

The VTT logo consists of the letters 'VTT' in a white, bold, sans-serif font, centered within an orange square. The background of the slide features a repeating pattern of stylized, overlapping shapes in orange, blue, white, and black, creating a sense of depth and movement.

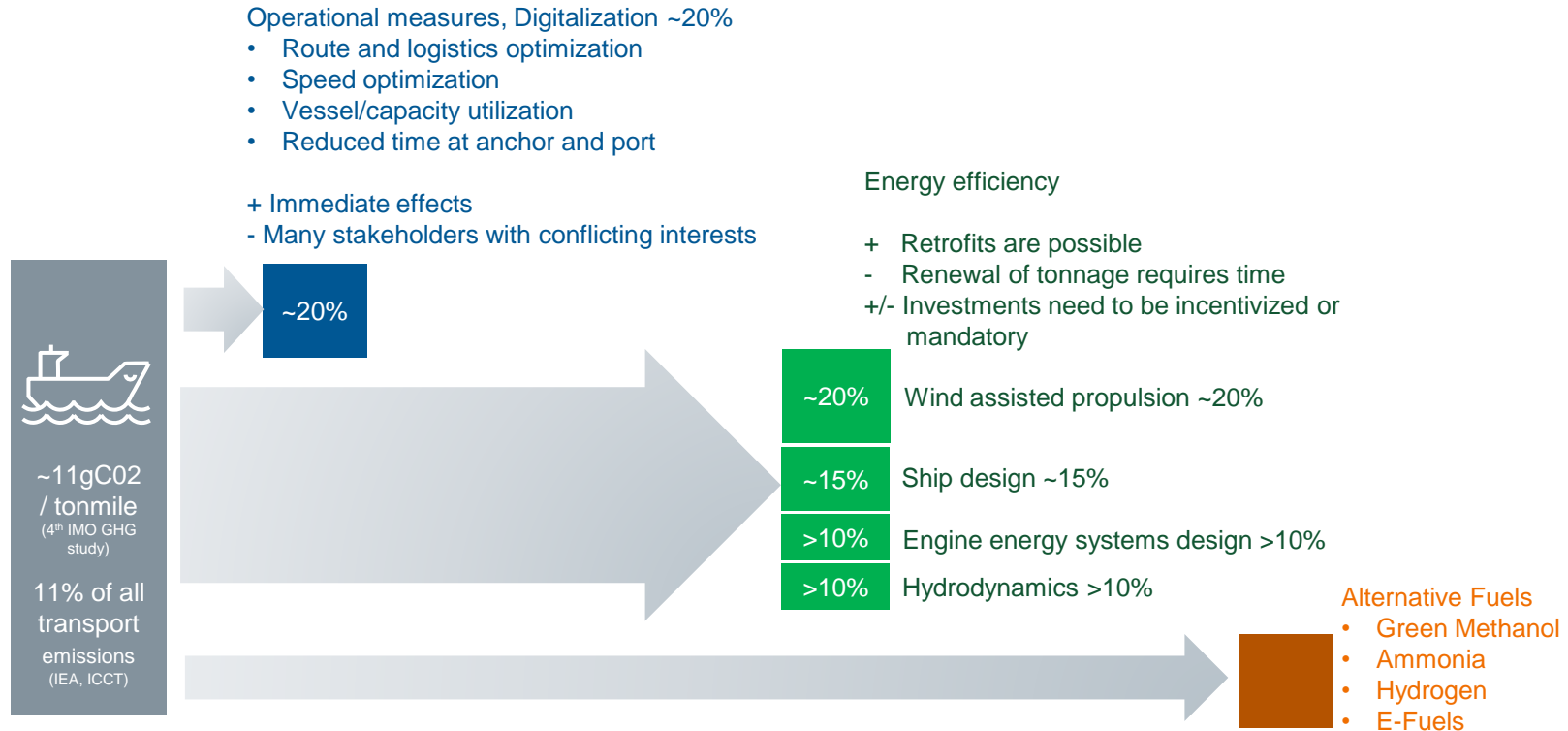
VTT

Murroksessa olevat merenkulun teknologiat

Teemu Manderbacka

21/08/2023 VTT – beyond the obvious

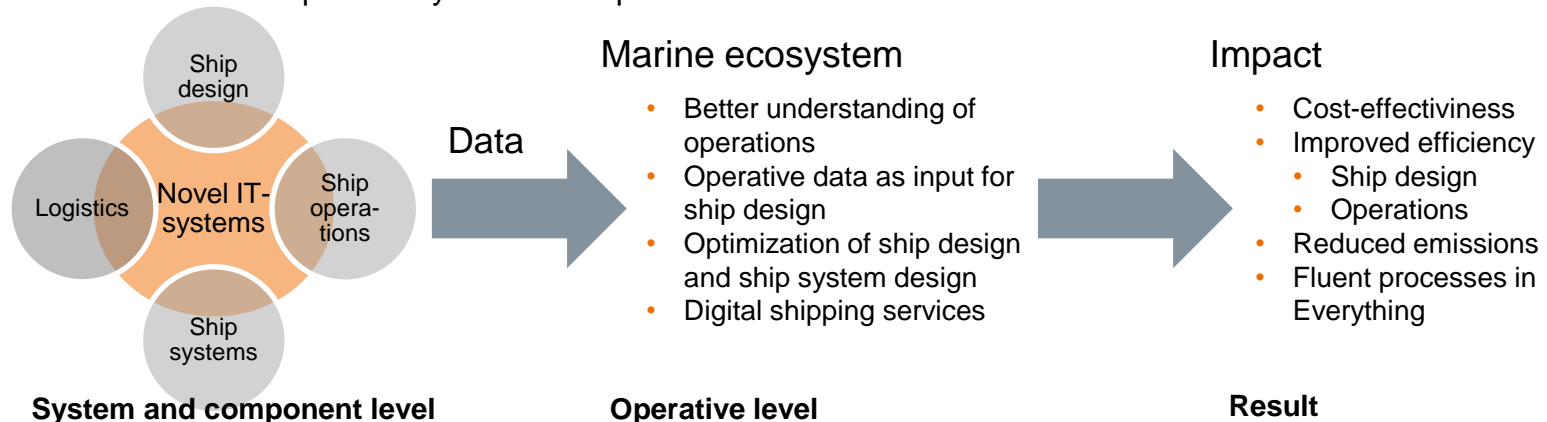
Potential to cut shipping emissions



Digitalization of shipping infrastructure and ship design

Digital transformation contributes to the ship building and shipping industries thoroughly

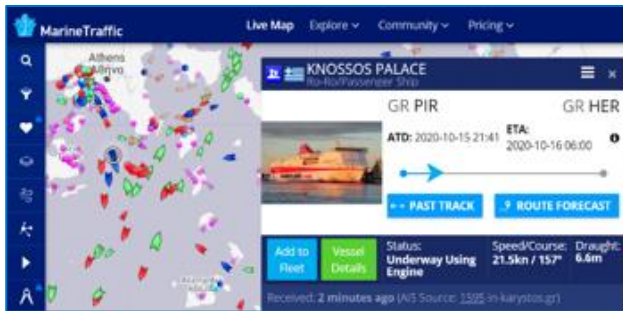
- Novel systems for operation optimization, safety critical systems and predictive maintenance
- Specification of information systems will be one crucial part of ship design process; IT-engineers consider the vessel and related IT-infra as a collection of IT-systems
- Particular issues: data ownership and transparency, distributed vs. centralized systems, connectivity, regulatory, shipping related services have to be digitalized. Often challenges are something else than technical and still quite many research topics!



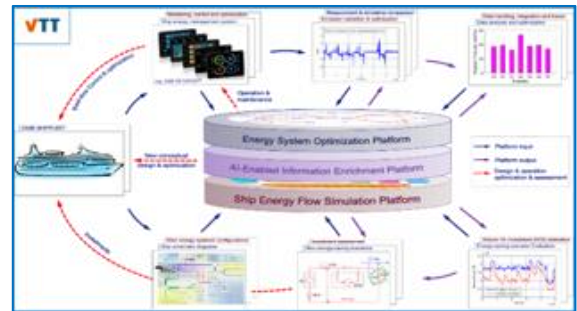
A decorative background pattern on the left side of the slide. It features a repeating geometric design of interlocking shapes in various shades of blue and green, creating a 3D effect of cubes and spheres.

Example projects on
-Digitalization
-Hydrodynamic efficiency
-Alternative Fuels

Holistic, beyond the state-of-the-art AI-empowered framework for decision-support models, data analytics and visualisations to build digital twins and maritime applications



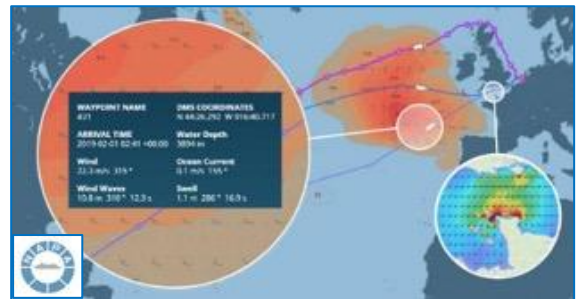
Pilot 1 - Ship modelling for global vessel traffic monitoring and management



Pilot 2 – Globally optimal design of ship energy systems



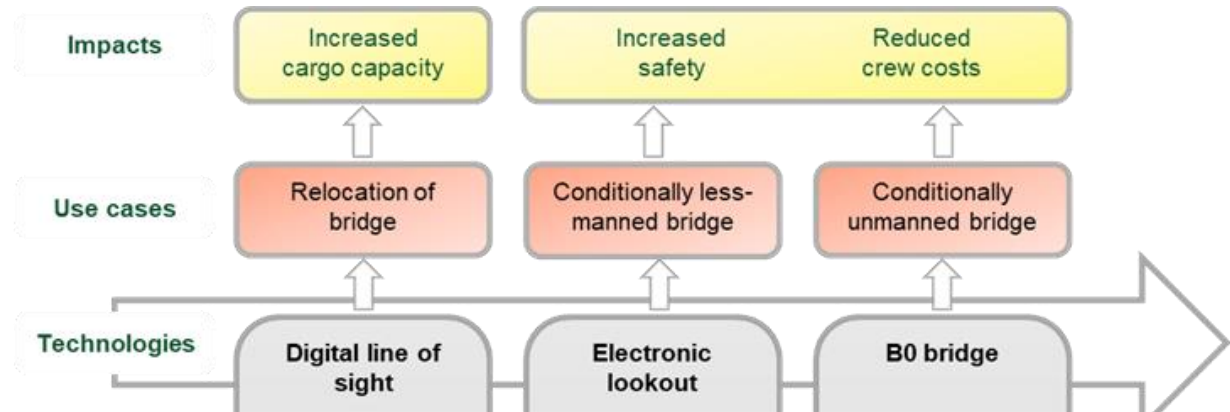
Pilot 3 – Autonomous ships in short sea transport



Pilot 4 – Weather routing and fleet intelligence service in shipping

ECAMARIS - Enablers and Concepts for Automated Maritime Solutions (2021-2023)

- Co-Innovation project funded by Business Finland
- ECAMARIS goals
 - Develop autonomous systems for digital line of sight, electronic lookout and Bridge Zero (B0) concepts
 - Specify the technical requirements for the concepts considering e.g., regulatory approval and cost-effectiveness
 - Develop research platforms which can be applied to evaluate the feasibility of the specified requirements



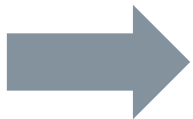
High-efficiency Modular Propulsion Concept - ModProp

Simulation platform for ship energy and power systems

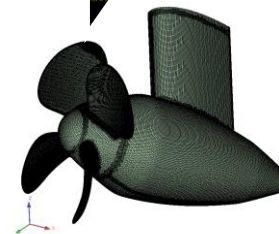
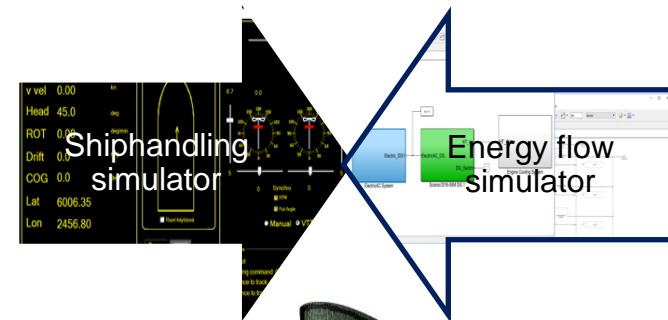
- Combined shiphandling and energy flow simulator platform for different operational conditions
- Energy and power management system design and optimization

Enhanced propulsor design

- Improved hydrodynamic efficiency



Increased efficiency by 10 % compared to present solutions
15% lower the CapEx of the designs with optimal dimensioning



Efficient novel propulsor concept

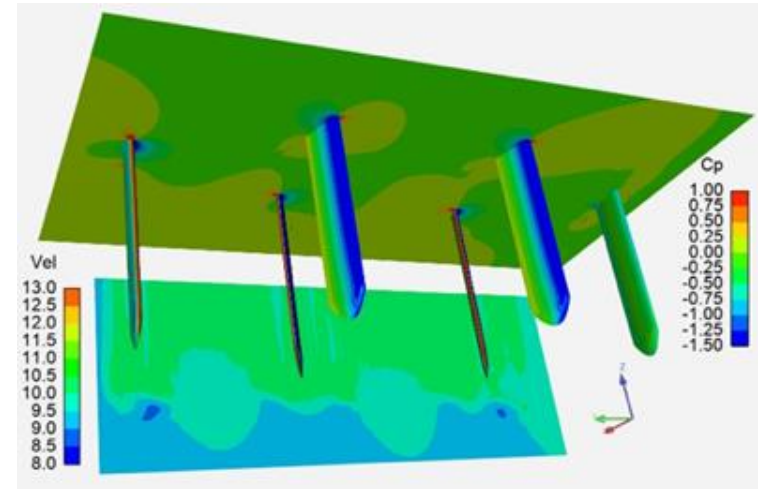
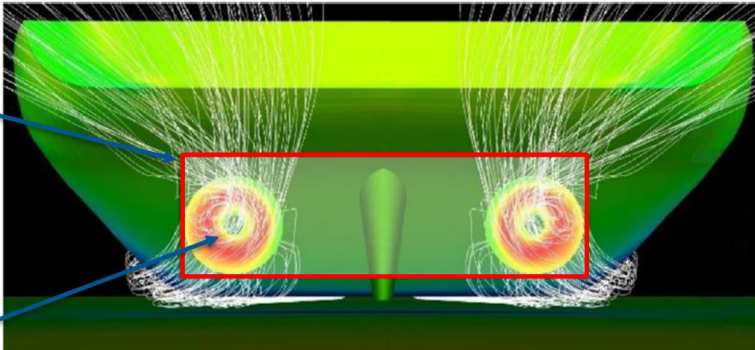
VTT has studied a novel propulsor concept which can decrease the energy needed for propulsion by 15 %

- Much larger swept area which reduces the propeller loading and improves efficiency
- Recovering rotational/lateral losses (similar to contrarotating effect in CRP propulsors)
- No need for rudder or other appendages, which leads to lower hull resistance

Novel propulsor concept has twice the swept area compared to traditional propeller

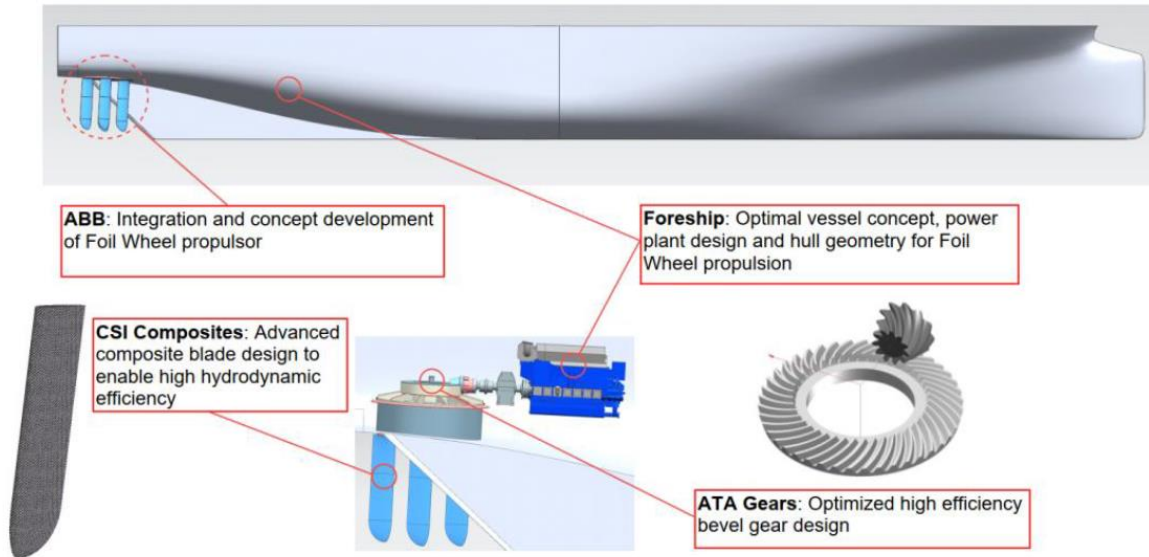
Large area propulsor

Traditional propeller



UltraPropulsor

- New propulsor and hull form innovations to significantly increase the propulsive efficiency
- Reduction of underwater radiated noise
 - methods to model the underwater noise and propeller cavitation phenomena



ABB

ATA
GEARS

FORESHIP
AT THE SHARP END

CSI COMPOSITE
SOLUTIONS & INNOVATIONS

VTT



Flagships



- Two hydrogen flagships will be deployed to illustrate the business viability and to promote social acceptability of FC&H2
- First in the world commercial cargo transport vessel operating on hydrogen
 - 200kW Fuel Cell module type approved
- Start operation during summer 2023 in the river Seine in Paris
- Future proof container vessel start operating autumn 2023 in Rotterdam
- More than 1 MW installed FC power
 - Gaseous H2 (via electrolysis) as a fuel
- Project coordinated by VTT
 - Partners: Ballard, Norled, CFT, LMG, ABB, Westcon Power & Automation, Persee, NCE Maritime Cleantech



Battery Electric – Hybrid – Hydrogen

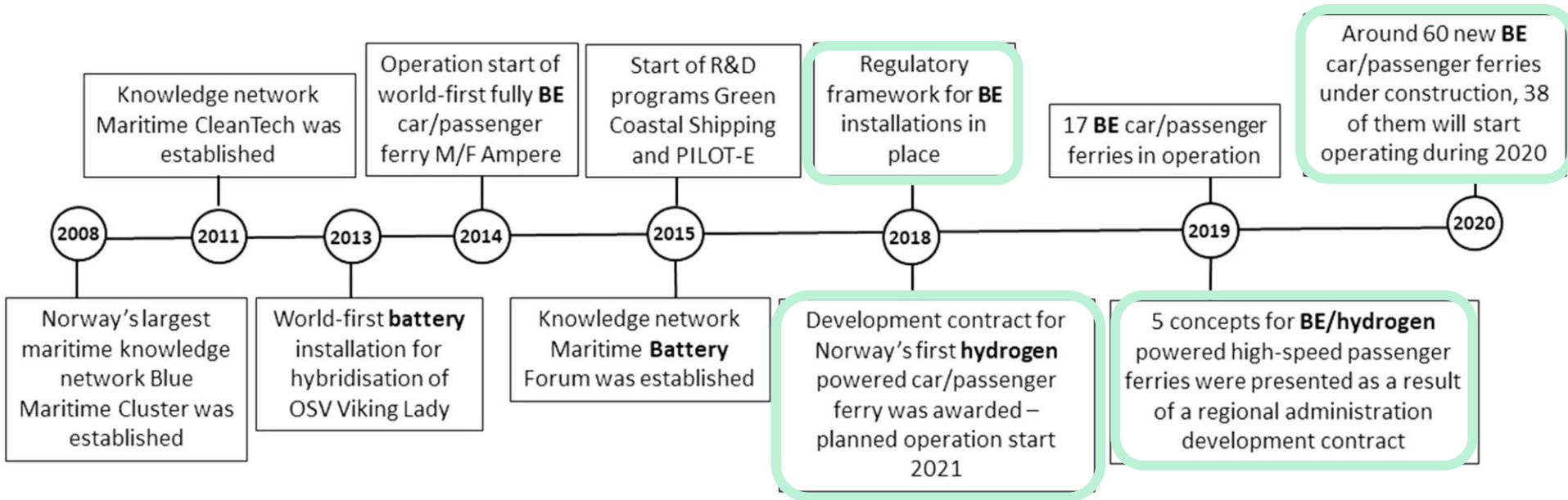
	Electric (full)	Electric hybrid (e.g. conventional engine)	Hydrogen (produced from renewable energy)
Reduction of GHG ^a	Very high	Moderate-High	Very high
Reduction of Nox ^a and SOx ^a	Very high	Moderate	Very high
Investment cost (on vessels)	High	Moderate-High	High
Fuel cost	Low	Moderate	High
Availability (incl. infrastructure)	Moderate	Moderate	Low
Vessel adaptation	Very high	Low-moderate	High
Infrastructure adaptation (incl. fuel production/energy conversion)	Moderate-high	Low-high	Very high
Market segment suitability	Vessels – short routes (e.g. ferries)	All – esp. variable energy demand	All
Importance of regularity	High	Low-high	Low

Source: Bach et al. 2020 – Implementing maritime battery-electric and hydrogen solutions: A technological innovation systems analysis.
Transportation Research Part D: Transport and Environment 2020

Norwegian Maritime Public Procurement

- Emission standards in specifications for public procurement contracts
- “Development Contracts”, granting extra funding for developing new solutions in combination with winning a tender

Timeline of Battery Electric (BE) and Hydrogen development milestones in Norway



Source: Bach et al. 2020 – Implementing maritime battery-electric and hydrogen solutions: A technological innovation systems analysis.
Transportation Research Part D: Transport and Environment 2020

Potential to cut shipping emissions

