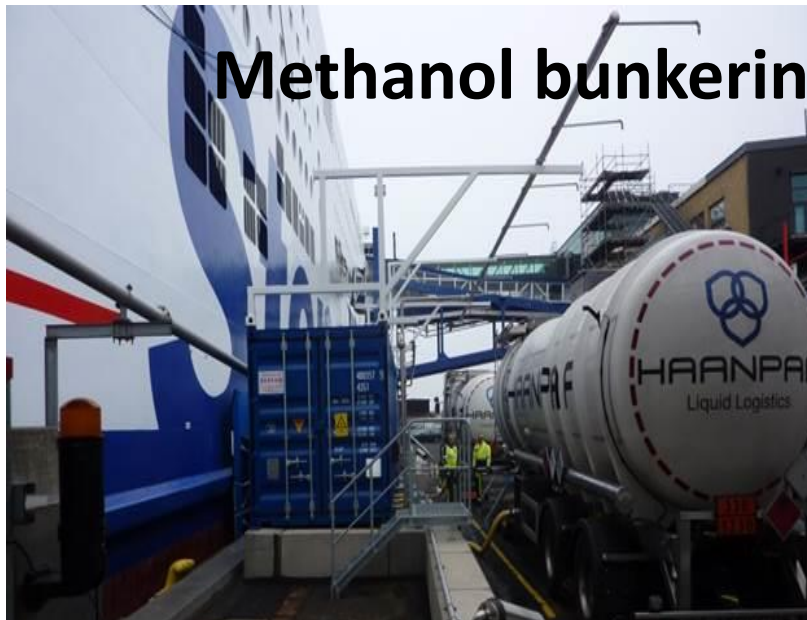


# STENA GERMANICA – WORLDS FIRST METHANOL SHIP





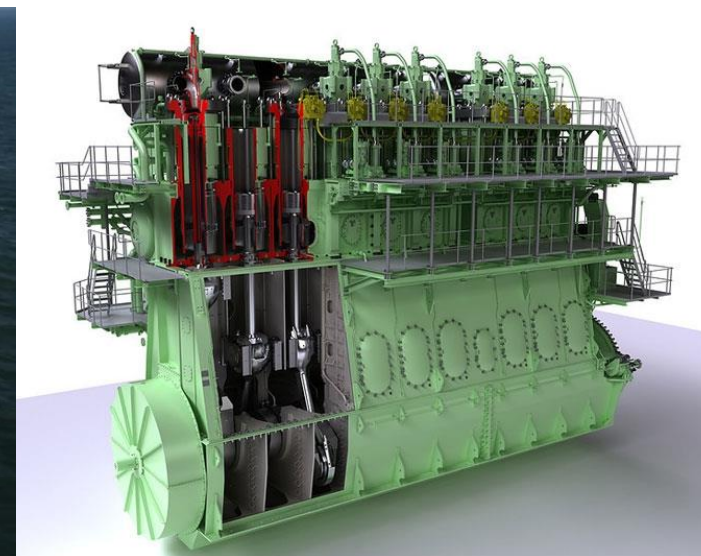
# Methanol bunkering in Gothenburg



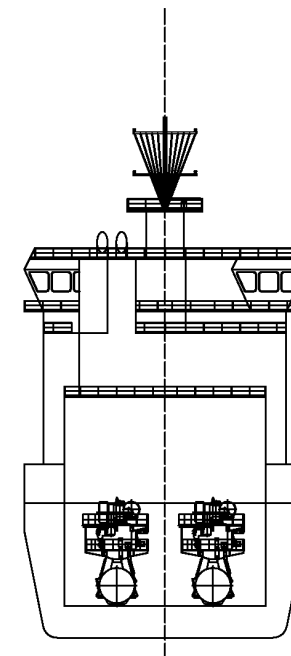
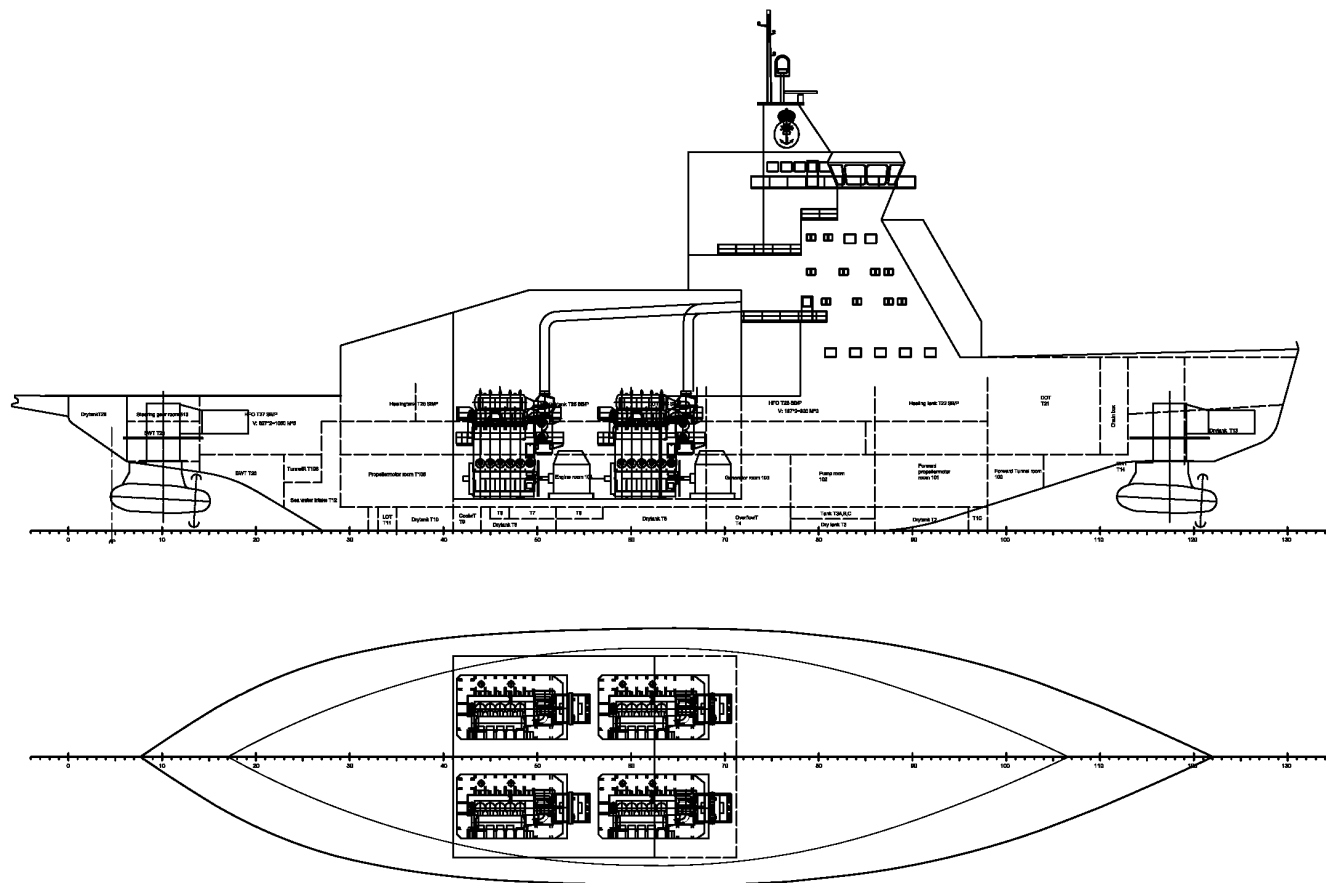
ida och framtida energikällor för Sjöfarten

## Methanol new buildings seven 50 000 dwt Chemical Tankers

MAN S50ME-B9.3-LGI TWO STROKE HIGH PRESSURE GAS (METHANOL) ENGINE

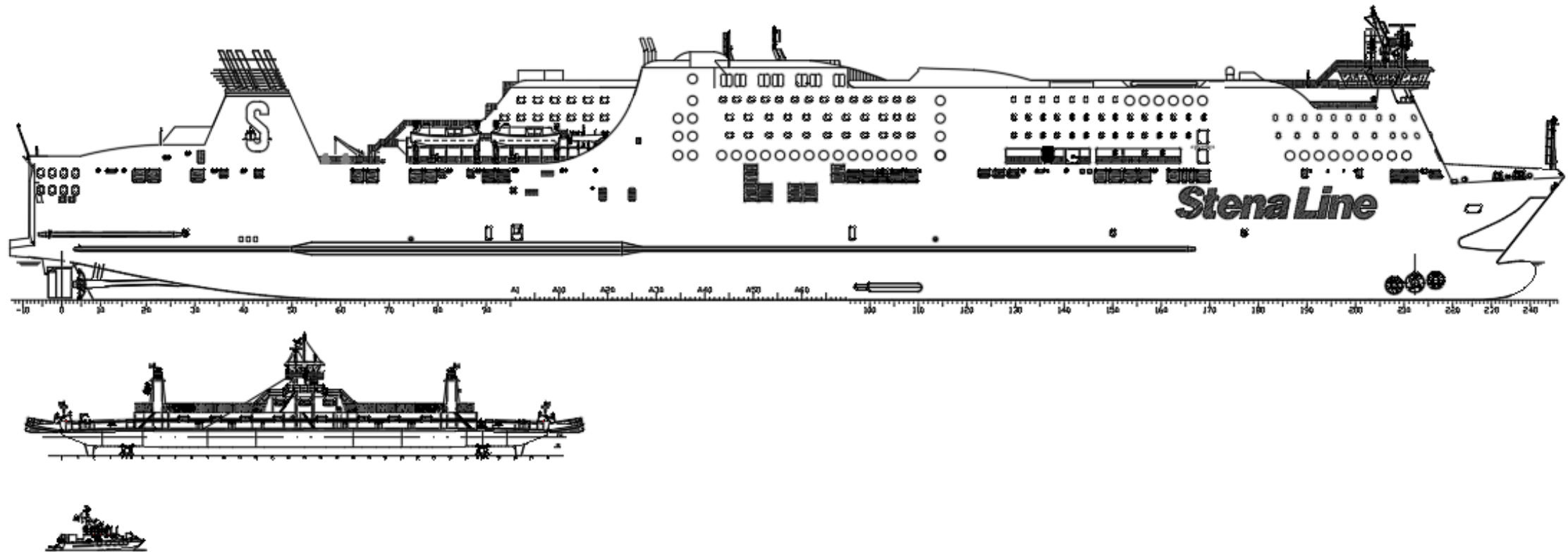


Methanol - Electric Ice breaker  
 4 x MAN (B&W) 5G50ME-B9.3 LGI  
 4 x 6300 kW = 25 200 kW



|                                                                                                                                                                                                         |                                                                                                                                                                                                                                     |                    |                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------|
| <p>Adolf Edelvärds gata 11 7<br/>         414 41 Göteborg<br/>         Sweden<br/>         Phone +46 31 884381<br/>         e-mail: info@scandinaios.com<br/>         web site: www.scandinaios.com</p> | Existing ice projects<br>ScandiNAOS AB signs all<br>drawings of ice breaking<br>equipment and all the<br>published, issued,<br>modified, manufactured or<br>repaired to any other way<br>without the permission of<br>ScandiNAOS AB |                    | Project number<br>SNP17121 |
|                                                                                                                                                                                                         | OWNER<br>---                                                                                                                                                                                                                        |                    |                            |
|                                                                                                                                                                                                         | Class<br>---                                                                                                                                                                                                                        |                    |                            |
|                                                                                                                                                                                                         | PREP. BY<br>EJ                                                                                                                                                                                                                      | DATE<br>2018-08-08 |                            |
| CHECK. BY<br>---                                                                                                                                                                                        |                                                                                                                                                                                                                                     | DATE<br>---        |                            |
| SCALE<br>1:50                                                                                                                                                                                           | Size<br>A0                                                                                                                                                                                                                          | SCLS<br>---        |                            |
| DRAW. BY<br>SNP17121-002                                                                                                                                                                                |                                                                                                                                                                                                                                     |                    |                            |

# SIZE MATTERS



# SUMMETH - METHANOL CONVERSION OF A ROAD FERRY

- Design considerations
- Hazards
- Regulations
- Safe design





# GreenPilot



- Main objective GreenPilot
  - Convert a Swedish Pilot boat to methanol operation
  - Provide a field test platform for various engine suppliers and various engine concepts

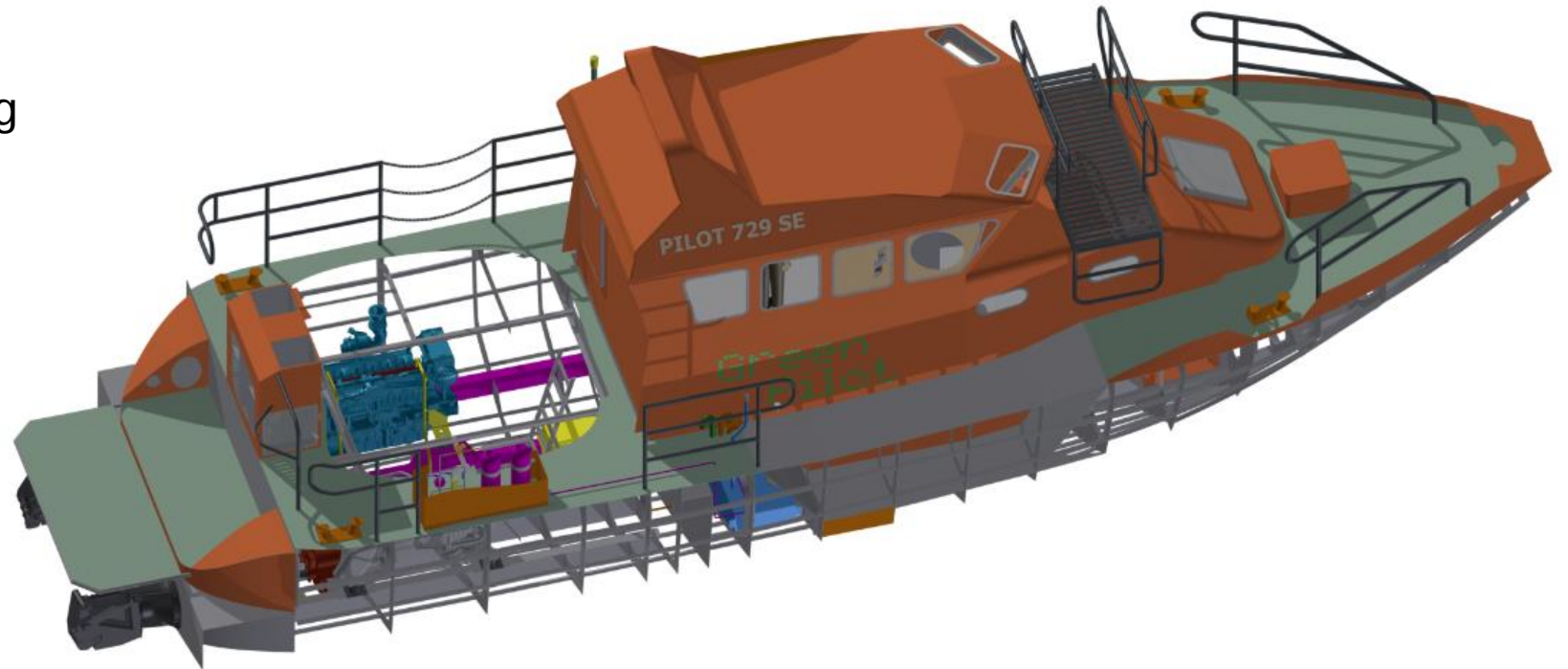
|                            |                        |     |
|----------------------------|------------------------|-----|
| Name                       | Pilot boat 729         |     |
| Year built:                | 1996                   |     |
| Yard:                      | Smögens plåt och svets |     |
|                            |                        |     |
| L <sub>OA</sub>            | 12,6                   | m   |
| L <sub>pp</sub>            | 11,1                   | m   |
| Breath <sub>moulded</sub>  | 4,16                   | m   |
| Depth <sub>moulded</sub>   | 1,05                   | m   |
| Draught <sub>moulded</sub> | 0,7                    | m   |
|                            |                        |     |
| Class                      | NBS Y 90               |     |
|                            |                        |     |
| Hull material              | Aluminium              |     |
| Superstructure             | Composite              |     |
|                            |                        |     |
| Light Ship Weight          | 11                     | ton |
| Gross Tonnage              | 20                     | ton |
| Net Tonnage                | 6                      | ton |
| Dead Weight                | 1.5 ton                | ton |
| Max Engine Load            | 2200                   | rpm |
| Max Speed*                 | 32                     | kn  |
|                            |                        |     |
| Main engines               |                        |     |
| No off                     | 2                      |     |
| Make                       | Cummins                |     |
| Type                       | QSM 11M                |     |
| Output each                | 433                    | kW  |
| RPM                        | 2300                   |     |
| Displacement               | 10,8                   | l   |
| Cylinders                  | 6                      |     |
| Bore                       | 125                    | mm  |
| Stroke                     | 147                    | mm  |
| L                          | 1328                   | mm  |
| W                          | 1080                   | mm  |
| H                          | 1012                   | mm  |
| Weight engine each         | 1188                   | kg  |
|                            |                        |     |



GreenPilot



- Fuel tanks
- Fuel system, tank and piping
- Tank inertion
- Gas detection
- Fire detection and suppression
- Engines



# Greenboat

## PARAGON 31

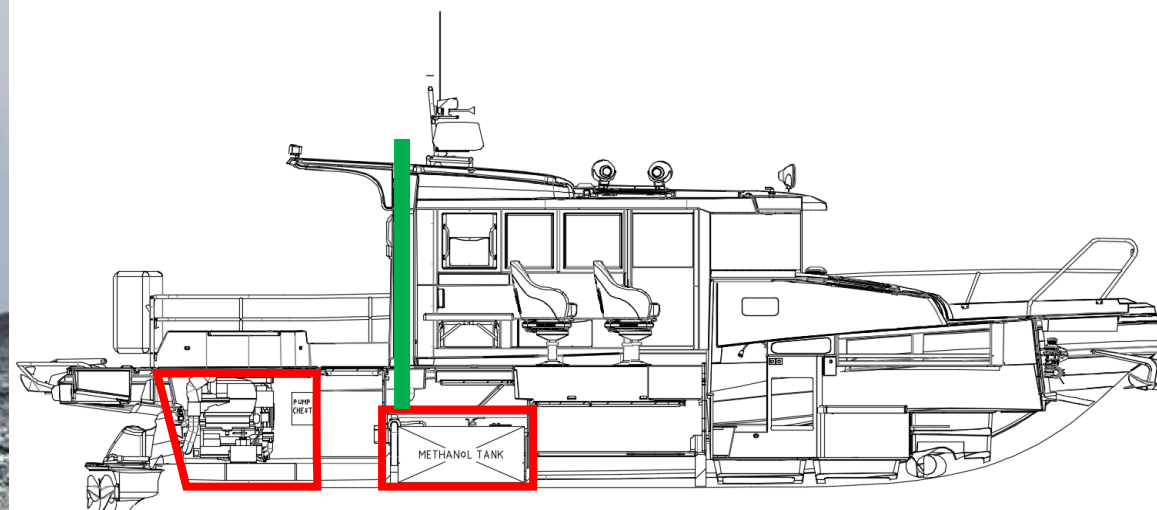


Loa 10,59 m

Lwl 8,32 m

Beam 3,47 m

Light Craft 6187 kg



Engine room  
2x engines  
2x Pump Chest

Tank room  
Gas safe  
Ventilated

# METHANOL AND ETHANOL

- Clean burning, efficient, universal, future-proof, energy carrier that can be sustainably produced in large quantities

