

NEWSletter 3



June 2024

18 months of SYNERGETICS

SYNERGETICS – Synergies for Green Transformation of Inland and Coastal Shipping – the Innovation Action funded by the Horizon Europe programme of the EU has been operational for 18 months. Since its inception at the headquarters of DST- Development Centre for Ship Technology and Transport Systems in Duisburg on 8.2.2023, the project has sought to establish synergies between the leading research institutions in the field of ship hydrodynamics and energy transition, innovation centres and shipping industry associations, shipbuilding industry, regulatory bodies, vessel owners, and technology providers, as well as between different European regions.

On 13th and 14th of June the General Assembly took place in Gothenburg, hosted by ScandiNAOS. The advancement towards the primary objective of the project, namely the creation of a comprehensive catalogue of developed retrofit solutions that will accelerate the green transformation of inland vessels and coastal ships, is encouraging. Over the course of the initial 18-month period, MARIN conducted a series of workshops, which constituted the basis of the Ship-Propulsion-and- Energy-Concepts (SPEC) analyses for the demonstrators. SPB and other partners took stock of 185 Pilot Projects whose lessons learned might benefit SYNERGETICS. Furthermore, DST tested the aft replacement solution for Demonstrator 5, designated as "Ernst Kramer", in the towing tank.



1| SYNERGETICS consortium at the General Assembly in Gothenburg

SYNERGETICS has also been engaged in extensive promotion of the project and its outcomes. The project's visibility and notoriety were enhanced through social media and blog posts, as well as its participation in a number of events, including the Transport Research Arena 2024, the Maritime Industry Fair in Gorinchem, Blue Week 2024, and Posidonia 2024, and by scientific publications.

We extend our gratitude to you for your continued engagement over the past 18 months and invite you to synergise with us at our forthcoming mid-term conference, scheduled to take place in Brussels on the 5th of November. Save the date!



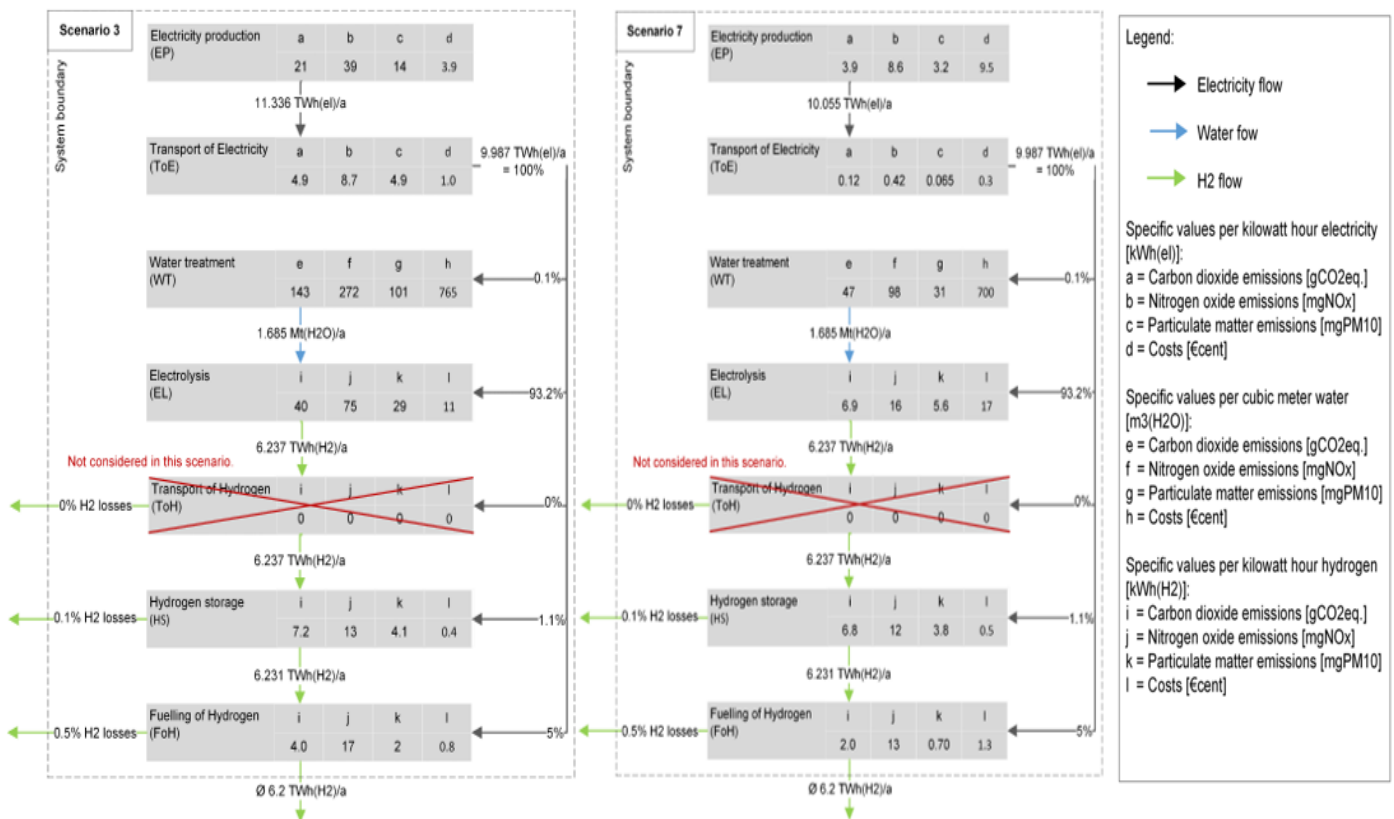


Activities – Scientific Paper

Hydrogen can play a key role in the greening of waterborne transport. Its use in internal combustion engines is a promising retrofit technology that will be demonstrated in SYNERGETICS Work Package 3. As one of the objectives of the project is to integrate the knowledge on technologies for decarbonisation of shipping and reduction of air pollutant emissions with the experience gained in the respective pilot projects and demonstrations, the scientific publications produced by the SYNERGETICS partners are expected to raise awareness among stakeholders and increase the outreach of the project, in addition to their scientific and technical value.

The paper "Renewable Hydrogen Supply Scenarios for Inland Waterway Transport in Europe", authored by Elimar Frank and Luca Stauss of SYNERGETICS partner OST, analyses the supply of inland waterway transport with renewable hydrogen in Rotterdam and shows the relevant environmental impacts and costs of well-to-tank value chain scenarios tailored to meet the current energy demand of this sector, i.e. the substitution of 6.2 TWh/year of fossil diesel by renewable hydrogen.

The paper compares two dominant scenarios in terms of GHG emissions and costs. One scenario is based on photovoltaic (PV) electricity from Morocco transported to Rotterdam for electrolysis (Scenario 3). The other scenario is based on electricity from offshore wind farms in the North Sea (Scenario 7).



2| Scenario comparison - Hydrogen supply for IWT in Europe

Despite the long transport distance of 3000 km, using PV electricity from Morocco is significantly cheaper than using wind power from the Northern Sea (by 37 %), but it is associated with 3.2 times higher specific emissions. However, political challenges must also be considered within this scenario, such as





international contracts and the construction of transport capacities for electricity through various European countries. For the scenarios with PV electricity from Morocco, the detailed discussion of scenarios with a hydrogen pipeline was omitted in this paper because the pipeline would lead to higher overall costs with only slightly lower emissions. Yet, pipeline options as well as the transport of hydrogen by ships are investigated in the pathway modelling carried out in **SYNERGETICS** Work Package 1.

The electrolysis has the highest impact on emissions and costs, especially the electricity demand. Assumptions regarding the improvement of both costs and emissions will have a major influence on the overall results when future developments and supply scenarios for renewable energy carriers are developed (WP5 of **SYNERGETICS**).

With costs of 0.12 up to 0.19 € per kWh of renewable hydrogen, both scenarios result in costs significantly higher than the fossil diesel price for energy in 2020 (about 0.05 €/kWh). Therefore, just for the energy carrier substitution, concepts, pricing measures and strategies (e.g. ETS, RED-III) are very much needed to close the gap in costs for the operators, in addition to the establishment of financing schemes addressing the corresponding retrofit and new-build solutions.

The paper has been published in the International Sustainable Energy Conference – Proceedings and is available [here](#).

Activities – Workshop

On the 30th of May 2024, the EU-funded projects **PLATINA4Action**, **SYNERGETICS** & **RH2IWER** collaborated to host a workshop on sustainable inland waterway transport. The workshop was held on the premises of the Dutch Inland Waterway Transport (IWT) Trade Fair Maritime Industry in Gorinchem. To attract the local vessel operating community, the language of the workshop was Dutch. Because of this, a significant number of vessel owners/operators was amongst the more than 200 attendees. Feedback from the attendees proved the workshop to be a success.

The collaborating EU-funded projects were able to insert their specific needs for interaction with relevant stakeholders.

For **SYNERGETICS**, the workshop acted as a workshop in the second work package where the mission is to find relevant greening pilots, gather their relevant lessons learned and stimulate interaction and information exchange between the operators of these pilots. With several pilot projects explained on stage and several other pilot projects attending, this mission was accomplished. Here,

especially the network lunch after the event, proved to be a fertile ground for the sought-after interaction.

All projects were represented by partners both on stage and as attendees. The outcome of the workshop was positive and several attendees summarised the overall messages as “realistic, but hopeful” for sustainability in IWT. The collaborating projects will evaluate the workshop, gather lessons learned and look for potential options for similar exercises in other regions. The workshop was broadcasted, and this broadcast and the presentations are available [here](#).



3| SPB presenting **SYNERGETICS** at Gorinchem

Work Package 3 - Progress of the Demonstrators

The objective of the **SYNERGETICS** Work Package 3 Demonstration is to validate the viability of retrofitting solutions for decarbonization and pollutant emission reduction for different coastal and inland navigation vessels in operation. The initial 18-month phase of the project demonstrated remarkable progress in the realisation of the planned demonstrations.

A series of workshops were conducted by MARIN with the relevant parties to serve as basis for the SPEC (Ship-Propulsion-and-Energy-Concepts) analysis. In case of the **SYNERGETICS** Demonstrator 6, via donau push vessel Bad-Deutsch Altenburg, three operational profiles have been considered to determine





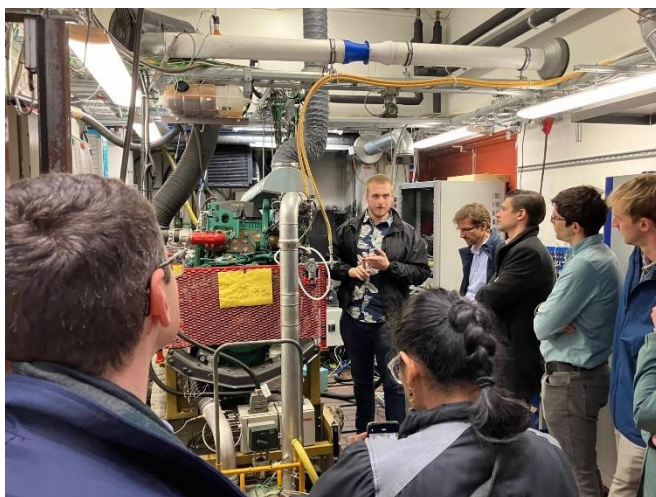
the power demand. The compliant retrofit solutions were ranked using weighing subjective factors such as OPEX, CAPEX, efficiency, emissions and TRL resulting in a list of preferred solutions. The feasible solutions were determined by applying design constraints like displacement, particulars, design ratios, etc. In the next steps, an additional operational condition with extreme parameters will be considered and the most suitable concept will be selected. The model will include the dimensioning of the power propulsion and energy system.

SYNERGETICS Subtask 3.3.2 addresses the greening potential of hydrodynamic improvements of a ship's hull and appendages. This includes a model-scale demonstration and the comprehensive analysis of the benefits of aft-ship replacement of the dry cargo motor vessel "Ernst Kramer" from the fleet of the German shipping company Rhenus, which actively supports **SYNERGETICS**. This 50-year-old vessel has an overall length of 105 m, a beam of 9.5 m, a draft of 3.22 m, and 1170 kW of installed engine power. Additionally, it is equipped with a 315kW bow thruster. The operational profile was analysed and a towing tank model testing was performed at the DST to establish the baseline performance of the ship. A parametric 3D CAD model was generated, which will allow for systematic and automatically controlled local and global shape variation via design variables. In the next steps RANS CFD simulations will be employed to calculate resistance, thrust and propulsion coefficients and subsequently a hydrodynamically optimized aft-ship shape.



4| Demonstrator 5 – Ernst Kramer tank tests

The battery pack application from ZES for the inland container vessel Alphenaar (Demonstrator 3) has been in operation, providing valuable lessons learned in respect to technical, economical, commercial, operational and political aspects.



5| Demonstrator 7- Visit at the engine testing facility

Substantial progress has been achieved as well in case of the system demonstrators.

A visit to the Demonstrator 7, comparing two different methanol solutions one compression ignite, the other one dual-fuel has been one of the highlights of the **SYNERGETICS** General Assembly in Gothenburg.

Future Proof Shipping, the partner leading Subtask 3.4.2, is collecting data from the two container vessels H2 Barge 1 and H2 Barge 2, both of which are powered by fuel cells. This data will be evaluated in order to develop a second-generation power management system for hydrogen fuel cell applications.

The business side of greening IWT and coastal shipping – a D1.2 teaser

Available and developing sustainable technologies and energy carriers make it possible to reach ambitious emission and net-zero goals stipulated by the EU 'Fit-for-55' and various national policies within IWT and coastal shipping. A major challenge for the implementation within the sector is the economic viability of those technologies. Within **SYNERGETICS** Work Package 1, the current literature as well as





stakeholder interviews are used to shed some light on the potential of various business models within IWT and coastal shipping.

Calculations from studies such as CCNR, Prominent or NEED reveal that it will be no easy feat to overcome current financial disadvantages in Total Cost of Ownership (TCO) for application of sustainable fuels. Substantial financing gaps are particularly apparent in CAPEX for the replacement of power trains on existing vessels. Challenges include the limited availability of investors, unfavourable demographics within the industry, low levels of standardization leading to limited upscaling potential and unclear future policy developments with potentially significant differences in national implementations. OPEX as another important aspect varies significantly depending on technology-paths and forecasts models for 2030 and 2050, as exemplified in the modelling parts of Work Package 1.

Pay-per-use or leasing schemes have the potential to overcome (some) hurdles to finance retrofit investments. Studies as well as best practice examples indicate that pay-per-use business models as for example introduced by **SYNERGETICS** -partner Zero Emission Shipping (ZES) are currently more advantageous for businesses than leasing options. Yet, both business models face limitations in large-scale adaptations within the industry. Joint-procurement, as further option to facilitate financing, has been deemed to be challenging to be implemented within the Rhine and Danube region by a recent CCNR-study due to (amongst several reasons) the high fragmentation and differentiation in the market.

Based on those findings and learnings, one major focus of the business model's exploration within this project has been on the potential of new value propositions and the question of how a business organization can monetize emission-reductions in this very price-sensitive market. One interesting approach is the concept of inseting, meaning that CO₂-emission avoidance is calculated and sold to interested stakeholder along the supply chain (therefore 'insetting' instead of the conventional 'offsetting'). Future Proof Shipping as part of the **SYNERGETICS** team is currently building such an inseting platform and network, sharing some interesting insights within the framework of the project.

The business environment within IWT and coastal shipping is highly challenging, with many uncertainties regarding the development of fuel costs, technology-paths and policy development. Variables such as loss of cargo space, payload, availability of the necessary infrastructure or ease of refuelling / recharging will become more important to look at going forward. Discussions with industry representatives indicate that there is currently no perceived 'first-mover-advantage' for companies seeking to transition to sustainable fuels. Other options such as 'polluter pays schemes' leading to earmarked contributions for fleet-renewal and retrofiting may be interesting contributions to a faster greening of the industry.

Events

Innovation Action **SYNERGETICS** presented at the [RETROFIT55](#) forum, and the [Posidonia Events 2024](#) in Athens, where [Green Marine](#) also shared its project outline.

These three projects are funded by the Horizon Europe programme of the EU and all address the potentials for greening of shipping by means of retrofit.

Due to the different focus of each project, they are complementary. A wide range of technologies and innovations is investigated and demonstrated, of which the shipping industry will benefit.

- **SYNERGETICS** is focusing on new fuels, electrification, hydrodynamic improvements and power management systems.
- **RETROFIT55** is focusing hydrodynamic and operational optimization and new technologies

such as wind-assisted propulsion and air lubrication.

- **Green Marine** is focusing on the possibilities of carbon capture and energy saving.

It was a great opportunity to share insights and developments. This will create synergy and accelerate our common goal to green the shipping industry.



6| MARIN presenting **SYNERGETICS** at Posidonia 2024





Danube Ports Days 2024

SYNERGETICS, in collaboration with TTS and DST, is proud to unveil our prominent engagement at the highly anticipated Danube Ports Days 2024, to be held at the Danube Commission in Budapest. Building upon the resounding success of previous years, this edition promises to deliver innovative discussions, collaborative insights, and a renewed commitment to sustainability.

->FIRSTHAND EXPERIENCES
 ->TANGIBLE SUCCESS STORIES
 ABOUT METHANOL, HYDROGEN,
 AND BATTERY TECHNOLOGIES




2024 DANUBE PORTS DAYS
 GET READY FOR AN ENERGIZING EVENT SET TO TRANSFORM THE SHIPPING INDUSTRY ALONG THE DANUBE RIVER!
 DIVERSE AND EXISTING SOLUTIONS FOR INLAND NAVIGATION
 SHOWCASE REAL-WORLD APPLICATIONS AND SUCCESSSES OF THE SYNERGETICS DEMONSTRATORS !!

at the Danube Commission in Budapest (hybrid event)

29-30 | OCT | 2024

www.synergetics-project.eu

Please mark your calendars, whether you plan to join us in Budapest or participate virtually. Danube Ports Day 2024 promises to be a platform for insightful discussions, fostering collaboration and innovation to facilitate sustainable port operations. Stay tuned for further details and registration information, which will be available soon on LinkedIn and the official **SYNERGETICS** project website at www.synergetics-project.eu/.

Save the date Prepare for an electrifying event set to revolutionize the shipping industry along the Danube River!

Transport Research Arena 2024

The Transport Research Arena (TRA) 2024 took place in Dublin on 14th April. For Innovation Action **SYNERGETICS** this was the perfect opportunity to present highlights of the work carried out in the first year of the project's lifetime to the numerous stakeholders attending the event.



In addition to being showcased at the stands of the WATERBORNE TP booth and the Swiss Federal Office of Transport, where attendees could enjoy the project's animation video and engage with the project partners, **SYNERGETICS** was present at the Technical 3.4.3 Environmental Sustainability session with a presentation of the paper titled '*Exploration and synchronization of greening of shipping by means of retrofit: The SYNERGETICS perspective*'. The authors of the paper are Igor Bačkalov, Elimar Frank, Benjamin Friedhoff, Alex Grasman, Justin Jasa, Niels Kreukniet and Martin Quispel representing the **SYNERGETICS** partners DST, OST, MARIN and EICB/SPB.

The paper presents the features and the possibilities of utilization of the unique database of pilot projects ("the Pilot database") created within the scope of WP2 (Synchronization). Containing information on 185 inland and coastal shipping greening pilots performed or planned between 2008 and 2026, this comprehensive database enabled the identification of the trends in greening of inland and coastal ships.

Blue Week 2024

From 8th to 12th April the City of Venice hosted the 2024 BlueWeek, an initiative to promote smart and sustainable use of environment in the maritime sector. This was a great opportunity for our own Niels Kreukniet to share the first findings of Innovation Action **SYNERGETICS** and insights into greening of inland and coastal ships gained thanks to the Pilot database – the most comprehensive database of greening pilots in inland and coastal shipping.





Coordinator:

DST – Entwicklungszentrum für Schiffstechnik und Transportsysteme e. V. (DE)

Partners:

SPB – Stichting Projecten Binnenvaart (NL)
Scandinaos AB (SE)
MARIN – Maritime Research Institute Netherlands (NL)
viadonau – Österreichische Wasserstraßen-GmbH (AT)
TTS – Transport Trade Services GmbH (AT)
ZT Büro Anzböck Richard (AT)
EUFRAK – Euroconsults Berlin GmbH (DE)
CRS – Hrvatski Registar Brodova (HR)
OST – Ostschweizer Fachhochschule (CH)

Argo-Anleg GmbH (DE)
FPS – Future Proof Shipping (NL)
Mercurius Shipbuilding BV (NL)
ZES – Zero Emission Services (NL)
Compagnie Fluviale de Transport (FR)
Sogestran (FR)
Koedood Diesel Service BV (NL)
CMB – Revolve Technologies Ltd. (UK)



Contact

DST – Entwicklungszentrum für Schiffstechnik und Transportsysteme e. V.
www.dst-org.de

Benjamin Friedhoff
Phone: +49-203-99369-29
E-Mail: friedhoff@dst-org.de

Igor Bačkalov
Phone: +49-203-99369-27
E-Mail: backalov@dst-org.de

Project website: www.synergetics-project.eu

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