VISION:
A Zero emission marine Future

MISSION:
Creating an economically compelling zero-emission marine ecosystem driving sustainable technology solutions and services

OBJECTIVES:
With the ecosystem’s collective over 300 million euro increase in R&D spend over the coming years, we will develop new competitive skills, human capital and world-class services and solutions, enabling the creation of additional annual revenue to Finland of one billion euros per year by 2030.

This will enable us to reach 60% GHG reduction in the maritime industry by 2030 and by 2050 all the Wärtsilä Veturi ecosystem products are carbon-neutral or carbon-negative.

60% GHG reduction in the maritime industry by 2030
Wärtsilä roadmap for Veturi project Zero Emission Marine

- Technologies enabling introduction of green fuels
- Green fuel production
- Automated and optimized operations – increased level of autonomy
- Outcome based business model – OBBM

Wärtsilä’s effort  Ecosystem effort
Technologies enabling introduction of green fuels

- Hydrogen Internal Combustion Engine (ICE) concepts and related enabling technologies
- Ammonia Internal Combustion Engine (ICE) concepts and related enabling technologies
- Further develop the methanol and ethanol ICE concepts
- Operating on blends – Develop technologies, testing and approving the use of various blends
- Aftertreatment – further reduction of global and local harmful emissions
- Further integration of new and existing Energy Storage systems for the Marine and Energy Markets

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027+ |
Path to Zero Emission Marine

Green fuel production

- Carbon Capture, Storage and Utilisation Technologies
- Develop and pilot Hydrogen production technologies
- Develop and pilot Ammonia production technologies
- Develop and pilot Hydrogen carriers for storage and logistics
- Expand sustainable feedstock alternatives for Bio Fuels (Liquid and Gaseous)
- Develop Bio & Synthetic Blends for green transition
  Ex-situ methanation

Years:
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027+

To X

Bio to X

Power to X
Automated and optimized operations – increased level of autonomy

Path to Zero Emission Marine

Platform enabling cloud applications

Models & APIs - Development of optimization and "autonomous ready" models, APIs and libraries, helping to quantify vessel and ecosystem level energy usage and related emissions

Integrations and data sources – Open APIs for equipment integration onboard, enabling new data for model development as well as integration of new data sources

Applications for automated, connected and optimized operations

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027+ |
### Outcome based business model – OBBM

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGINE SFOC OPTIMIZATION</td>
<td>Engine efficiency and emission reduction through upgrades and optimized operations</td>
</tr>
<tr>
<td>VESSEL FUEL OPTIMIZATION</td>
<td>Vessel fuel efficiency and emission reduction through propulsion upgrades and energy savings devices</td>
</tr>
<tr>
<td>EMISSION COMPLIANCE (CII)</td>
<td>Capability to guarantee fuel savings that are required for targeted CII rating</td>
</tr>
<tr>
<td>FINANCING &amp; RISK MANAGEMENT</td>
<td>Capability to offer financing and performance guarantees for fuel savings</td>
</tr>
<tr>
<td>ASSET USAGE</td>
<td>Fuel &amp; emission savings through optimized usage of the powertrain and the vessel</td>
</tr>
</tbody>
</table>

**Path to Zero Emission Marine**

- **2022**
- **2023**
- **2024**
- **2025**
- **2026**
- **2027+**

- Scaling up the released OBBM offerings to new segments and customer bases
- Extend OBBM offering with addition value propositions (e.g. conversions to future zero-carbon fuels & lean manned engine room)
Research topics

Knowledge creation
- Risk management
- Sector coupling & regulations
- Green fuel material questions
- Resilience
- Emission monitoring
- Cyber-security
- Safety

Simulations / modelling
- Combustion concepts
- Engine and propulsion efficiency
- Energy optimization & AI
- Emission forecasting with data models
- Data models and API
- Integration pilots for applications

New solutions
- Ex-Situ Methanation
- Green Fuel storage and logistics
- Emission reduction concepts (gas, noise)
- Cloud application platform and interfaces
- Commercial models for fuel and emission reduction
- Commercial lifecycle models for alternative fuels

Market studies
- Socio-economic study
- Combustion concepts
- Green fuel cost & availability