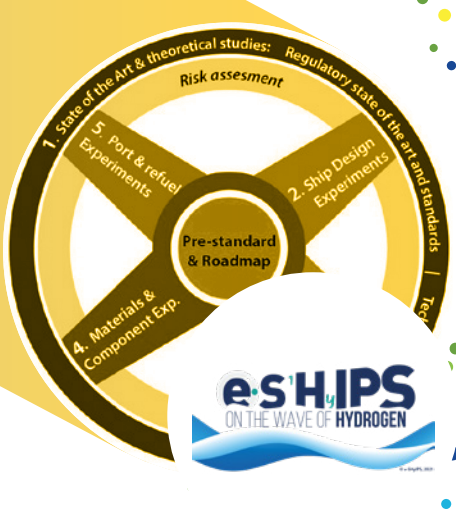
E-SHyIPS

ECOSYSTEMIC KNOWLEDGE IN STANDARDS FOR HYDROGENIMPLEMENTATIONONPASSENGERSHIPS



Project ID:	101007226
PRD 2023:	Panel 5 – cross-cutting
Call topic:	FCH-04-2-2020: PNR on hydrogen-based fuels solutions for passenger ships
Project total costs:	EUR 2 560 000
Clean H_2 JU max. contribution:	EUR 2 500 000
Project period:	1.1.2021–31.12.2024
Coordinator:	Politecnico di Milano, Italy
Beneficiaries:	Agenzia Nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, Atena Scarl – Distretto Alta Tecnologia Energia Ambiente, Cineca Consorzio Interuniversitario, Danaos Shipping Company Limited, Dimos Andravidas-Kyllinis, DNV Hellas Single Member SA, Ghenova Ingeniería SL, Ingegneria del Fuoco SRL, Levante Ferries Naftiki Etaireia, Oy Woikoski AB, Proton Motor Fuel Cell GmbH, Scheepswerf Damen Gorinchem BV, Teknologian tutkimuskeskus VTT Oy, UNI – Ente Italiano di Normazione, Università degli Studi di Napoli Parthenope

https://e-shyips.com/

PROJECT AND OBJECTIVES

Hydrogen is considered an option for reaching emission reduction targets; however, there is currently no regulatory framework applicable to hydrogen-fuelled ships. e-SHyIPS brings together hydrogen and maritime stakeholders to gather new knowledge based on regulatory framework review and experimental data. The project's approach is vessel independent, and is focused on the risk and safety assessment methodologies. e-SHyIPS will define a pre-standardisation plan for an update – regarding passenger ships using hydrogen-based fuels – to the International Code of Safety for Ships using Gases or other Low-flashpoint Fuels, and a roadmap to boost the hydrogen maritime economy.

NON-QUANTITATIVE OBJECTIVES

- e-SHyIPS aims to define functional scenarios relating to the project concept. In close cooperation with the project's industrial maritime partners, the technical and functional requirements of hydrogen-based-fuels passenger ships will be elicited in operational profile scenarios. Use cases for vessel design will be defined in line with the requirements of industrial maritime partners and the stakeholders.
- The project aims to determine vessel scenario and bunkering functional and technical requirements for the purpose of producing a scenario report. The technical features of hydrogen-based-fuels passenger ships will be described for the associated subsystem (pumps, hoses, etc.). The metrics and safety-related analyses to be conducted will be communicated and specified for the purposes of the risk assessment process. Operational features, such as bunkering procedures and hydrogen fuel conditions, will also be described, defining the limits for the scope of the analysis.
- The results of the analysis of emergency hydrogen discharge or major leaks from the vessel were expected at the end of 2022. The test is focused on piping/venting mast arrangements for emergency hydrogen discharge, and the dispersion of hydrogen outside the ship.
- The guidelines for ship design and operation regarding emergency hydrogen discharge for different types and sizes of vessel and of hydrogen storage were expected to be finalised at the end of 2022.
- The project aims to determine best risk and safety practices for the maritime sector. It will report on technical knowledge gaps and models for risk assessment and risk management of gaseous hydrogen and liquid hydrogen, and hydrogen-based alternative fuels on ships, in 2024.

PROGRESS AND MAIN ACHIEVEMENTS

- The project has developed ecosystemic knowledge of standards for hydrogen implementation for passenger ships.
- Fuel cell stack inclination testing has been completed (listed in the Innovation Radar).
- Fuel cell salt spray testing has been carried out.
- Hazard identification analysis for gas-compressed hydrogen has been undertaken.
- The safety system has been reviewed.
- Hazard identification analysis for liquid hydrogen has been undertaken.
- Explosion risk has been assessed.
- New forcing/damping methods have been tested in OpenFOAM.
- Mesh has been optimised, with a focus on seakeeping.
- The zero hull velocity wave–hull interaction simulation (in LincoSim) has been validated.
- The new LincoSim production web application for external expert users has been tested.

FUTURE STEPS AND PLANS

- e-SHyIPS will continue to develop the hydrodynamic analysis. The LincoSim platform using the updated mesh and wave–hull interaction simulation will be rolled out (expected to be completed in 2023).
- The safety assessment of each vessel design for each scenario is expected to be completed at the end of 2023.
- The technical report on the H_2-based fuel bunkering system's basic design is expected to be completed by the end of 2023.
- The onboard H_2 dispersion and explosion model test will be carried out, with enhanced results expected by the end of 2023.
- Results from the material and component testing and post-mortem analysis are expected at the end of 2023.
- Initial results for the fuel delivery and bunkering solutions for ships were expected at the end of 2022.
- NMA and ISO dissemination of gaps and research considerations is expected to take place at the end of 2023.

QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Performance degradation (potential loss at constant current)	mV		– 10 mV to – 20 mV during U–I curve – 13 mV during continuous operation	⚙
	Constant operation of stack possible	–	Yes	Yes	✓
	To find materials that do not induce additional degradation of the fuel cell compared with baseline	Comparison with reference samples	No additional degradation	Certain ethylene propylene diene monomer materials that may be suitable for the cathode sides have been identified	✓

Clean Hydrogen Partnership
Co-funded by the European Union