



Dear reader,

Welcome to the first edition of our newsletter, where we bring you the most recent updates and developments from the **ZHENIT** project. In this edition, we delve into the project's core objectives, introduce a new consortium member, provide technical updates, and share our latest publications.

What is ZHENIT?

The **ZHENIT** project promotes Waste Heat Recovery (WHR) to achieve 2030 IMO/EU decarbonization targets for the shipping sector. By developing and validating WHR solutions at various temperature levels, ZHENIT aims to utilize waste heat for different onboard services like cooling, power, and desalination.

The project integrates digital solutions and wind hybrid propulsion to reduce vessel energy consumption by 25%. Coordinated by RINA Consulting, the project involves 13 partners from 6 countries and interacts with key platforms like ZEWT and IMO.

Attica Group Joins the Project

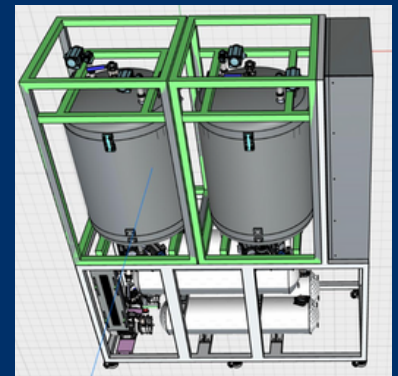
Attica Group, a leading player in the Greek and international passenger shipping industry, has joined the **ZHENIT** consortium. With a fleet of over 40 ships under well-known brands such as Superfast Ferries, Blue Star Ferries, Hellenic Seaways, and ANEK Lines, Attica Group connects more than 60 destinations daily, providing high-quality transport services on Greek and international routes (Greece-Italy).

The Group has expanded into the tourism sector, acquiring three hotels in Naxos and Tinos. Attica Group was the first in the passenger shipping industry worldwide to issue a Responsibility & Sustainability Report in 2009, according to GRI guidelines. In 2024, Standard & Poor's Global Corporate Sustainability Assessment (CSA) ranked Attica among the top 25% of companies worldwide in the Transportation and Transportation Infrastructure sector, validating their commitment to sustainability.



Technical Updates

In the previous period, we finalized the 3D design and began the manufacturing process.



This included producing two modules with a fine mesh filled with material, attaching supporting punch plates, creating a filled phase changer, and welding the vessel. The modules were then installed in the frame and connected with water tanks. Progress was also made on the PLC cabinet.



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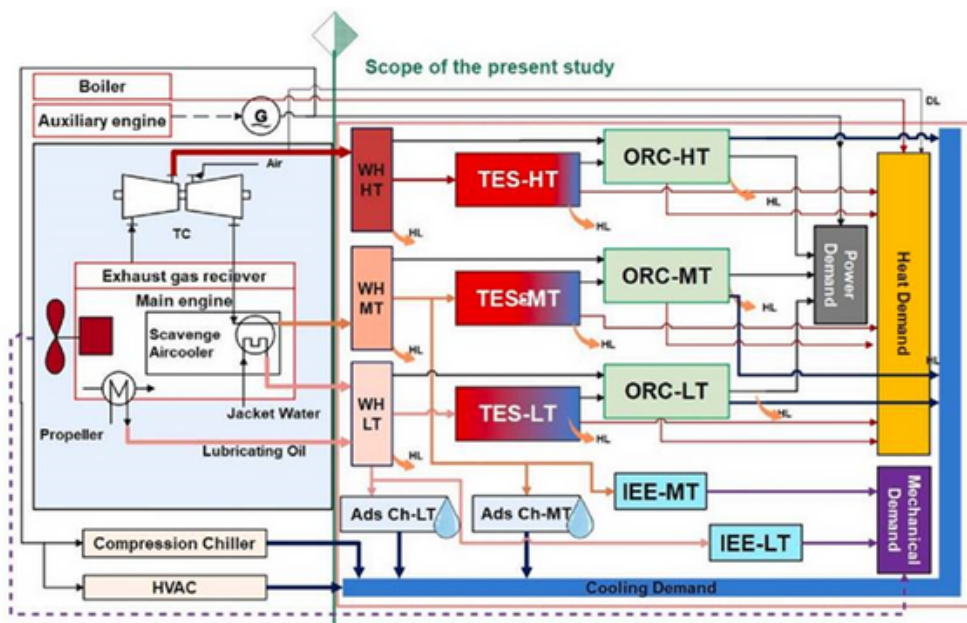
Challenges faced during the manufacturing process included positioning the vessel next to the water tank and welding two flanges together.

Latest publications

In this section, we present the latest research and findings from the **ZHENIT** project. These publications delve into the innovative technologies and systemic approaches we are developing to enhance waste heat recovery in maritime vessels. Our goal is to provide valuable insights and evidence of the efficacy and potential of WHR solutions in advancing the energy efficiency and sustainability of the shipping industry. Below, you'll find summaries of our most recent papers, which highlight key advancements and their implications for the future of maritime energy systems.

Optimally integrated waste heat recovery through combined emerging thermal technologies: Modelling, optimization and assessment for onboard multi-energy systems

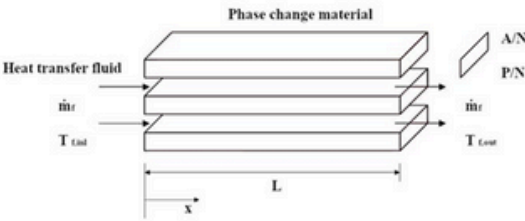
This paper investigates systemic waste heat valorization on maritime vessels, demonstrating how innovative WHR technologies can work together synergistically. It proposes a techno-economic analysis framework using Mixed Integer Linear Programming (MILP) to evaluate the dynamic operation of the WHR system during a vessel's journey. The study shows that the optimized WHR system enhances energy efficiency by 5-7.5 percentage points and reduces fuel consumption by 13%, with an IRR of about 15%.



Innovative waste heat valorisation technologies for zero-carbon ships – A review

This review examines WHR technologies for maritime applications, highlighting the performance of various technologies within the onboard energy system. It notes that while traditional turbocompounding is fully implemented, ORC systems and absorption refrigeration systems need more research for marine applications. Emerging technologies like thermal energy storage, hybrid refrigeration systems, isobaric expansion engines, and others are still in development. The review underscores the need for further research, cost reduction, and integration of these technologies to improve fuel efficiency and reduce emissions.

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$$\begin{cases} \frac{\partial u}{\partial t} = \frac{k}{\rho} \frac{\partial^2 T}{\partial x^2} + \frac{UP}{\rho A} (T_f - T) \\ \frac{\partial T_f}{\partial t} + \frac{\dot{m}}{\rho_f A_f} \frac{\partial T_f}{\partial x} = \frac{UP}{\rho_f A_f c_{pf}} (T - T_f) \end{cases} \quad u = \begin{cases} c_s (T - T_{ref}) & \text{if } T < T_m \\ c_s (T_m - T_{ref}) + \chi H_o & \text{if } T = T_m \\ c_s (T_m - T_{ref}) + H_o + c_l (T - T_m) & \text{if } T > T_m \end{cases}$$

Parameter	Unit	L=0.80 m	L=0.90 m	L=1.00 m	L=1.10 m	L=1.20 m
Volume	m ³	0.30	0.37	0.46	0.55	0.66
Mass	kg	474	594	727	873	1034
Energy storage	kWh	13.56	17.17	21.19	25.64	30.52
Energy storage density	kWh/m ³	45.57	45.85	46.07	46.26	46.41

Stakeholder feedback survey

We highly value your feedback and invite you to participate in our stakeholder survey to gather insights on the **ZHENIT** project's technologies. Your input is crucial for shaping the future of waste heat recovery solutions in the maritime sector. Please take a few minutes to complete the survey and share your perspectives on the implementation and impact of these innovative technologies. You can find it by scanning the QR code below or at the following link:

<https://forms.office.com/e/8gCtbRXz5u>



FILL OUT THE ZHENIT STAKEHOLDER SURVEY

SCAN HERE





Funded by the European Union

Thank you for reading!

Stay tuned for more updates on the **ZHENIT** project.

Best regards,

ZHENIT Team