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## D2.2: Regional workshop co-creation results on policy and business models

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## List of Acronyms

Abbreviation	Description
APDL	Administração dos Portos do Douro, Leixões e Viana do Castelo (Port Administration of Douro, Leixões, and Viana do Castelo)
CEA	Commissariat à l'Énergie Atomique et aux Énergies Alternatives (Commission for Atomic Energy and Alternative Energies)
CPS	Compañía de Puertos Sostenibles (Company of Sustainable Ports)
CNG	Compressed Natural Gas



EHOO	Ennschafen OÖ GmbH
SEANERGY	Sustainability Educational Programme for Greener Fuels and Energy on ports
EOPSA	European Onshore Power Supply Association
SSE	Shore Side Electricity
ETS	Emissions Trading System
EU	European Union
FV	Fundación Valenciaport
FPS	Future Proof Shipping BV
GHG	Greenhouse gas
HEDNO	Hellenic Electricity Distribution Network Operator S.A.
ICE	Internal Combustion Engine
IDAE	Instituto para la Diversificación y Ahorro de la Energía (Institute for Energy Diversification and Saving)
IHE DELFT	Stichting Ihe Delft Institute For Water Education
INSTEIMED	Institute for the Integration of the Mediterranean and Euro-Mediterranean Studies
ISDEFE	Ingeniería de Sistemas para la Defensa de España S.A. (Engineering Systems for the Defense of Spain)
ITE	Instituto Tecnológico de la Energía (Energy Technological Institute)
ITG	Instituto Tecnológico de Galicia (Galician Technological Institute)
LNG	Liquified Natural Gas
MTCC	Maritime Technology Cooperation Centre
NTUA	National Technical University of Athens
OPS	Onshore Power Supply
RAEWW	Regulatory Authority for Energy, Waste and Water, in Greece.
RINA	RINA Consulting SPA
SEANERGY	Sustainability Educational Programme for Greener Fuels and Energy on ports
SSE	Shore-Side Electricity
WECs	Wave Energy Converters
WMU	World Maritime University





## Executive Summary

This deliverable provides a comprehensive and multifaceted approach to advancing sustainable maritime and port development. It reviews the outcomes of various regional and demo-port workshops, highlighting the critical need for an integrated approach that combines policy, businesses, technology, industry, port authorities, and stakeholders' engagement to achieve sustainable port and port-city developments.

The four regional workshops, covering areas from the Baltic-Atlantic-North to South-West Europe (Mediterranean) and including inland waterways, have emphasized the importance of regulatory agility, strategic planning, community engagement, and financial support. These workshops were crucial in identifying regional specifics and each port's unique challenges and opportunities.

Three demo-port workshops conducted by FV, EHOO, and DAFNI provided practical insights into port decarbonization and energy transition. They facilitated an exchange of best practices, approaching innovative solutions, thus contributing significantly to the overarching goals of the SEANERGY project.

A notable aspect of the SEANERGY project was the Pan-EU Workshop led by WMU, which succeeded in crafting a cohesive Pan-European perspective on maritime sustainability. This workshop highlighted the importance of collaborative efforts across regions and sectors, underscoring the need for unified strategies that cater to diverse regional needs while aligning with EU-wide sustainability goals.

The Triple Layer Business Canvas Models, used as an analytical tool, were instrumental in systematically evaluating various aspects of sustainable maritime and port development. These models facilitated the identification of key economic and financial assets, creating a structured approach to developing sustainable business models and strategies for maritime communities and ports.

The SEANERGY D2.2 collects and represents valuable information from different regions of Europe for ports' sustainable development, combining policy, business, technology, and community engagement. Its insights are vital for future policymaking and promoting sustainable maritime practices.





## 1. Introduction

### 1.1 Purpose of the document

The SEANERGY project is an initiative funded under the Horizon Europe program aimed at fostering sustainable energy generation and fuel sources, especially in port activities and cities. This document represents the deliverable for Task 2.2 of the SEANERGY project, titled "Regional workshops on policy and business model development."

The main goal of deliverable D2.2 is to organize and conduct regional and demo-port workshops, as well as a Pan-EU workshop, to gain direct insights from stakeholders on current policies and prospective business models. The workshops aim to gather feedback from different stakeholders regarding implementing the technologies identified in D1.2, ascertain challenges and policy barriers, discuss how to integrate these technologies, and develop novel business models that can accommodate incorporating sustainable energy generation and other sustainable fuel sources.

As the task leader, Magellan Circle has contributed to proposing these workshops' guidelines, agenda, content, and methodology. The intention has been to utilize the gathered insights to promote future policy adjustments and encourage the adoption of these sustainable energy technologies into the port value chain and city activities. This document, therefore, serves as a report detailing the workshop procedures and their respective outcomes.

### 1.2 Structure of the document

This document is structured into several key chapters. Following this introduction, Chapter 2 delves into the methodology for developing and organizing the workshops. Chapters 3 and 4 detail the execution and findings of the regional and demo-port workshops, respectively.

Chapter 5 discusses the Pan-EU Workshop conducted by WMU and its significant outcomes. Subsequently, Chapter 6 delves into the Preliminary Triple Layer Business Model Canvas, encompassing its development, application to demo-ports, and the identification of economic and financial opportunities. The document culminates with a conclusion and recommendations in Chapter 6, offering a comprehensive summary and future action guidance.



The document's scope extends to providing thorough insights into the planning, execution, and results of the workshops. It includes a detailed analysis of stakeholder feedback on sustainable energy technologies, the challenges and opportunities of current policies, and the prospects for innovative business models incorporating these sustainable solutions.

As a pivotal part of the SEANERGY project, Deliverable 2.2 builds upon findings from Work Package 1 (WP1). It emphasizes the identification and dissemination of potential sustainable energy technologies for ports and cities. The workshops serve as platforms for presenting these technologies and gathering stakeholder feedback to refine them further, including policy and business implications.

Additionally, these workshops contribute to the co-creation of solutions and new business models, informing tasks like developing Master Plan strategies. The gathered feedback and insights will influence future policy directions and regulatory changes, impacting overall project outcomes and deliverables.

Finally, the development of the Triple Layer Business Canvas Models is instrumental in the financial and economic analysis of each demo-port. It uncovers opportunities and assets that can be integrated into the SEANERGY project's broader strategic and operational framework.

### 1.3 Methodology for developing and organizing workshops

A comprehensive and thoughtful approach was adopted to prepare for the regional and demo-port workshops. As the leader of Deliverable 2.2, CRCL developed an exhaustive set of guidelines, laying down the framework for the workshops' conduct. The guidelines encompassed crucial elements, including the workshop objectives, anticipated outcomes, and general methodology for stakeholder interaction.

The format and agenda for the workshops were designed to provide a seamless flow of discussions and interactions. The agenda incorporated an introduction, presentations on sustainable energy technologies identified in D1.2, open talks, brainstorming on business models, and a closing session summarising the key outcomes and next steps. The content focused primarily on explaining the new technologies and their implications for the port industry in an understandable yet technical manner.



The methodology adopted for these workshops was one of co-creation and participatory dialogue. It was envisioned that useful insights and co-create innovative solutions to the challenges can be gained by engaging diverse stakeholder groups in an open discussion on the technical, policy, and business dimensions of sustainable energy in ports.

More in detail, a key factor in the success of the workshops was the selection of regional representatives and stakeholder groups. The regional representatives, chosen based on their expertise and connections within their regions, served as the primary contact points for workshop invitations and distribution.

Stakeholder groups were identified considering a broad range of perspectives on sustainable energy technologies in ports. These included academics, port technicians, policymakers, business owners, port authorities, and representatives from cities. The aim was to ensure a holistic understanding of the policy and business environment and to engage all relevant parties in the co-creation of solutions.

Invitations were extended to identified stakeholder groups through the elected representatives. The stakeholder identification and invitation process were done with an understanding of the need for varied perspectives, the importance of each stakeholder's contribution to the process, and the role they play in implementing the technologies and business models discussed.

The methodology for Deliverable 2.2 has been designed to maximise stakeholder engagement, foster a productive exchange of ideas, and result in concrete and implementable business models and policy recommendations for sustainable energy generation and fuel sources in ports and cities.



## 2. Regional Workshops

This chapter provides insights into various regional workshops, namely the Baltic-Atlantic-North, Inland Waterways, East-Med, and the South-West Europe Region workshops. These workshops, organized by different bodies like WMU, EHO, DAFNI, and FV, were instrumental in gathering stakeholder feedback, identifying challenges, and exploring opportunities for sustainable maritime and coastal community development. The focus was on understanding regional specifics and integrating regional and local insights into broader strategic frameworks for sustainable maritime and port developments.

### 2.1 Regional Workshop1: Baltic-Atlantic-North Regions (by WMU)

#### **Objectives, scope, and stakeholder participation**

On August 30<sup>th</sup> 2023, this seminar aimed to bring together representatives from different European stakeholders, particularly from Baltic-Atlantic-North regions, and to support the EU Horizon-funded project SEAENERGY (Sustainability Educational programme for greenNER fuels and enerGY on ports).

The World Maritime University (WMU) workshop under the EU Horizon Europe-funded project SEAENERGY aimed to advance maritime decarbonization by adopting greener fuels and energy in ports. The workshop's objectives and scope were extensive, bringing together representatives from the International Maritime Organization (IMO) and the European Union. It focused on the role of green technologies and global cooperation in maritime decarbonization. The event underscored important topics like current progress, challenges, best practices, capacity building, life cycle assessment, and cost-benefit analysis. A key feature was the roundtables on the second day, which allowed the identification of main benefits and barriers in technologies, business models, policies, regulations, and global cooperation in the port sector from both international and regional perspectives.

During the workshop, relevant stakeholders shared their perspectives on the role of green technologies and global cooperation towards maritime decarbonization. Highlighting important topics such as current progress, challenges, best practices, capacity building, life cycle assessment and cost-benefit analysis. On the second day, roundtables were carried



out to identify the main benefits and barriers in four broad topics: technologies, business models, policies and regulations, and global cooperation towards the decarbonization of the port sector from an international and regional perspective.

Stakeholder participation was diverse, with onsite and online attendees encompassing port managing bodies, terminal operators, regulators, international organizations, trade associations, technology developers, researchers, educators, and energy providers. A total of 58 people attended onsite, and 12 joined online. The roundtables, which saw active participation from 26 stakeholders, were central to the workshop, enabling deep dives into the specified topics and fostering collaborative discussions. The audience and the stakeholders that participated in the workshop were mainly divided into the following groups:

*Table 1. WMU workshop onsite participation.*

Stakeholder participation ONSITE	Number
Port managing body and Terminal operators	4
Regulators	1
International organisations and trade associations	8
Technology developers and manufacturers	3
Research and education	38
Energy providers, energy transition facilitators and third parties (designers, architects, contractors, construction workers, port project managers, consultants, and other service providers)	4
Total	58

*Table 2. WMU workshop online participation.*

Stakeholder participation ONLINE	Number
Port managing body and terminal operators	2
Regulators	1
International organisations and trade associations	2
Technology developers and manufacturers	
Research and Education	6



Energy providers, energy transition facilitators and third parties (designers, architects, contractors, construction workers, port project managers, consultants, and other service providers)	1
Total	12

The round tables aimed to identify the main benefits and barriers in four broad topics: technologies, business models, policies and regulations, and global cooperation toward the decarbonization of the port sector from an international and regional perspective. Each participant was assigned to one of the four roundtables, and every group had one hour and 30 minutes to discuss and structure one or two slides with the conclusion of the topics discussed in each roundtable.

### Onsite Participation:

Roundtable 1. Technologies

Participant	Role/Title	Organization
Susann Dutt	Member of the Executive Committee	EOPSA(European Onshore Power Supply Association)
Fanny Lossy	Director - Environment, Maritime Safety and Offshore	European Community Shipowners' Associations
Jaap Gebraad	Secretary-General	Waterborne Technology Platform
Jennie Folkunger	Head of Environment and Sustainability	Port of Trelleborg
Ervin Vargas Wilson	Technical Director	MTCC (Maritime Technology Cooperation Centre)Latin America
Kenneth Widell	Project Manager	Wärtsilä
Luisa Spaggiari	Engineer	Ramboll

Roundtable 2. Business models

Participant	Role/Title	Organization
Davide Gualco	Project Manager	RINA Consulting spa
Michele Acciaro	Associate Professor	Copenhagen Business School
David Daniels	Senior Forskare	VTI
Yildiz Williams	Lead Marine Consultant	Lloyd's Register





Roundtable 3. Policy and legislation

Participant	Role/Title	Organization
Sonia Yeh	Professor	Chalmers University of Technology
Goran Dominioni	Assistant Professor	Dublin City University
Vivian Rambarath-Parasram	Director & Head	MTCC Caribbean
Bogdan Oldakowski	Secretary-General	Baltic Ports Organization
Petar Sofev	Project Manager	Copenhagen Business School

**Online participation:**

Participant	Role/Title	Organization
Wei Ruan	Director & Head	MTCC Asia
Tim Verhoeven	Projects and Policy Manager for Sustainable Shipping	Antwerp Port Authority
Anaëlle Boudry	Senior Policy Advisor	European Sea Ports Organisation
Pierre Cariou	Senior Professor	KEDGE Business School
Mark Clintworth	Maritime Project Risk Management and Finance Expert	WMU
Erik Bertholet	Business Manager for Logistics, Offshore Wind at Eemshaven	-
Lydia Ngugi	Project Head	MTCC Africa
Sukhjit Singh	Head of School (Maritime Science)	University of Gibraltar

**Discussions, roundtables, and feedback**

The roundtable focused on the challenges and opportunities in decarbonizing ports and shipping, particularly on the policies and regulations. The participants represented various stakeholders such as research and education, port managing bodies, and international organizations. The discussion highlighted the importance of stakeholder engagement, the need for a business model that supports decarbonization, and the potential benefits of greening ports; in addition to that, the complexity of stakeholder analysis and the need for cooperation and collaboration were also emphasized. Moreover, the role of national and international legislation and the need to stimulate the development of green infrastructure in ports was also discussed. The meeting discussed the challenges and opportunities in



transitioning ports to greener operations. The role of governance, regulations, and stakeholder involvement were highlighted as key factors.

To conclude, three broad topics (drivers/benefits, barriers/challenges, and actions) have been discussed, and the main contributions are presented in the following tables:

*Table 3. Drivers or benefits of policies and regulations for port decarbonization.*

Drivers/Benefits
<ul style="list-style-type: none"> <li>•The importance of implementing national and international legislation to reduce carbon emissions in ports</li> <li>•The potential of partnerships in facilitating the greening of the shipping sector</li> <li>•The role of national policy in promoting green transition in ports</li> <li>•Discuss and improve procurement strategies in public ports</li> <li>•Involve different stakeholders in policy design</li> <li>•Design well-structured collaborative projects for green transition</li> <li>•Explore opportunities in Methanol and Ammonia production</li> <li>•Platforms for the exchange of good practices among stakeholders</li> </ul>

*Table 4. Barriers or challenges of policies and regulations for port.*

Barriers/Challenges
<ul style="list-style-type: none"> <li>•Need for cooperation with stakeholders in decarbonizing the port sector from different backgrounds</li> <li>•Challenges in decarbonizing shipping due to lack of market availability of suitable fuels and government priorities</li> <li>•Complexity of regulation and accountability in developing countries that are major flag states but not necessarily beneficiaries of shipping state interests</li> <li>•The importance of identifying the amount of finance needed to support the decarbonization process(despite fluctuating market and risks).</li> <li>•Need for consistency in policies at local and international levels and the importance of solving global level problems at the global level</li> </ul>

*Table 5. Actions in developing policies and regulations for port decarbonisation.*

Actions
<ul style="list-style-type: none"> <li>•Consistency and uniformity in policies at local and international levels</li> <li>•Support the need for creating a green infrastructure in ports</li> <li>•Estimate the public financing needed for creating the infrastructure in ports for the zero carbon transition of the shipping sector</li> <li>•Promote national policy for green transition in ports</li> <li>•Develop different strategies for private and public sector ports to move towards decarbonization</li> <li>•Explore ways to incentivize green transition among stakeholders</li> </ul>



In short, the workshop's policy analysis and feedback session explored the complexities of port and shipping decarbonization. Participants from various sectors, including port management and international organizations, discussed the significance of stakeholder engagement and the necessity of supportive business models for decarbonization. The potential benefits of greening ports, the importance of national and international legislation, and the need for green infrastructure in ports were also highlighted. The discussions emphasized the role of governance, regulations, and stakeholder involvement in transitioning ports to greener operations.

Furthermore, an additional roundtable was conducted with the participation of maritime experts (research and education, energy transition facilitators and third parties, and technology developers). First of all, it is reiterated that identifying stakeholders is very important for developing appropriate business models in the green transformation process. Ports are facilities that provide services in different dimensions, such as social value, local economic development, and facilitating connectivity and should be modelled accordingly. However, there are requirements that each port be compatible with the laws and local practices of the country in which they are located, leading to severe limitations in implementing a uniform business model.

During the discussions, a key limitation identified was the challenge ports face due to the European Union's transition away from fossil fuels. A particular concern highlighted was the lack of adequate backup energy sources to support this shift. The transition to green energy is critical, but this move could face significant hurdles without sufficient alternative energy solutions.

Additionally, the transformation towards greener operations in ports was seen to lag compared to other processes. The influence of large oil companies was also noted as a potential factor that could decelerate the green transformation, indicating a need for a more balanced approach to managing the transition.

While not always viewed favourably by local residents due to pollution concerns, Ports play a vital role in creating employment and offering various opportunities for local communities. This duality underscores the importance of addressing environmental concerns while recognizing ports' socio-economic benefits.



Thus, the discussions emphasized the need for a strategic approach to transition ports from fossil fuels. This involves reducing reliance on fossil energy sources and ensuring adequate; sustainable backup energy systems are in place to support this transition effectively. Such a comprehensive strategy would help ports overcome these limitations and serve as crucial economic hubs while aligning with broader environmental goals.

As a result, conclusion was reached on the following outputs:

- Ports should be managed using an effective model in which the local community and port stakeholders can be involved more in the processes. Still, local laws and the lack of a mindset prioritising maximum social benefit rather than maximum profit are essential shortcomings.
- It is crucial to identify the future stakeholders in new business models, and this will accelerate the green transformation and encourage more stakeholders to be included in the process. On the other hand, cultural differences, the fact that ports do not have much of importance in the final consumers' perception, and the slowing effect of large oil companies were evaluated as significant constraints.
- Emphasis was placed on shaping business models according to local needs, and it was evaluated that this transformation could pave the way for ports to become energy hubs. The resistance of port management to changing its mindset has been determined to be a constraint.
- Transporting offshore electricity production through ports has been accepted as another business model, and there was a consensus that this process will increase the efficiency of the ports. Still, it has been predicted that there may be difficulties due to the need for more space and the high initial investment cost. It is also possible that the process will progress slowly as more cooperation will be required. European ports like Rotterdam and Antwerp-Bruges are transitioning into green energy hubs. They are integrating offshore wind power and exploring hydrogen production projects (Eurelectric, 2023). This shift aligns with the EU's RePowerEU strategy to boost renewable hydrogen production and import. These initiatives mark a significant move towards sustainability and reducing emissions in the maritime sector (CW Team, 2023).





In summary, business model development was one of the critical areas of focus. The discussions acknowledged the importance of identifying stakeholders in the green transformation process. Ports, serving multifaceted roles in social value, local economic development, and connectivity, face challenges in adopting uniform business models due to varying local laws and practices. Concerns were raised about the limitations posed by the shift away from fossil fuels and the potential slowdown of green transformation by large oil companies. The workshop concluded that ports should adopt proactive management models that prioritize social benefits and involve local communities and stakeholders more actively in decision-making processes.



*Figure 1. Regional Workshop1: Baltic-Atlantic-North Regions by WMU*

### **Key outcomes and recommendations**

The workshop served as a forum for in-depth discussions on the drivers and challenges in pursuing port decarbonization, as well as potential courses of action encompassing technology, business models, policies, and regulations. During the sessions, participants strongly highlighted the following key areas of focus:



- Addressing port decarbonization requires a comprehensive approach that brings together various stakeholders and strategies.
- Collaboration is key, encouraging partnerships between the private and public sectors to combine resources and expertise.
- Incentives, such as tax incentives, subsidies, and financial support, can facilitate the adoption of environmentally friendly practices.
- Investments in technologies and infrastructure are essential to reduce emissions in port operations.
- The development of comprehensive decarbonization strategies that encompass both the private and public sectors is crucial for a cohesive and effective approach added to local, regional, and global cooperation.
- Research and development initiatives, accompanied by training programs.
- Stricter regulations, effective monitoring systems, voluntary agreements and cooperation are vital to contribute to the transition towards cleaner ports.
- Market-based measures (MBM) and investments in green finance offer benefits by incentivizing emission reduction.
- Cooperation and collaboration not only within the port but also with ships and land transport.

To conclude, key findings and recommendations underscored the need for a comprehensive approach to port decarbonization, integrating various stakeholders and strategies. Collaboration between the private and public sectors, incentives for adopting environmentally friendly practices, and investments in technology and infrastructure were highlighted as crucial elements. The development of comprehensive decarbonization strategies, stricter regulations, effective monitoring systems, and market-based measures were also recommended to facilitate the transition to cleaner ports. Also, the importance of cooperation and collaboration within the port community and with ships and land transport was emphasized.





## 2.2 Regional Workshop 2: Inland Waterways (by EHO)

### Objectives, scope, and stakeholder participation

The Regional Workshop Ennshafen Port, held on September 21<sup>st</sup>, 2023, was a significant event focused on the energy transition in inland ports within the Danube Region, particularly under the EU HORIZON Europe SEANERGY project. This workshop brought together over 40 participants, including key stakeholders from Danube ports' administrations and the SEANERGY project consortium. The main objectives were to develop guidelines for greening ports and create a Clean Energy Centre Master Plan. This plan encompasses goals, targets, training modules, and actions for port stakeholders to transform ports into clean energy hubs.

Significant focus was placed on the initial results of the SEANERGY project, emphasizing the methodology for the Clean Energy Hub Master Plan, which is due for implementation in 2024. Discussions revolved around the necessity of developing green ports and the first steps many Danube ports have taken in this area. The workshop also shed light on the Corporate Sustainability Reporting Directive's complex requirements, emphasizing the importance of environmental and social impact reporting. The workshop encouraged interactive discussions among participants, focusing on implementing identified technologies, addressing organizational gaps, and overcoming economic and technological barriers to green investments. There was a consensus on the need for a stable policy, regulatory, and investment framework for greening ports. The event was in hybrid mode, with the following participants:

*Table 6 Participants of Regional Workshop 2: Inland Waterways*

Participant	Organization
Ahmed Elkafas	RINA
Aleksandra	-
Alexio Picco - Circle	Circle Touch
Anas Alamoush	World Maritime University
Anca Jianu	CERONAV
Andreas Plank, Bayernhafen	Bayernhafen
Beatrice D'auria	Circle Touch



Participant	Organization
Bettina Matzner	viadonau
Božana Matoš	Ancoris
Cristian Dobroitoiu	Romanian Maritime Training Centre
Dc Secretariat Do	Danube Commission
Danube Commission's Secretariat	Danube Commission
Davide Gualco	RINA
Dejan Trifunovic, Dc Sec	Danube Commission
Dirk Foschee	Argo-Anleg
Efip	European Federation of Inland Ports
Elena Gascón	AtPerson
Elia Malevska	Bulgarian Ports Infrastructure Company
Ennschafen-Office	Ennschafen
European Sea Ports Organisation	European Sea Ports Organisation
Georgiana Capota	-
Irem Silajdzic	CENER21: Center for Energy, Environment and Ressources / Sarajevo
Ismini Moustafelou Dafni	DAFNI Network
Jasna Muskatirovic Dc	Danube Commission
Johann Ramirez Zer0-E	ZERO-E Engineering
Karin Voglsam	Ennschafen
Ksenija Hajdukovic Pga	Administration of Upper Lloyd's
Manfred Seitz	Danube Commission
Marina Arroyo	Fundacion Valenciaport
Marta Wolska Dg Move	European Commission
Mathias Von Tucher	DanLog
Mihaela Vintila_Ceronav	CERONAV: Romanian Maritime Training Center / Constanta-Galati
Natalia Calderon	World Maritime University
Petros	DAFNI Network
Peyman Ghaforian	World Maritime University
Pjotr Suvorov Dc	Danube Commission
Ro Monica Patrichi	Romanian Maritime Training Centre
Ralf Jina	DDSG Holding



Participant	Organization
Robert Kadnar	VPAS: Verejne Pristavy, a.s. [public ports] – port authority of Bratislava
Sasa Jovanovic	IC Group
Sanita Džino	Enova
Stevan	-
Svetlana Stirbu	DanLog
Werner Auer	Ennshafen
Laure Roux	Central Commission for Navigation on the Rhine
Topala Mihaela	Romanian Maritime Training Centre
Z.Naydenova	Bulgarian Ports Infrastructure Company

Below are the online participants:

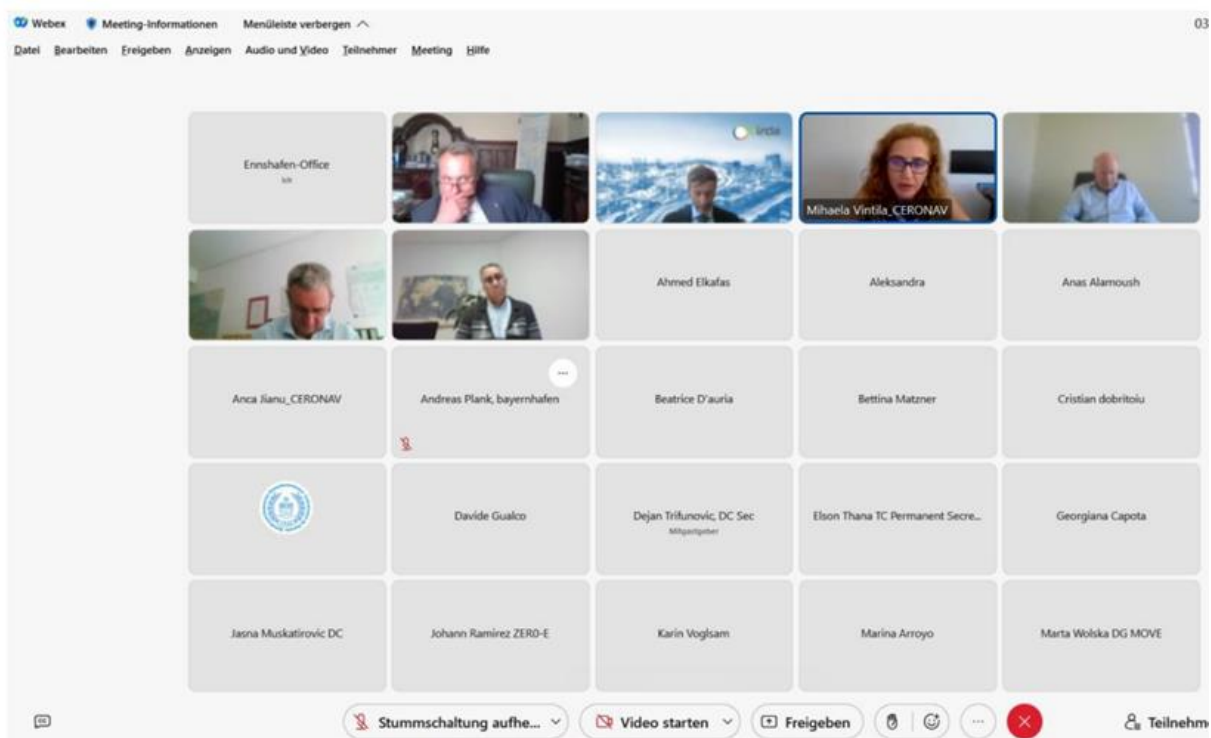


Figure 2. Online participants of the Inland Waterways workshop

In summary:

Regarding stakeholder participation, the workshop featured presentations from key figures, including the Danube Commission, iC-Consulenten, Ennshafen Port, ESPO (European Sea Ports Organisation), and EFIP (European Federation of Inland Ports). These



presentations covered a range of topics, from green port initiatives to the implications of the EU taxonomy for ports and the challenges in regional port developments in the Danube Region. The workshop had 40 participants, primarily from Danube ports' administrations and the SEANERGY project consortium. The participants were involved in interactive discussions on various topics, including energy transition and port development plans.

### **Discussions, roundtables, and feedback**

The policy analysis and feedback sessions at the workshop emphasized the significant role of the Danube Commission in ensuring free navigation and facilitating the development of ports. Discussions included ESPO's investment study, which shed light on European ports' infrastructure investment needs and financing challenges. A critical focus was on the implications of the EU taxonomy for sustainable activities, highlighting the evolving landscape of regulatory frameworks and their impact on port operations. The sessions also discussed the growing investment needs of ports, underlining the importance of new legal requirements such as the Corporate Sustainability Reporting Directive and European Sustainability Reporting Standards, which reshape the maritime industry's operational and reporting standards.

The Policy Analysis and Feedback session highlighted several key aspects of port development and sustainability:

1. **Danube Commission's Role:** The Danube Commission focuses on ensuring free navigation on the Danube and promoting and monitoring port development. It emphasizes the need for intensive cooperation and coordination among port actors, both locally and transnationally.
2. **ESPO's Contribution:** ESPO, representing port authorities in the EU and other countries, conducted a study on the investment needs of European ports. They addressed the EU taxonomy for sustainable activities, noting its impact on port activities and investments, including the exclusion of some essential port activities and the potential financial repercussions for ports not labelled as "green."
3. **Legal and Financial Implications:** New legal requirements, such as the Corporate Sustainability Reporting Directive (CSRD) and European Sustainability Reporting Standards (ESRS), were discussed. These regulations will likely increase the focus on CO2



pricing and resilience against climate change, impacting funding programs and client expectations.

4. **EFIP's Viewpoint:** EFIP highlighted the need for more investment in line with the “fit for 55” and green transition policies. There's a call for expanded funding, particularly through the Connecting European Facility (CEF), and a campaign for more support from national governments.

The session underscored the growing need for port infrastructure investment and the challenges of evolving legal and financial landscapes. It also emphasized the importance of collaboration among various port stakeholders to facilitate sustainable and resilient port development. The workshop underlined the necessity of developing business models that incorporate sustainable practices. Practical examples from Ennshafen and other Danube Region Ports were presented to illustrate the implementation of greening strategies in ports.

### **Key outcomes and recommendations**

The workshop's key findings and recommendations focused on realistic goals for the sustainable transformation of inland navigation in the inland waterways in Europe, particularly the Danube Region. Central to these were developing onshore power supply and adopting CO<sub>2</sub>-reduced fuels for inland vessels. These measures are seen as viable for achieving sustainable change in the short, medium, and long term. Key points included the importance of collaborative efforts in implementing energy transition technologies addressing social, economic, and technological challenges. The necessity of clear business models, regulatory frameworks, and investments in green infrastructure was emphasized. The discussions highlighted the urgency of decarbonization and the opportunities it grants in port development.

The workshop brought forth various viable perspectives on energy transition and decarbonization in port operations and inland navigation. It pointed out the need for greening efforts, including alternative energy sources like e-fuels<sup>1</sup> and hydrogen, and the challenges associated with their adoption. The critical role of onshore power supply in decarbonizing

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<sup>1</sup> E-fuels, short for electro-fuels, are synthetic fuels produced by combining hydrogen (obtained from water electrolysis using renewable energy sources) with carbon dioxide (captured from the atmosphere or industrial processes). These fuels are considered renewable and carbon-neutral when used, as they can potentially recycle





inland waterways was discussed, along with the challenges due to existing grid capacities and the need for comprehensive regional approaches and technical harmonization.

It was stressed that ports could lead the way in energy transition, though investment paths need to be clearer. The significance of differentiated strategies for various vessel types was noted. Transitioning to clean energy sources was recognized as essential for ports to stay relevant in the transport market despite economic and regulatory barriers.

In conclusion, the workshop underscored the need for a comprehensive approach that includes greening strategies, the importance of onshore power supply, overcoming challenges in adopting alternative energy sources, and the necessity of collaborative approaches to facilitate energy transition in Danube shipping and port operations.<sup>2</sup>

### 2.3 Regional Workshop 3: South-West Europe Region (by FV)

#### **Objectives, scope, and stakeholder participation**

The workshop Port Decarbonization Technologies was held on November 8 th, 2023, in online format by Fundaci3n Valenciaport.

The objective was to organize the regional workshop and obtain feedback from the South-West Europe (West-Mediterranean) stakeholders regarding barriers and solutions to the port's energy transition and decarbonization.

The covered area was South-West Europe and included relevant stakeholders from the

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<sup>2</sup> A few aspects of inland waterways was not addressed directly, however, these aspects which are reflected below briefly are expected to be covered in details in the following deliverable D2.3 of SEANERGY project. Therefore, as a complementary to the workshop, here are three points to be discussed further for European inland waterways:

- Drought Impact on the Danube: Severe droughts have led to low water levels in the Danube, affecting navigation and trade. This issue has particularly impacted Romania, near the Delta and Port of Constanta, where large vessels have been limited in capacity, highlighting the need for a drought risk monitoring plan.
- Rhine-Danube Connection: Both the Rhine and Danube rivers face similar challenges due to climate change, such as reduced water levels affecting navigation. These shared issues necessitate integrated strategies for sustainable navigation and port operations across Europe's interconnected waterways.
- Addressing River Conditions: Despite the distinct characteristics of the Danube and Rhine, their common challenges like climate change impacts call for collaborative, regional approaches to ensure sustainable river navigation and operations.

Incorporating these aspects into the workshop's scope could provide a more holistic understanding of the challenges faced in inland waterway navigation and port operations in the context of climate change and environmental variability.





maritime and technology sectors of Spain, Italy, France and Portugal.

During the regional workshop, there were around 50 professionals from South-West Europe's port ecosystem, including port authority members, technology industry employees, university researchers and others:

*Table 7. Participants in the workshop of South-West Europe Region (by FV)*

Name	Country	Organization
Josep Sanz	Spain	Fundación Valenciaport
Marina Arroyo	Spain	Fundación Valenciaport
Sandra Roselló	Spain	Fundación Valenciaport
Federico Torres	Spain	Port Authority of Valencia
Raúl Cascajo Jiménez	Spain	Port Authority of Valencia
Gemma Martí	Spain	Grupo Torres
Milagros Peña Tortosa	Spain	ITE - Instituto Tecnológico de la Energía
Tomás Michael Reilly Rocket	Spain	ITE - Instituto Tecnológico de la Energía
Jean Christophe	Spain	Delegación Junta de Andalucía en Bruselas
Javier Cervera	Spain	Baleària
Jacob Escobar Gomez	Spain	ISDEFE - Ingeniería de Sistemas para la Defensa de España S.A. (Engineering Systems for the Defense of Spain)
Maria Magdalena Moreno García	Spain	ISDEFE - Ingeniería de Sistemas para la Defensa de España S.A. (Engineering Systems for the Defense of Spain)
Laura Martinez Abellan	Spain	ISDEFE - Ingeniería de Sistemas para la Defensa de España S.A. (Engineering Systems for the Defense of Spain)
Elizabeth Giraut Ruso	Spain	ITG - Instituto Tecnológico de Galicia
Hugo Lopes	Portugal	APDL - Administração dos Portos do Douro, Leixões e Viana do Castelo
Alfredo Gutierrez Arce	Spain	IDAE - Instituto para la Diversificación y Ahorro de la Energía
Álvaro García	Spain	KpQ – Keel pro Quo
Pedro De Frías López	Spain	MSC Terminal Valencia
Sylvain PICHON	France	CMA-CGM Shipping company
Victoria	Spain	CPS - Compañía de Puertos Sostenibles



Name	Country	Organization
Juan Boix	Spain	CPS Infraestructuras Movilidad y Medio Ambiente
Michaela Odonohoe	Spain	GE Vernova
Rachel Connor	Spain	GE Vernova
Jose Perez Alacreu	Spain	INSTEIMED S.A.
Ahmed Gamal Hamed Elkafas	Italy	RINA Consulting S.P.A
Srikanth Vinjimore Kesavan	France	CEA - Commissariat à l'Énergie Atomique et aux Énergies Alternatives
Germain Ranquet	France	CEA - Commissariat à l'Énergie Atomique et aux Énergies Alternatives
Bernat Ibanyez Oliver	Spain	Autoridad Portuaria de Castellón
Raul Salinas	Spain	Siemens S.A.
Montserrat Espin	Spain	Bureau Veritas
Mònica Rivera	Spain	Albea Group
Alberto Vargas	Spain	Danfoss S.A.
Alessandro De Domenico	Italy	Caronte&Tourist S.p.A.
Fabio Palermo	Italy	Caronte & Tourist
Andrea Bardi	Italy	ITL- Italian Transport and Logistics
Marta Ibarra García	Spain	TSK - TSK Electrónica y Electricidad S.A.
Ramon Zubiaga Garteiz	Spain	Grupo Consulmar
Daniele Roncagliolo	Italy	Università degli studi di Genova
Thibaut DION	France	Sia Partners
Benoit Fournaud	France	HDF Energy
Andre Pestana Dos Santos	Belgium	European Commission
Evangelia Piteni	Italy	AdSPMAM - Autorità di Sistema Portuale del Mare Adriatico Meridionale
Lia Piteni	Italy	AdSPMAM - Autorità di Sistema Portuale del Mare Adriatico Meridionale
Simone Libri	Italy	North Tyrrhenian Sea Port System Authority

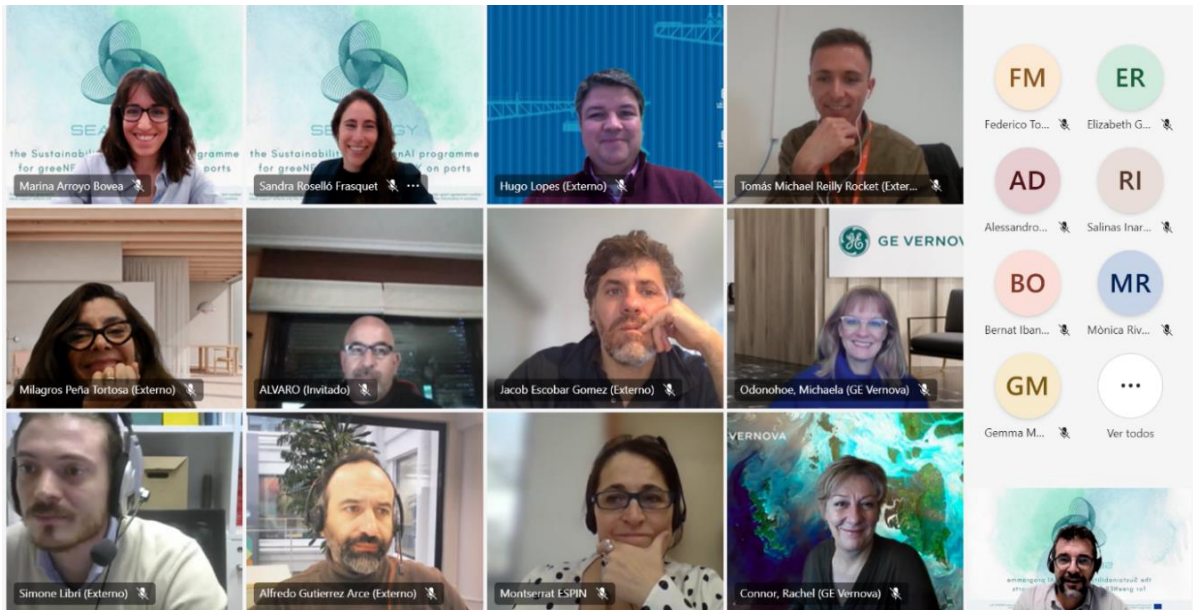


Figure 3. Workshop of South-West Europe Region

In terms of participation in the discussion, there were several speakers:

- Federico Torres, Director of Ecological Transition of the Port Authority of Valencia, introduced the event.
- Sandra Roselló, Innovation Technician in Fundación Valenciaport, introduced the SEANERGY project.
- Marina Arroyo, Decarbonization Project Manager in Fundación Valenciaport, presented SEANERGY's Catalogue of technologies for port decarbonization.
- Josep Sanz, Energy Transition and Sustainability Director in Fundación Valenciaport, was a Moderator.

Afterwards, the stakeholders were divided into three groups that would rotate in the different roundtable discussions “economic/business models, social/legal, technologies” to assess the barriers and solutions they perceived in terms of achieving the energy transition and decarbonization in the maritime sector. Each roundtable was moderated by a member of Fundación Valenciaport, who had a list of questions focusing on energy transition and port decarbonization.

### Discussions, roundtables, and feedback

In the **economic/business models roundtable**, the discussions focused on balancing short-



term costs with the long-term benefits of decarbonization. Participants acknowledged the complexity and the need for public administration support. Investing in innovative technologies like electric vehicles, alternative fuels, and renewable energy sources can yield long-term financial benefits despite current economic uncertainties and the risks associated with immature technologies.

Moreover, in **the social/legal aspects** roundtable, key barriers to implementing decarbonization measures were discussed, including economic risks and the need for high-quality information and financial support. There's a call for more organizational guidance, clear environmental standards, and strategic alignment by governments to promote sustainable practices. Legal uncertainties, such as the lack of a clear regulatory framework, pose challenges to adopting new technologies and fuels.

In the **technological roundtable**, participants discussed the current state of technology in relation to achieving zero emissions objectives in the maritime sector. The consensus was that while current technologies are not sufficient to achieve zero emissions, they can significantly reduce the carbon footprint. There's a need for further research and development of new and developing technologies, such as hydrogen generation and electrolyzers, to mature and implement them at a lower cost. Challenges include the high cost of fossil energy and the need for more mature technologies. Ports require fuel and electrification transformations, with the economic aspect being a key consideration. Private companies are less inclined to invest in new technologies, often leaving it to public administration. Regulatory challenges and the need for greater dialogue and cooperation between port authorities were also highlighted. Lastly, the risks associated with new technologies, such as economic, regulatory, and security risks, were discussed, with the suggestion that these could be mitigated through policies, cooperation, and diversification.

### **Key outcomes and recommendations**

Discussions were very productive as all the different stakeholders were engaged and participated freely in the work they carried out in their companies. They also explained their limitations, challenges, and solutions. Summaries of the different roundtables:

**Economic/Business Models:**

- Balancing short-term decarbonization costs with long-term benefits is challenging. Public administration support is crucial.
- Investing in innovative technologies, like electric vehicles and alternative fuels, can lead to long-term cost reductions.
- Technologies without financial or legislative maturity present high risks. Established technologies, like photovoltaics, are preferred over less mature ones.
- Creating internal markets can help repay investments. Ports can adopt new business models focusing more on electrical solutions and smart grids.
- Port authorities are becoming central to electricity internal distribution, necessitating proper legal framework modifications.

**Social/Legal Aspects:**

- Decarbonization measures face economic risks and require quality information and financial support to overcome barriers.
- Public authorities should guide smaller organizations, establish environmental standards, and promote green practices in ports.
- Government incentives in the form of non-repayable grants and strategic alignments can facilitate decarbonization.
- Legal uncertainties regarding new technologies and alternative fuels need a clear regulatory framework scheme.
- Highlighted that most companies already have decarbonization strategies and departments or sections dedicated to this matter that have important roles in decision-making.

**Technologies:**

- Current technologies are insufficient for zero emissions objectives. There's a need for more research and development.
- Economic considerations, regulatory criteria, and environmental impact are key in evaluating new port decarbonization technologies.
- Economic, regulatory, and security risks associated with new technologies can be





mitigated through policies and diversified operations.

- No single low/zero emission technology is the most promising; a mix, including electrification and e-fuels, is a reasonable approach.
- Optimal management and forecasting of electrical resources and needs are ways to support decarbonization.

These are the key points of a comprehensive discussion on the challenges and strategies for decarbonization in port industries, including economic, social, legal, and technological aspects. Overall, the event was considered a success, as attendees showed interest in the SEANERGY project, wishing well for the continuation of the project, as well as expressing the desire to follow up on the Catalogue of Technologies once it is uploaded on the project's website.

#### 2.4 Regional Workshop 4: South-East Europe Region (by DAFNI)

##### **Objectives, scope, and stakeholder participation**

The East Med Regional Workshop, organized by DAFNI on November 23<sup>rd</sup> in a hybrid format in Athens, Greece, and online, was a significant event under the EU project SEANERGY. The workshop highlighted the importance of supporting means to achieve energy efficiency, preferably using local green energy and alternative fuels and green port transportation. These efforts are directed towards mitigating climate change, improving the natural environment, and enhancing living conditions in port cities. This was in line with the SEANERGY project's goal to mitigate climate change and improve natural environments and living conditions in port cities.

A key aspect of SEANERGY is the development of three Master Plans adapted for each pilot port, serving as useful, non-binding consulting tools for stakeholders. These plans are designed to aid in the designing and implementation of infrastructure upgrades towards clean energy and digital transition.

The workshop began with welcomes and introductions by notable figures, including DAFNI director Kostas Komninos and officials from the Ministry of Maritime Affairs, the Cyprus Ports Authority, and local government representatives. Petros Markopoulos (DAFNI) and Reza





Karimpour (Magellan Circle) presented the project overview and current EU policies for the green transition of ports. Anas Alamoush (WMU) concluded the first session with preliminary findings from SEANERGY's studies on port decarbonization, focusing on stakeholder analysis, emission categorization, drivers for energy transition, and identified barriers such as economic, informational, and technical challenges, along with recommended solutions.

The workshop featured two-panel sessions. The first, moderated by Kostas Komninos, focused on policy developments and economic incentives, with participants from regulatory authorities, academia, and the private sector. The second panel, led by Petros Markopoulos, discussed best practices in port decarbonization and innovations, featuring insights from academia and private sector representatives on decarbonization projects in various Greek ports. The event concluded with a presentation by Vassiliki Tsoukala, NTUA professor and Director of the Laboratory of Harbour Works.

The workshop saw the participation of 13 people on-site and 20 online, including representatives from the Cyprus Ports Authority, Croatian and Black Sea port authorities, the Port of Piraeus, the Regulatory Authority of Energy Waste and Water (RAEWW), and HEDNO (Hellenic Electricity Distribution Network Operator). Academia and the private sector were also represented, with contributions from the University of Aegean and SEANERGY project leads. In total, 13 people joined on-site, while another 20 joined online:

*Table 8. Workshop Participants in South-East Europe Region*

Name	Organization	Role/Title
Reza Karimpour	SEANERGY project	Lead Partner
Anas Allamoush	SEANERGY project, WMU	Partner
Dimitrios Lyridis	NTUA	Associate Professor & Director of the Laboratory for Maritime Transport
Vasiliki Tsoukala	NTUA	Professor & Director of the Laboratory of Harbour Works
Ioannis Prousalidis	NTUA	Associate Professor, School of Naval Architecture & Marine Engineering
George Caralis	NTUA	Researcher, School of Mechanical Engineering
Antonios Stylianou	Cyprus Ports Authority	Chairman of the Board



Name	Organization	Role/Title
Ugo Toic	Cres Island Development Agency	Representative
Drazen Pandza	Port of Ploče	Representative
Dimitris Mavrakis	Coordinating Commission of the Black Sea Energy Center	President
Dimitrios Spyrou	Port of Piraeus	Representative
George Loizos	RAEWW	Director of Strategy and International Affairs & Head of Electricity Networks and New Technologies
George Loukos	HEDNO	Research & Innovation Director
Theofanis Kontopoulos	HEDNO	Electrical and Computer Engineer, Research & Innovation Department
Maria Lekakou	University of Aegean	Professor of Maritime Economics & Dean of Business School
Representatives	Municipal Port Fund of Skyros	Port Authority
Representatives	Association of Greek Ports	Port Authority
Representatives	Municipal Port Fund of Kos	Port Authority
Representatives	Municipality of Skopelos	Port Authority
Representatives	Port Authority of Lavrio	Port Authority
Representatives	Heraklion Port Authority	Port Authority
Representatives	Port Authority of Kerkyra (Corfu)	Port Authority
Stefanos Dallas	PROTASIS	Industry Representative
Panagiotis Mitrou	Lloyd's Register	Industry Representative
Anna Lekka	GATES	Industry Representative

### Discussions, roundtables, and feedback

Policy discussions emphasized aligning energy regulations with EU mandates and the need for a "regulatory experiment" to quickly overcome regulatory barriers. Most port services' electrification was identified as a strategic priority by HEDNO, aligning with the EU Green Deal. The discussions also focused on integrating the SEANERGY master plan with ports' master plans, the need for strategic planning in energy upgrades, and the distinction between financial support mechanisms for small and large ports.



More in detail, the workshop's policy analysis and feedback session provided crucial insights into the challenges and strategies for energy transition in ports. Key points included:

1. Regulatory Framework and Experimentation:

- The Regulatory Authority of Energy Waste and Water (RAEWW) noted that energy regulations need to align with EU policies. However, the pace of technological advancements like cold ironing is outpacing the regulatory framework. A "regulatory experiment" was suggested to overcome regulatory barriers and inform future policy development quickly.

2. Electrification and Strategic Planning:

- HEDNO emphasized electrification as a strategic priority, aligning with the NCEP and the EU Green Deal. Collaboration with regulatory authorities and stakeholders is crucial for this endeavour.
- The National Technical University of Athens (NTUA) highlighted the need for strategic planning in port master plans, integrating the SEANERGY master plan with the ports' existing plans. This includes addressing the absence of current port situation mapping and resilience plans.

3. Financial Support and Green Corridors:

- A distinction between small and large ports was noted, with financial support for smaller ports needing to come from national or regional funds.
- The concept of "green corridors," especially in island regions, was proposed, with initiatives like electric ferries connecting islands to demonstrate decarbonization benefits.

4. Community Engagement and Funding Challenges:

- The University of Aegean advocates for active community involvement, suggesting that participatory initiatives can significantly enhance the public's buy-in and support for the energy transition in island regions.
- High competition for financing and the challenge of self-financing decarbonization projects were identified as major hurdles.

5. Port Electrification and Smart Development:

- A typical roadmap towards smart and sustainable ports was discussed, considering EU and national policies, peak power demands, and load forecasting. This roadmap



includes grid expansion planning and the transformation of ports into smart energy systems.

- Challenges for this roadmap include grid expansion, power quality issues, energy mix, and regulatory concerns.

#### 6. Technical Issues and Infrastructure Upgrades:

- High energy demands from Shore-Side Electricity (SSE) systems can lead to grid stability issues, particularly for non-interconnected islands.
- Spatial limitations and unmapped cable routings pose challenges for small ports.
- Upgrades to existing electrical infrastructure and substations are essential to accommodate SSE systems.

#### 7. Licensing and Permits:

- Different solutions for SSE systems (containerized or building-based) have varying permit requirements, with containerized solutions generally needing fewer permits.

This session underscored the complexity of port decarbonization, highlighting the need for regulatory agility, strategic planning, community engagement, financial support, and technical upgrades to achieve energy transition goals.







*Figure 4. Regional workshop South-East Europe (East Med)*

The workshop underscored the importance of developing smart and sustainable port business models. The roadmap towards smart ports includes EU and national legislation, peak power demand estimation, and load forecasting for various types of ports. It also considers grid expansion planning and establishing a business model that addresses technical issues and training needs.

#### **Key outcomes and recommendations**

Key recommendations included integrating Energy Efficiency Port Plans into Port Master Plans and developing cold ironing infrastructure as an emerging energy upgrade project. The development of energy infrastructure should ensure resilient and safe port operations. The concept of "green corridors" between islands was proposed to activate the development of innovative green technologies. A "regulatory experiment" was suggested as a framework to deploy and test innovative applications for the green transition of ports.

More in detail, the workshop concluded with several key recommendations and strategies for advancing the green transition in ports:





### 1. **Regulatory Adaptation and Experimentation:**

- Aligning energy regulations with EU mandates is crucial, with a "regulatory experiment" proposed to address the gap between technological advancements and existing regulations. This approach allows for testing and implementing innovative green transition applications.

### 2. **Strategic Infrastructure and Planning:**

- Integrating Energy Efficiency Port Plans into Port Master Plans is essential for cohesive strategic development.
- The development of SSE infrastructure is a key focus area, reflecting the trending direction for port energy upgrades.
- Ensuring resilient and safe operations by developing robust energy infrastructure is vital.

### 3. **Innovation and Collaboration:**

- The concept of "green corridors" between islands could catalyse the adoption of green technologies and demonstrate decarbonization benefits.
- Collaboration between ports, regulatory authorities, technology providers, and communities is key to accelerating innovative solutions and public acceptance.

### 4. **Financial Support and Community Involvement:**

- Differentiating financial support mechanisms for small and large ports, with a focus on regional and national funding for smaller ports.
- Community engagement, particularly in island regions, is critical for the success of energy transition projects.

These conclusions highlight the importance of a multifaceted approach involving regulatory agility, strategic planning, innovative technology deployment, community engagement, and financial support to effectively transition ports towards sustainable and energy-efficient operations.



### 3. Demo-Port Workshops

Chapter 3 details the Demo-Port Workshops conducted by FV, EHO, and Dafni. These workshops were pivotal in engaging stakeholders directly involved with port operations and management. They provided platforms for discussing specific challenges and opportunities in port decarbonization and energy transition, focusing on the practical application of theoretical frameworks and strategies developed in earlier phases of the project. The workshops facilitated an exchange of best practices and innovative solutions tailored to the unique needs of each demo-port.

#### 3.1 Demo-Port Workshop 1 By FV

The Valencia demo-port workshop, part of the SEANERGY project, was held on July 6th, 2023, with the following key aspects:

##### **Objectives, scope, and stakeholder participation**

The workshop, organized by Fundaci3n Valenciaport, aimed to engage local stakeholders from the Port of Valencia in discussing barriers and solutions to the port's energy transition and decarbonization.

The workshop consisted of engaging various local stakeholders from the Port of Valencia. The primary objective was identified as conducting the workshop to gather feedback from these local stakeholders regarding barriers and potential solutions to the port's energy transition and decarbonization.

The workshop witnessed the participation of approximately 30 professionals from Valencia's port ecosystem. This diverse group included terminal operators, port authority members, government employees, logistics workers, and others. Several key speakers contributed to the workshop, including the Director of Ecological Transition of the Port Authority of Valencia, the Head of the Climate Change Policy Coordination Service of the regional government, a specialist from a certification company, and a university professor. The workshop works began with introductions and lectures, followed by stakeholders being divided into groups for roundtable discussions on "economic/legal, social, technologies" to identify barriers and solutions for the energy transition and decarbonization of the Port of Valencia.



During the demo-port workshop, we had around 30 professionals from Valencia's port ecosystem, including terminal operators, port authority members, government employees, logistics workers and others:

*Table 9. Workshop Participants for demo-port - FV*

<b>Name</b>	<b>Organization</b>
Elena Giner Alemany	Autoridad Portuaria de Valencia
Paula Tortosa Góngora	APM Terminales Valencia SA
Mar Bauza Siquier	CSP Iberian Valencia Terminal SAU
Mari Fe Peñaranda Nohales	APM Terminales Valencia
Javier Almenar Belenguer	Garbaport SL
Reme Gil Camacho	Dock Logistics Spain
Francisco Casa Boada	Generalitat Valenciana
Fran Escudero Adrián	Reciclamás y Seroil Reciclamás
Ana Galán Hidalgo	CPEV
Ignacio Goda García	MSCTV
Adriana Hidalgo Gómez	Boluda
Alberto Martínez Roger	Amarradores Valencia
Miguel Ángel Portugués	Infoport
Jaume Ivars Ferrer	Intersagunto Terminales SA
Pilar Sánchez Hurtado	Fundación Valenciaport
Alicia Martí Rubio	Fundación Valenciaport
Jean-Marie Mancy de Andrés	Baleària
María Alberola Oltra	Baleària Eurolineas Marítimas SA
Mar Abad Sánchez	Portuaria Levantina SA
Juan Antonio Cuevas Fajardo	Urbaser Sertego
Carla Sapiña Vidal	Infoport Valencia SA
Zineb Debbourn Ouazil	APM Terminals
F. Javier Rodrigo Sanmartín	Galp Energía España Parque de Valencia
Alejandro Toucedo	Remolcadores Boluda SA
Kira González Gala	VMG Refit & Repair
Marco Santurio	LRQA España SL
Olga Rivas	LRQA
Inés Picazo	Planta Regasificación de Sagunto SA



Name	Organization
Lidia Caballero Dolz	Docks Logistics Spain
Josep Sanz Argent	Fundación Valenciaport
Marina Arroyo Bovea	Fundación Valenciaport
Víctor Cloquell	Universidad Politécnica de Valencia
Federico Torres Monfort	Autoridad Portuaria de Valencia
Raúl Cascajo Jiménez	Autoridad Portuaria de Valencia

### Speakers

Role/Title	Organization	Notes
Director of Ecological Transition	Port Authority of Valencia	Introduced the event
Head of the Climate Change Policy Coordination Service	Regional Government	“Climate change and ecological transition Law of the Valencian Region”
Specialist	Certification Company	Explained certification options for decarbonization
University Professor	Universidad Politécnica de Valencia	Lecture on calculating the carbon footprint
Project Manager	Fundación Valenciaport	Introduced the SEANERGY project and the workshop

Afterwards, the rest of the stakeholders were divided into three groups that would each rotate in the different roundtable discussions “economic/legal, social, technologies” to assess the barriers and solutions perceived by them in terms of achieving the energy transition and decarbonization of the Port of Valencia. Each roundtable was moderated by a member of Fundación Valenciaport, who had a list of about ten questions focusing on energy transition and port decarbonization.

### Key outcomes

The Demo-Port Workshop 1, part of the SEANERGY research project, yielded productive discussions and valuable insights from various stakeholders. The workshop included discussions on financial/legal aspects, social impacts, and technological advancements in decarbonization. These discussions were moderated by Fundación Valenciaport members. The feedback and solutions discussed during these sessions would contribute to shaping the port's



approach to decarbonization, aligning with the broader goals of the SEANERGY project. Here is a summary of the key findings and recommendations from the workshop:

### **Financial/Legal**

- Public authorities should provide assessment services on decarbonization technologies, particularly for smaller companies unfamiliar with these technologies.
- Greater dissemination of information regarding labels and certifications reflecting decarbonization efforts is needed.
- Technical guidelines and continuous training on new technologies and regulations were suggested.
- Tax reductions, extended concessions, and a proactive administrative approach towards infrastructure adaptation for the energy transition were recommended.
- Support for renewing older equipment and adopting electric vehicles and chargers was highlighted.
- Addressing legal challenges in adopting new technologies, like grant processing and legalizing new technologies, requires external support.

### **Social**

- Decarbonisation and energy transition are generally considered in decision-making processes within companies.
- Barriers like economic and technological limitations, legislation, and subsidy issues were identified.
- Collaboration with other port companies, certification requests, and internal and external communication strategies are in place.
- The need for more involvement of universities and research centres in port industry challenges was emphasized.
- Training in multidisciplinary fields combining engineering and law is necessary to facilitate the energy transition.

### **Technologies**





- The current state of technology is seen as insufficient to achieve zero emissions, with economic barriers and the need for more alternative fuels has been noted.
- Electrification and hydrogen were identified as promising emission-free technologies, and biogas as a low-emission technology.
- Economic feasibility, accessibility, security, and minimal impact on operations are key considerations when adopting new technologies.
- Challenges like accessibility, safety issues, and the need for a clearer legislative/technical framework were highlighted.
- Encouraging collaboration between companies and technology providers is vital, as is the need for more information and awareness about low/zero emission technologies.

The workshop successfully fostered productive discussions and generated interest in the SEANERGY project. Attendees expressed a desire to follow up on the project's results and found the discussions relevant and informative. These findings and recommendations reflect a comprehensive understanding of the challenges and opportunities in the energy transition and decarbonization within the port industry, with a focus on the Port of Valencia. The insights gathered are crucial for developing effective strategies and policies to facilitate a sustainable transition in the port sector.

### 3.2. Demo-Port Workshop 2 By EHOÖ

The demo-Port Workshop Ennshafen, held on 20th September 2023 at Ennshafen Port, was organized by Ennshafen OÖ GmbH. It involved key stakeholders from the Danube Region, including Ennshafen Port's management, Viadonau, DDSG, and Circle Group. The workshop was built upon the Port Development Plan (PDP) Ennshafen from the EU project DIONYSUS, focusing on greening the port and addressing potential bottlenecks. Interactive discussions included an overview of Ennshafen Port, the SEANERGY project, and various sustainable initiatives like renewable energy, green fuel production, waste management, and smart port operations. The workshop highlighted collaborative efforts for sustainable port development in the Danube Region.



### Objectives, scope, and stakeholder participation

The workshop's goals were to outline specific challenges and opportunities for implementing green port technologies and policies in the inland waterway region. This included addressing the region's unique characteristics and the different stages of development among Danube ports. The workshop mainly built upon the Port Development Plan (PDP) of Ennschafen, which had been discussed with stakeholders in previous bilateral meetings under the EU project DIONYSUS. The PDP has already incorporated various tasks related to greening the port. The SEANERGY workshop aimed to showcase the different approaches to greening ports in the Danube Region.

A wide range of stakeholders were involved, including port owners, local and national public authorities, infrastructure and service providers, SMEs, concessionaires, carriers, international organizations, researchers, technology developers, and energy providers. Their input was crucial in shaping the port's development plan, including energy topics.

Port stakeholders and Circle's lead partner discussed the diverse approaches to greening ports. Interactive discussions took place, allowing stakeholders to share insights and experiences.

*Table 10. Main (Roundtable) participants of the demo-port workshop by EHO0*

Name	Organization	Role/Title
Werner Auer	Ennschafen Port	General Manager
Christina Eckmayr	Ennschafen Port	Secretary
Karin Voglsam	Ennschafen Port	Project Manager
Klaus Dieplinger	viadonau	River Basin Management
Harald Beutl	viadonau	Property Development
Karl Kuhn	DDSG	General Manager
Alexio Picco	Circlegroup	General Manager of Circlegroup

Various stakeholder interviews were conducted, focusing on aspects like road rehabilitation, energy topics, railway development, CO2 neutrality strategies, and waste management.

### Key outcomes



Feedback components discussed gathered insights from stakeholders to identify potential improvements or challenges related to policy implementation. The workshop also focused on integrating sustainable energy generation and fuel sources into the port's value chain. This included discussions on renewable energy, green fuel production, waste management, circular economy, energy efficiency, smart port operations, and sustainable infrastructure. The workshop summarized the main findings and recommendations, providing insights on policy changes, potential barriers, and opportunities for innovation. It informed the SEANERGY Master Plan and future regulatory changes.

Ennshafen's plan addressed low-carbon initiatives, cargo and core infrastructure, digitalization, general topics, and basic infrastructure. Specific measures included large-scale photovoltaic (PV) deployment, LNG/CNG expansion, eFuels for vessels, shore power installations, and exploring potential future hydrogen developments.

The SEANERGY demo-port workshop at Ennshafen focused on the Port Development Plan (PDP), underscoring sustainable development initiatives like renewable energy, green fuel production, waste management, circular economy, energy efficiency, and smart operations. The PDP also incorporated carbon capture, collaboration with local industries, and green financing. Key discussions highlighted the unique challenges and diversity in the Danube Region's inland ports, emphasizing the need for tailored approaches due to different ports' varying economic statuses and developmental stages. Administrative and geographical challenges, like varying water levels and diverse riparian country memberships in the EU, were also noted as significant considerations for port development.

### 3.3 Demo-Port Workshop 3 By DAFNI

The SEANERGY demo-port workshop, focusing on the Syros-Hermoupolis port, was held online on 7 December 2023 and organized by DAFNI. It formed part of deliverable D2.2 of the SEANERGY project, aiming to develop guidelines, policies, and business models for sustainable energy generation and fuel sources in ports. The workshop's key elements and findings can be summarized as follows:



The workshop summary document contains information about various participants and their affiliations. Based on the content, here is a list of participants organized into a table format:

*Table 11. Key Participants of demo-port by DAFNI*

Name	Organization	Role/Title
Kostas Komninos	DAFNI Network	General Director
Ismini Moustafelou	DAFNI	Presenter
Petros Markopoulos	DAFNI	Presenter
Eirineos Zervos	Municipal Port Fund of Syros	Head of the Technical Department
Dimitrios Lyridis	National Technical University of Athens	Associate Professor, School of Naval Architecture and Marine Engineering
Charilaos Antonopoulos	Marnet S.A.	Partner & Coordinator of Technical Studies
Vasiliki Tsoukala	National Technical University of Athens	Professor, School of Civil Engineering

### **Objectives, scope, and stakeholder participation**

The workshop aimed to understand stakeholders' perspectives and gather feedback on implementing sustainable energy technologies. It was a platform to discuss green transportation challenges and opportunities at the Syros-Hermoupolis port.

The workshop involved various stakeholders, including DAFNI, the Municipal Port Fund of Syros, the National Technical University of Athens, and Marnet S.A. They discussed the current situation and future plans of the Syros-Hermoupolis port and its Master Plan, focusing on sustainability aspects like solar panels, bioclimatic design, and cold ironing infrastructure.

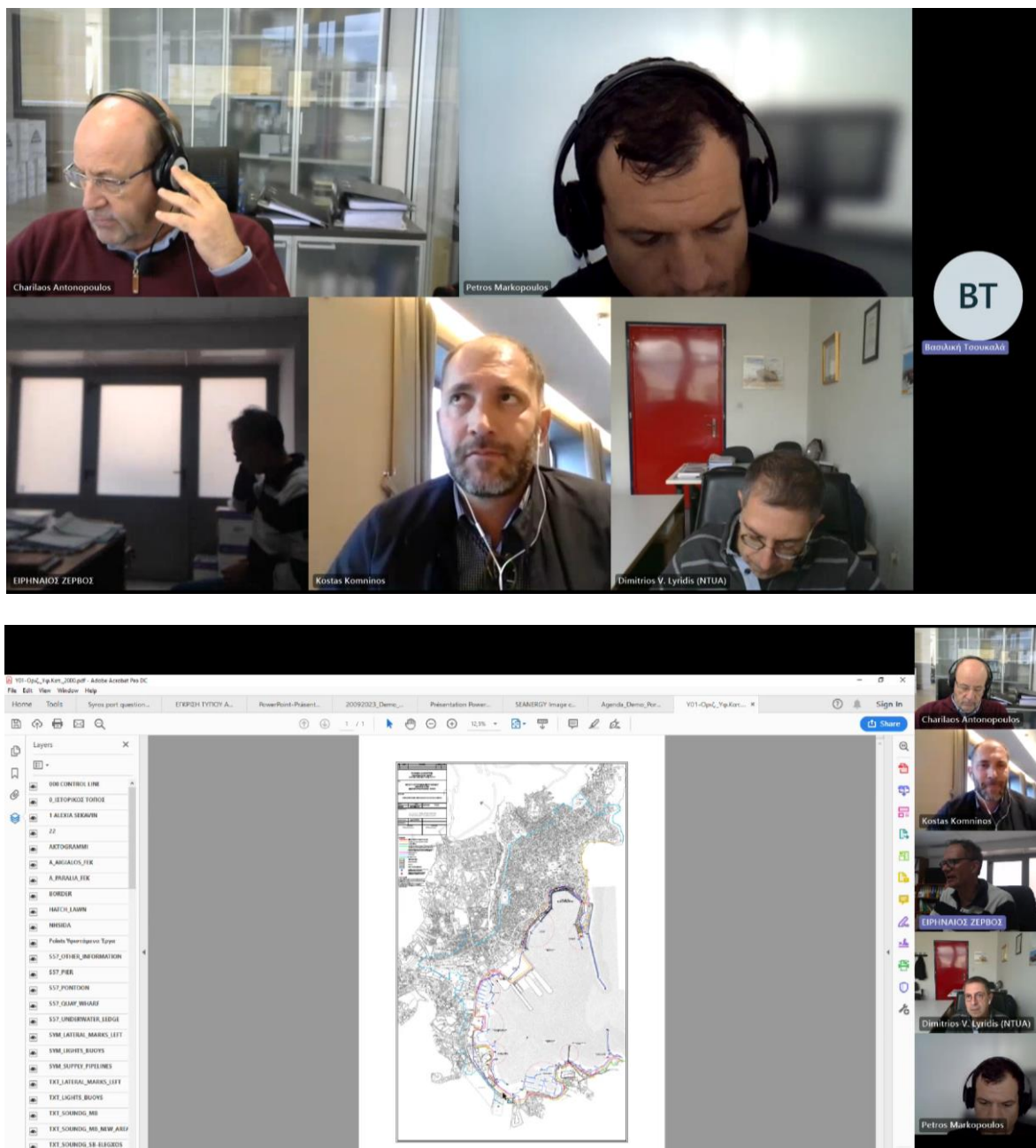


Figure 5. Demo-Port Workshop by DAFNI

## Discussions

This SEANERGY Demo Port Workshop, moderated by Kostas Komninos from DAFNI, focused on developing a SEANERGY Master Plan for the Syros port. The workshop featured presentations and discussions on the current situation and plans of Syros Port, emphasizing its multifunctional nature and the array of activities it hosts, such as cruise and passenger ships, shipyards, and cargo transport. Key points discussed included:





**Current Port Situation and Plans:** Eirineos Zervos from the Municipal Port Fund of Syros outlined the port's activities and existing Master Plan, including solar panel plans and plans focused on a bioclimatic approach.

**Challenges for Shore Side Electricity (SSE):** Dimitrios Lyridis from the National Technical University of Athens highlighted challenges in installing SSE infrastructure, such as limited network capacity, space constraints, and financial feasibility. The potential for cold ironing for cruise ships was discussed further, motivated by the fact that they have longer port stays.

**Incorporating Energy Innovations:** Vasiliki Tsoukala, also from the National Technical University of Athens, suggested including energy innovations like Wave Energy Converters (WECs), photovoltaics, and wind turbines in the port's Master Plan, along with feasibility studies needed to attract funding.

**Future Planning and Business Models:** The workshop emphasized the need for additional studies to be included in the ongoing development of the Master Plan. Discussions also touched upon different business models for renewable energy sources to meet the increased demand expected from cold ironing.

### Key outcomes

The workshop's refined and revised outcomes and key findings are as follows:

- 1. Infrastructure and Capacity Limitations:** The workshop identified critical limitations in network capacity and available space, which pose challenges to installing Shore Side Electricity (SSE) infrastructure at the Syros port. Emphasis was placed on incorporating SSE in the port's Master Plan to overcome these challenges.
- 2. Integration of Energy Innovations:** Discussions highlighted the potential of integrating innovative energy solutions like Wave Energy Converters (WECs), photovoltaics, and wind turbines into the port's infrastructure. These technologies are crucial for the port's sustainable energy transition.
- 3. SEANERGY Master Plan Implementation:** The workshop underscored the need to integrate interventions from the SEANERGY Master Plan (once it is ready) into the port's utilization Master Plan, marking a strategic move towards sustainable port development.



4. **Sustainable Energy and Mobility Strategies:** Solutions like virtual net metering were proposed for renewable energy generation. The Master Plan is set to include measures for clean energy generation, cold ironing infrastructure, and sustainable mobility within the port area.
5. **Exploring Alternative Business Models:** The necessity of exploring alternative business models was recognized, including the potential formation of an Energy Community with local and regional stakeholders. This approach aims to facilitate the port's transformation into a green and sustainable hub.
6. **Stakeholder Collaboration for Green Transformation:** The workshop highlighted the importance of innovative approaches and active stakeholder involvement in integrating sustainable energy solutions into port operations, emphasizing collaborative efforts for a successful green transformation.

The SEANERGY Demo Port Workshop at Syros-Hermoupolis port focused on overcoming infrastructure barriers, integrating innovative energy technologies, and fostering stakeholder collaboration to achieve a sustainable and green future for port operations.



## 4. Pan-EU Workshop

The Pan-EU Workshop, organized by WMU on 31<sup>st</sup> August 2023, brought stakeholders from across Europe to discuss broader, continent-wide strategies for sustainable maritime and port development. This workshop aimed to synergize the regional and demo-port insights, creating a cohesive Pan-European perspective on maritime (and port) sustainability. It highlighted the importance of collaborative efforts across regions and sectors, emphasizing the need for unified strategies that cater to diverse regional needs while aligning with EU-wide sustainability goals.

### Objectives and scope

This seminar aimed to bring together representatives from the IMO and the EU, with the central support of the EU Horizon Europe funded project SeaEnergy (Sustainability EducationAI programme for greenNER fuels and enerGY on ports). During the first day, relevant stakeholders shared their perspectives on the role of green technologies and global cooperation towards maritime decarbonisation. Highlighting essential topics such as current progress, challenges, best practices, capacity building, life cycle assessment and cost-benefit analysis.

### Stakeholder participation

The audience and the stakeholders that participated in the workshop were mainly divided into the following groups:

*Table 12. Onsite participation in Pan-EU workshop*

Stakeholder participation ONSITE	Number
Port managing body and Terminal operators	4
Regulators	1
International organisations and trade associations	8
Technology Developers and Manufacturers	3
Research and Education	38
Energy providers, energy transition facilitators and third parties (Designers, Architects, Contractors, Construction workers, port project managers, consultants, and other service providers)	4
Total	58



The World Maritime University received 58 people on site, of which 11 stakeholders actively participated by making presentations focused on strategies for decarbonising the maritime industry.

*Table 13. List of onsite participation for Pan-EU workshop*

Stakeholder participation
European Commission
Fonden Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping
International Maritime Organization (IMO)
RINA Consulting
Wärtsilä
Lloyd's Register
University of Genoa
World Maritime University
MTCC Africa
MTCC Latin America
MTCC Caribbean



*Figure 6. Pan-EU Workshop at the WMU*



## **Key findings and recommendations**

The climate crisis is an urgent global challenge that demands immediate and substantial reductions in greenhouse gas emissions across all industrial sectors around the globe. One critical aspect often overlooked is the environmental cost associated with the continued use of fossil fuels. These emissions not only contribute to global warming but also lead to air and water pollution, habitat destruction, and adverse health effects. Acknowledging the environmental impact of fossil fuels is imperative to instigate transformation. Achieving the necessary decarbonization of the global maritime sector by 2050 is an ambitious endeavour requiring a profound systemic shift encompassing every aspect of the value chain. This transformation encompasses developing greener propulsion technologies and revolutionizing vessel design, operational practices, and the fuels used.

Amid the quest for sustainability, a contentious debate has emerged regarding allocating costs associated with the transition to green shipping. Stakeholders address who should bear the financial burden of adopting cleaner technologies and fuels, be it shipowners, governments, or the broader private sector. Simultaneously, breaking down the barriers to upstream production of alternative fuels becomes of paramount importance, fostering innovation and scalability to make these fuels more accessible and affordable. Furthermore, ports stand at the epicentre of the energy transition, serving as pivotal hubs where renewable energy infrastructure, notably offshore wind, can thrive. This offers a unique opportunity for ports to evolve into multifaceted energy hubs, hosting manufacturing, staging, operations, and maintenance facilities, propelling the maritime industry and global efforts towards a sustainable energy future.

## **Results**

The aims that have been adopted allowed for the gathering of pertinent information regarding the ongoing activities within the region concerning the energy transition in ports. It also enabled us to identify and delineate the existing barriers and recommendations, thereby facilitating a comprehensive understanding of the intricate nature of this issue and providing valuable insights into potential improvements.





### Ongoing activities

Numerous institutions are engaged in various initiatives to advance the port energy transition. These initiatives encompass the development of comprehensive playbooks and guides tailored to the industry's needs. Additionally, rigorous analyses are being conducted to scrutinize life cycle assessment (LCA) models and explore the viability of different fuel types. A prominent feature of these activities involves the establishment of "green corridors" to facilitate more sustainable transportation within and around ports.

Some actions have been structured around five key areas of focus, encompassing policy and regulation, the enhancement of energy efficiency, advances in energy and fuel technologies, influencing customer behaviour, and engaging the finance sector. Recognizing the need for innovative and encompassing solutions, there is an emphasis on creating new business models, financial frameworks, and regulatory structures that align with the industry's ambitious goals. Within this context, boosting energy efficiency and promoting alternative fuels have emerged as potential solutions to drive the transition towards sustainability.

On a broader scale, the European Green Deal is shaping the vision to decarbonize the maritime sector. A pivotal component of this approach involves the incorporation of the EU Emission Trading System, an effective tool for imposing a price on carbon emissions. Furthermore, plans are underway to extend the application of this system to the maritime sector, which indicates a substantial step toward reducing greenhouse gas emissions.<sup>3</sup>

In terms of innovative propulsion systems, there is a growing interest in harnessing wind assistance to complement traditional engines. This includes using two four-stroke engines equipped with controllable pitch propellers and gate rudders to compensate for yaw when utilizing wind propulsion. Additionally, there is an exploration into the potential of fuel cells or hydrogen combustion engines and itinerary optimization within the cruise industry. Other notable development in this transition involves the potential shift from heavy diesel generators to the utilization of liquefied natural gas (LNG) and hydrogen for power generation. This move can substantially reduce emissions and environmental impact.

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<sup>3</sup> It can be reduced to zero through the use of hydrogen.



To support these transitions, a concerted effort is being made to develop software for environmental management, which provides real-time data on fuel consumption and potential greenhouse gas emissions savings. Moreover, gathering first-hand experiences from crew members aboard bulk carriers plays a crucial role in fine-tuning strategies and making recommendations to further advance the port energy transition. These collective activities signify the industry's commitment to reducing its carbon footprint and embracing more sustainable practices.

### **Barriers**

The transition to green shipping and port-related energy changes faces significant barriers regarding investments, infrastructure, and onboard technology. The cost disparity between traditional and alternative fuels, with the latter being more expensive, threatens to increase shipping prices by 10 to 30%, hindering widespread adoption. The hesitancy between ship owners and fuel producers exacerbates this issue, while outdated business models and contentious debates about cost allocation further complicate the transition. Additionally, challenges exist in unlocking upstream alternative fuel production due to financial commitments and reluctance to enter off-take agreements. Ports require substantial financial investments for repurposing infrastructure, especially for green ammonia production. Technological and demand development struggles persist, and managing ammonia combustion and toxicity remains complex. On the infrastructure front, load spatial planning and investments are required to accommodate energy needs, and decarbonizing shipping poses challenges. Onboard, questions persist about how non-green corridor vessels can access alternative fuels, the feasibility of using sails on container ships, and concerns about regulation adherence and wing sail maintenance. These barriers collectively emphasize the magnitude of the transformation the maritime industry needs to adopt sustainable and environmentally responsible practices. Table 14 and Table 15 summarise the main barriers and obstacles discussed during the workshop.



*Table 14. Barriers associated with infrastructure onboard.*

Barriers - Infrastructure (onboard)
<ul style="list-style-type: none"> <li>• There's a concern about how ships not on the green corridors can engage in the incentives and provision of fuels.</li> <li>• Concerns about the feasibility of using sails on container ships.</li> <li>• Concerns about visibility regulations with the use of sails.</li> <li>• Questions about the decommissioning and maintenance of the wing sails.</li> </ul>

*Table 15. Barriers associated with infrastructure onshore.*

Barriers - Infrastructure (onshore)
<ul style="list-style-type: none"> <li>• The changing infrastructure landscape in ports and the need for spatial planning.</li> <li>• Approximately two thirds of new infrastructure investment to accommodate alternative fuels will have to be made on land.</li> <li>• The challenge of reducing and decarbonizing shipping, including dealing with local emissions.</li> <li>• The challenge of storing and refueling hydrogen for long voyages.</li> <li>• Ammonia and hydrogen will require up to three and four times more space in a port respectively.</li> </ul>

*Table 16. Barriers associated with investments and costs.*

Barriers - Investments and costs
<ul style="list-style-type: none"> <li>• The cost of alternative fuels is expected to be two to five times more expensive than current fuels.</li> <li>• The transition to green shipping could result in 10 to 30% higher shipping prices.</li> <li>• High investment levels, and the chicken and egg cycle between ship owners and fuel producers, with each waiting for the other to make the first move.</li> <li>• The current business models in the shipping industry are outdated and do not benefit all stakeholders equally.</li> <li>• There's a debate about who will bear the cost of the transition to green shipping.</li> <li>• Unlocking barriers for upstream production of alternative fuels requires tremendous investments and there's a lack of willingness to take an off-take agreement.</li> <li>• Ports and terminals need to repurpose existing infrastructure to handle alternative fuels, which requires massive investments.</li> <li>• The high cost of green ammonia production.</li> <li>• The struggle between technology developers and demand developers.</li> <li>• The difficulty of managing ammonia combustion and the toxicity of ammonia.</li> <li>• The need for operational optimization and scalability of the power plant</li> </ul>

## General recommendations



The workshop was a platform for in-depth dialogues concerning the factors propelling and hindering port decarbonization. It also provided a space to explore potential avenues involving technology, business models, policies, and regulations. Within the sessions, participants emphasized the following primary areas of interest:

- Ensure the Innovation Fund deploys around 1.6 billion euros to accelerate the decarbonization of the maritime sector up to 2030.
- Create business models, new financial frameworks, and new regulatory frameworks that will support the industry's ambitions.
- An urgent need to put a cost on carbon to make alternative fuels competitive at a broader level.
- The industry needs to work closely with alternative fuel suppliers, implement energy efficiency projects, and introduce additional regulations within the next six to nine years.
- Importance of technology sharing and technical cooperation.
- Necessity to collect and verify information for the digital models.
- Relevance of technical knowledge transfer and the development of national action plans to address greenhouse gas emissions from the shipping industry.
- Benchmarking Greenhouse Gas Emission Reduction.



## 5. Preliminary Triple Layer Business Model Canvas

### 5.1. Development of Triple Layer Business Canvas Models as an Analytical Tool

This subchapter presents a comprehensive framework for sustainable port development, integrating key aspects like sustainable energy generation, economic viability, environmental sustainability, and operational efficiency in port settings.

The Triple Layer Business Canvas Model represents an innovative analytical tool designed to enhance the strategic planning and development processes within the context of sustainable port operations and energy generation. This section aims to delve into the specifics of its creation and the underlying methodology. The Triple Layer Business Canvas Models were conceptualized as a comprehensive framework to encapsulate the multifaceted nature of sustainable port development. This involved integrating key aspects of sustainable energy generation and port operations. The tool's design reflects the complex interplay between economic viability, environmental sustainability, and operational efficiency in port settings (Joyce, Paquin, & Pigneur, 2015).



Figure 7. Triple Layer Business Canvas Models





The development of this tool followed a systematic approach, starting with identifying the critical components that influence sustainable port operations.

The methodology of the Triple Layer Business Canvas Model includes integrating diverse aspects of sustainable port operations, such as energy generation, economic viability, environmental impact, and socio-economic context. It involves a thorough stakeholder analysis encompassing port authorities, shipping companies, and local communities. The models emphasize sustainability, assessing sustainable energy sources and their port integration alongside economic viability and business strategies. They are customized for port-specific needs and align with existing port plans and maritime policies. The development process is iterative, incorporating feedback for continuous refinement. The application of these models aids ports in transitioning towards sustainability by analyzing current operations, developing integrated plans, and exploring innovative business models for sustainable technology and infrastructure investments. This approach guides ports in making informed decisions towards sustainable practices (De Martino, 2021).

## 5.2. Application to Demo-Ports

This subchapter explains and shows the practical application of the models in three different demo-ports (Valencia, Ennshafen, and Syros-Hermoupolis), each with its unique context. In THIS Subchapter, the focus is on the development of an analytic tool as part of the Triple Layer Business Canvas Models. This tool systematically evaluates and integrates various aspects of sustainable maritime and port development. The analytic tool aids in identifying key drivers, challenges, and potential solutions, facilitating a structured approach to developing sustainable business models and strategies for port communities.

### **Demo-Port 1: Valencia**

The first demo-port, Valencia, provided a rich context for applying the Triple Layer Business Model Canvas. The model was instrumental in understanding the port's unique economic and financial landscapes. Key insights from the Valencia demo-port workshop included:

- **Financial/Legal Insights:** The workshop identified the need for public authorities to provide assessment services on decarbonisation technologies, particularly for smaller



companies. Emphasis was placed on disseminating information regarding labels and certifications reflecting decarbonization efforts and supporting renewing outdated equipment and adopting electric vehicles.

- **Social Considerations:** Integrating decarbonization and energy transition into decision-making processes underscores a commitment to sustainable development, but it faces challenges such as economic feasibility for smaller entities and a technological gap in available solutions. For example, investments in greener infrastructure may require significant capital that smaller companies may not have. Additionally, the social acceptance of new technologies can be hindered by a lack of understanding or direct benefits seen by the local communities.
- **Technological Innovations:** While current technology may fall short of achieving zero emissions, there are promising developments that could bridge this gap. Electrification, through the use of electric vehicles and port equipment, is a viable path, but it requires substantial initial investments and infrastructure upgrades. Hydrogen fuel cells offer another path, potentially providing a high-energy, low-emission alternative for heavy machinery and ships. Yet, the technology is in its nascent stage and needs more research and development. Similarly, biogas produced from organic waste can be a sustainable fuel source, but it requires efficient waste collection and processing systems, which may not be present in all ports.

This detailed examination helped understand the port's economic and financial landscapes and identify potential areas for sustainable growth.

### **Demo-Port 2 : Ennshafen**

The Ennshafen demo-port's application of the Business Canvas Model showcased its adaptability to different port contexts. Key elements from the workshop included:

- **Challenges and Opportunities:** The workshop outlined specific challenges and opportunities for implementing green port technologies and policies, particularly in the inland waterway region.
- **Sustainable Initiatives:** The discussion centred around renewable energy, green fuel production, waste management, and smart port operations. The workshop highlighted



collaborative efforts for sustainable port development in the inland waterways, particularly in the Danube Region.

- **Strategic Planning:** The focus was on integrating sustainable energy generation and fuel sources into the port's value chain, including renewable energy and green fuel production.

### **Demo-Port 3: Syros-Hermoupolis**

The application of the model at Syros-Hermoupolis port focused on:

- **Sustainability Focus:** Discussions on the port's multifunctional nature, with activities such as cruise and passenger ships, shipyards, and cargo transport. Key discussions included the current port situation, plans for solar panels, bioclimatic design<sup>4</sup>, and challenges in installing Shore-Side Electricity (SSE).
- **Energy Innovations and Business Models:** Integration of Wave Energy Converters (WECs), photovoltaics, and wind turbines into the port's Master Plan. The necessity of exploring alternative business models for renewable energy sources was emphasized.
- **Master Plan Integration:** The workshop highlighted the need to integrate interventions from the SEANERGY Master Plan into the port's utilization Master Plan, marking a strategic move towards sustainable port development.

The implementation of the Triple Layer Business Canvas Models for Valencia, Ennshafen, and Syros-Hermoupolis ports provided critical, practical insights into the nuanced approaches necessary for sustainable port development. These models effectively guided the strategic planning process, highlighting the importance of adaptability and innovation in addressing each port's unique challenges and opportunities. They facilitated a holistic integration of

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<sup>4</sup> Bioclimatic design refers to an architectural approach that takes into account the natural environment, climate, and local resources to create buildings that are environmentally friendly and energy efficient. This design philosophy aims to harmonize architectural design with natural elements like sun, wind, and temperature, to minimize energy consumption and reduce the building's environmental footprint. An example of bioclimatic design in a port setting could include the use of solar panels to harness solar energy, creating structures that maximize natural light and ventilation, or designing landscapes that naturally regulate temperature, like green roofs or water features. The goal is to integrate the port infrastructure seamlessly with the surrounding environment, reducing energy needs and promoting sustainability.



sustainability into the ports' business strategies, uncovering economic opportunities and informing decisions towards eco-efficient port management.

### 5.3. Identification of Economic and Financial Opportunities

This section compiles insights from applying the Business Canvas Models to demo-ports, focusing on identifying crucial economic and financial assets, growth prospects, and investment opportunities for sustainable energy initiatives and port modernization. It emphasizes the importance of harnessing economic and financial resources for sustainable maritime and port development, stressing the need for strategic financial planning and investment in sustainable infrastructure and technologies.

Key findings from the demo-ports include:

- **Demo-Port 1:** Highlighted financial and legal opportunities, social impact considerations, and the potential of low/zero emission technologies like electrification, hydrogen, and biogas.
- **Demo-Port 2:** Focused on implementing green technologies and renewable energy, with an emphasis on the unique economic challenges and strategic planning needs in the Danube Region.
- **Demo-Port 3:** Addressed infrastructure and energy innovation challenges, including the integration of Wave Energy Converters (WECs), photovoltaics, and wind turbines, and the necessity for strategic planning and alternative business models.

The comparative analysis across these ports revealed:

- **Economic and Financial Assets:** Potential for renewable energy generation, technological advancements, and public-private partnerships.
- **Investment Opportunities:** Infrastructure upgrades, energy efficiency projects, renewable energy initiatives, green corridors, and smart port operations.
- **Challenges and Barriers:** Financial and legal barriers to new technologies, regulatory agility needs, and strategic planning for sustainable practices.



- **Recommendations for Future Development:** Enhancing stakeholder collaboration, integrating energy efficiency plans into Port Master Plans, and exploring innovative financial and business models (Ports Green Gateways to Europe, 2020).

Overall, the Triple Layer Business Canvas Models effectively identified key assets and opportunities, shaping strategies for sustainable development and guiding policy decisions and business model adaptations in port operations and sustainable energy initiatives. This section summarizes these models' effectiveness in providing actionable insights and identifying economic opportunities for sustainable port development.





## 6. Conclusion and Recommendations

The engagement of over 200 experts from a broad spectrum of sectors, including port industry, maritime, energy, transportation, academia, city governance, public authorities, infrastructure and service providers, SMEs, concessionaires, carriers, international organizations, technology developers, and researchers, has been crucial in these workshops. Representing a wide swath of European regions, their collective expertise and perspectives have been instrumental in addressing the unique challenges and opportunities that European ports encounter in their shift towards sustainable energy and fuel practices.

This mix of professionals, ranging from port administrators and terminal operators to regulators, trade associations, educators, and energy providers, has illuminated the complex nuances of this transition. Their discussions and insights not only underscore the multifaceted nature of the transition but also emphasize the need for a concerted, cross-sectoral effort to navigate the complexities involved. The collaboration and shared knowledge across these diverse sectors and regions are vital in steering port and maritime operations towards a more sustainable and environmentally responsible future.

The SEANERGY D2.2 document comprehensively highlights the multi-faceted approach required to advance sustainable maritime and port development. This includes the pivotal role of regional and demo-port workshops in gathering diverse stakeholder perspectives and understanding each port's unique challenges and opportunities.

A key element in this approach is the concept of innovation and collaboration, which is exemplified by the idea of "green corridors" between islands. Such corridors could serve as catalysts for adopting green technologies, showcasing tangible decarbonization benefits. This initiative highlights the potential for innovative solutions in reducing carbon emissions and promoting sustainable maritime practices.

Furthermore, the regional workshops, spanning from the Baltic-Atlantic-North to South-West and South-East European regions and also inland waterways, have underscored the



importance of regulatory agility, strategic planning, community engagement, and financial support for transitioning ports towards sustainable and energy-efficient operations.

In line with this, collaboration between ports, regulatory authorities, technology providers, and communities is emphasized as a crucial factor. This collaborative approach is key to accelerating the adoption of innovative solutions and enhancing public acceptance, thereby facilitating a smoother transition to sustainable maritime practices.

The Demo-Port workshops, conducted by entities like FV, EHO, and DAFNI, have been instrumental in offering practical insights into port decarbonization and energy transition. These workshops encourage the exchange of best practices and innovative solutions tailored to the unique needs of each port and contribute significantly to the overarching goals of the SEANERGY project.

Moreover, the Pan-EU Workshop, led by WMU, has successfully synthesized these regional and demo-port insights, crafting a cohesive Pan-European perspective on maritime sustainability. This further emphasizes the necessity of collaborative efforts across regions and sectors, highlighting unified strategies that cater to diverse regional needs while aligning with EU-wide sustainability goals.

In conclusion, the SEANERGY D2.2 document, through its regional and demo-port workshops, effectively lays down a roadmap for sustainable maritime and port development. It highlights the crucial need for an integrated approach to achieve sustainable maritime development, combining policy, business, technology, and community engagement. The insights and strategies derived from these workshops will be pivotal in guiding future policy decisions and fostering sustainable maritime and port operations practices.

**Key takeaways from this deliverable:**

- **Integration of Sustainable Practices:** The workshops have highlighted the importance of integrating sustainable energy practices into port operations. This includes the adoption of green technologies, renewable energy, and innovative business models tailored to the unique characteristics of each port.



- **Stakeholder Engagement and Collaboration:** A recurring theme throughout the project has been the critical role of stakeholder engagement and collaboration. The insights and feedback gathered from diverse stakeholders are instrumental in shaping strategic plans and policies for sustainable port development.
- **Economic and Financial Considerations:** The Triple Layer Business Canvas Models have proven to be effective tools for identifying economic and financial assets and opportunities. It facilitates strategic planning and investment in sustainable maritime infrastructure and technologies.
- **Challenges and Barriers:** The project has also identified various challenges and barriers to the transition towards sustainable port operations, including financial, legal, technological, and infrastructural hurdles. Addressing these challenges requires regulatory agility, innovative financing, and strategic planning.
- **Policy Recommendations and Future Directions:** The insights gathered from the project provide a solid foundation for future policy decisions and business model adaptations. The recommendations emphasise the need for enhanced stakeholder collaboration, integration of energy efficiency plans into port master plans and innovative financial and business model exploration.

In conclusion, the SEANERGY D2.2 project offers valuable contributions to the ongoing discourse on sustainable port development. This project's outcomes inform future policy decisions and business model adaptations and align with broader goals of environmental sustainability and economic viability in the maritime sector. The project sets a precedent for future initiatives aimed at transforming ports into sustainable, energy-efficient hubs, contributing significantly to global efforts in combating climate change and promoting sustainable development.



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