Horizon Europe Energy - HORIZON-CL5-2021-D3-02

EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA)

D.4.1: SEANERGY HANDBOOK

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Contact person	Beatrice Dauria (Project Coordinator) - dauria@circletouch.eu		
Project website	www.seanergyproject.eu		

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Document History			
Date	**Version**	**Name**	**Changes**
04/10/2024	First Draft	ATP	Intro, ToC, Structure, full body text, factsheets, conclusions
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11/10/2024 – 21/10/2024	Third Draft	Peer reviewers	Comments, remarks and changes added to enhance the final result
24/10/2024	Trial Test presentation	RINA/ATP	Feedback inclusion
31/10/2024	Final version	Coordinator	Final Submission

TABLE OF CONTENT

Executive Summary

The SEANERGY Handbook is a comprehensive training manual designed to equip stakeholders with the practical tools and knowledge needed to implement the recommendations outlined in the Master Plan (MP) for energy transition in ports. This digital user-friendly handbook also features interactive worksheets that allow users to customize strategies tailored to their specific port's needs. By using this resource, port users can navigate the MP more effectively and take concrete steps towards achieving their energy transition goals.

4.1.1 INTRODUCTION

The SEANERGY Handbook serves as a valuable resource for stakeholders seeking to implement sustainable energy transition strategies in their ports. By combining practical worksheets with the knowledge gained from the SEANERGY Master Plan (MP) and Academic Course Modules, this deliverable shall be used by ports users to customize their energy transition strategy and align it with the MP's recommendations in accordance with EU regulations.

Additionally, the SEANERGY Handbook is designed to be a user-friendly tool that guides users through the process of developing and implementing sustainable energy transition strategies. The handbook comprises several templates each covering a specific aspect of port energy transition such as energy management in ports, how to apply hydrogen in ports and supply chain with risk and mitigation strategies, new technologies, becoming an energy hub, complying with key policies and regulations, ESG analysis, port continuous improvement, financing and how to adapt the SEANERGY MP to the local strategy development.

By using the SEANERGY Handbook, ports can:

- Improve their understanding of energy transition,
- Develop customized strategies to complete their energy transition processes,
- Access valuable resources and tools,
- Align with the Master Plan and the EU Green Deal,
- Quantify the impact of their actions towards green transition,
- Achieve long-term sustainability goals.

Furthermore, it is important to underscore the methodology used for developing the SEANERGY HB is built on a foundation of collaboration and expertise sharing. The approach is outlined as follows:

1. **Integration of preliminary outcomes from WP3**.

   With the extensive MP review, several modules were developed to leverage insights from the SEANERGY MP ensuring a solid academic and industry programme. This includes real-port scenarios in the SEANERGY Challenge to understand the unique challenges and opportunities that European ports are facing. Such regional challenge

has been designed to encourage active participation, dialogue, and exchange of ideas among young professionals and port stakeholders.

This interactive format is combined with the SEANERGY HB templates, which are an aid for ports to report, monitor and evaluate their own local energy-transition plans' objectives and strategies

2. **Extensive literature review and expert engagement**.
   An extensive literature review was conducted alongside engagements with SEANERGY partners whose expertise provide rich and interesting insights that inspired the personalization and design of each template. This dual approach enables the SEANERGY HB to cover a wide range of perspectives and templates. It is worth highlighting that, in order to simplify the MP and provide the manual (4.1.3) and the video, collaborative inputs by all partners and research were carried out.
3. **Feedback integration from SEANERGY partners**.
   The consortium's review and analysis are critical to ensure the deliverable's quality and refine the information so that it is relevant, actionable, and aligned with both stakeholders' and ports' needs and expectations. Furthermore, both the HB and MP will undergo verification and validation across train-end user events and other port validation workshops, across Europe. So, an updated version of this Deliverable with minor modifications will be included in D4.3.

For all these reasons, the SEANERGY HB is a relevant and adaptable tool reflecting the unique characteristics and catering to the evolving needs of European ports.

Purpose of the document

The purpose of the SEAENERGY Handbook is to provide comprehensive digital resource designed to ports towards developing their own green transition roadmaps by implementing suitable sustainable solutions derived from the SEANERGY MP. Likewise, the HB offers an overview of the SEAENERGY project phases and the current state of art of the achieved landmarks. Additionally, the handbook comprises customizable worksheets, designed to meet individual port specific needs.

Beyond its educational role and practical value, the SEANERGY HB is a strategic asset. In fact, it empowers ports and stakeholders to take effective action to the adaptation of sustainable energy technologies in their own green transition efforts and to become significant energy hubs locally, regionally and across the EU.

Ultimately, the SEANERGY Handbook achieves two primary objectives. First, it simplifies the Master Plan through an instructional manual and video, making it more accessible to stakeholders. Second, by distributing the handbook to end users and ports, it promotes a sense of community within the value chain and encourages wider adoption of the Master Plan and handbook practices in a broader range of ports and stakeholders.

Structure of the document

The SEANERGY Handbook is composed of five interrelated sections that smoothly guide end-users, ports, and stakeholders towards understanding the practical actions they can undertake for their energy transition strategies.

The handbook begins with the introduction (4.1.1) that outlines its purpose, structure, target audience and defines each subsequent section.

The second section 4.1.2 *"Project Overview and Landmarks"* provides visual elements which summarize the SEANERGY Project phases and their value, as well as the achieved landmarks until the present date [M25 – October 2024].

Section 4.1.3 *"How to Navigate the SEANERGY Masterplan"* offers guidance on using the MP in a simple way to implement and adapt it to each ports' energy strategy, enabling them to find relevant information more easily. This section is complemented by a video called MP Instructional map, which is displayed on the SEANERGY website: www.seanergyproject.eu

Section 4.1.4 is a valuable resource and toolkit for ports, as it offers personalized and customizable templates for Port Energy Transition strategies such as managing energy requirements in ports, how to finance green transition projects, a communication plan to engage with stakeholders and risk mitigation in hydrogen applications, among others. Such templates are an aid for ports to develop and upgrade green energy transition.

Lastly, this deliverable concludes with a summary (4.1.5) that highlights the most significant outcomes of the SEANERGY HB.

Relation to other project deliverables

Deliverable 4.1 SEANERGY Handbook is related to four key deliverables in WP3 (D3.1, D3.2, D3.4) and the two subsequent deliverables in WP4 (D4.2. and D4.3) as hereby explained.

The SEANERGY MP (D3.1) developed a series of content and explained the steps to start, implement, monitor and assess green energy transitions in ports. Said document was then adapted to the SEANERGY Website (3.2) to make it more accessible for port and stakeholders. However, as the MP is comprehensive, thorough and quite technical, the SEANERGY HB has developed both a video and a manual (4.1.3) to highlight what can be found on each step of the MP so that ports and stakeholders can access the information straightforwardly and in an easy way. The manual includes website captures to make navigation more effective.

Furthermore, deliverable 3.4 the Booklet of MP Academic Programme (Course and Challenge) are a series of training modules (with their corresponding syllabus, knowledge manuals, and videos) that help current and future port professionals and stakeholders to understand energy requirements, key tools and methods, legislation, innovative technologies, to assess port performance and to adapt to techniques specific port environments and turning your port as an integrated hub. At the same time, a regional challenge is proposed with a real-life case scenario so that anyone taking the MOOC in the platform can test the learnt knowledge into hands-on applications. It is the fresh ludic initiative to hear the voices of skilled young professionals in the sector and how they envision transition in the chosen regional ports. To complete this theoretical and practical knowledge, SEANERGY HB has developed templates (4.1.4) to analyze any given port's current situation and to help them standardize reports, communicate results, address financial challenges while ensuring continuous improvement.

As a result, The HB helps ports to analyze where they stand in energy transition, to keep record of changes to be implemented within the port environment, which at the same time will provide a "feedback loop system" to enhance the Master Plan for future iterations (D.4.2) before the final version (D4.3) is released for the European Community at the end of the SEANERGY Project.

4.1.2 PROJECT OVERVIEW AND LANDMARKS

Figure 4.1.2.1 : Project Overview

This image outlines the four primary phases of the SEANERGY Project, highlighting key outcomes that demonstrate its significance. It also visualizes the integral role of stakeholder engagement throughout the project's implementation.

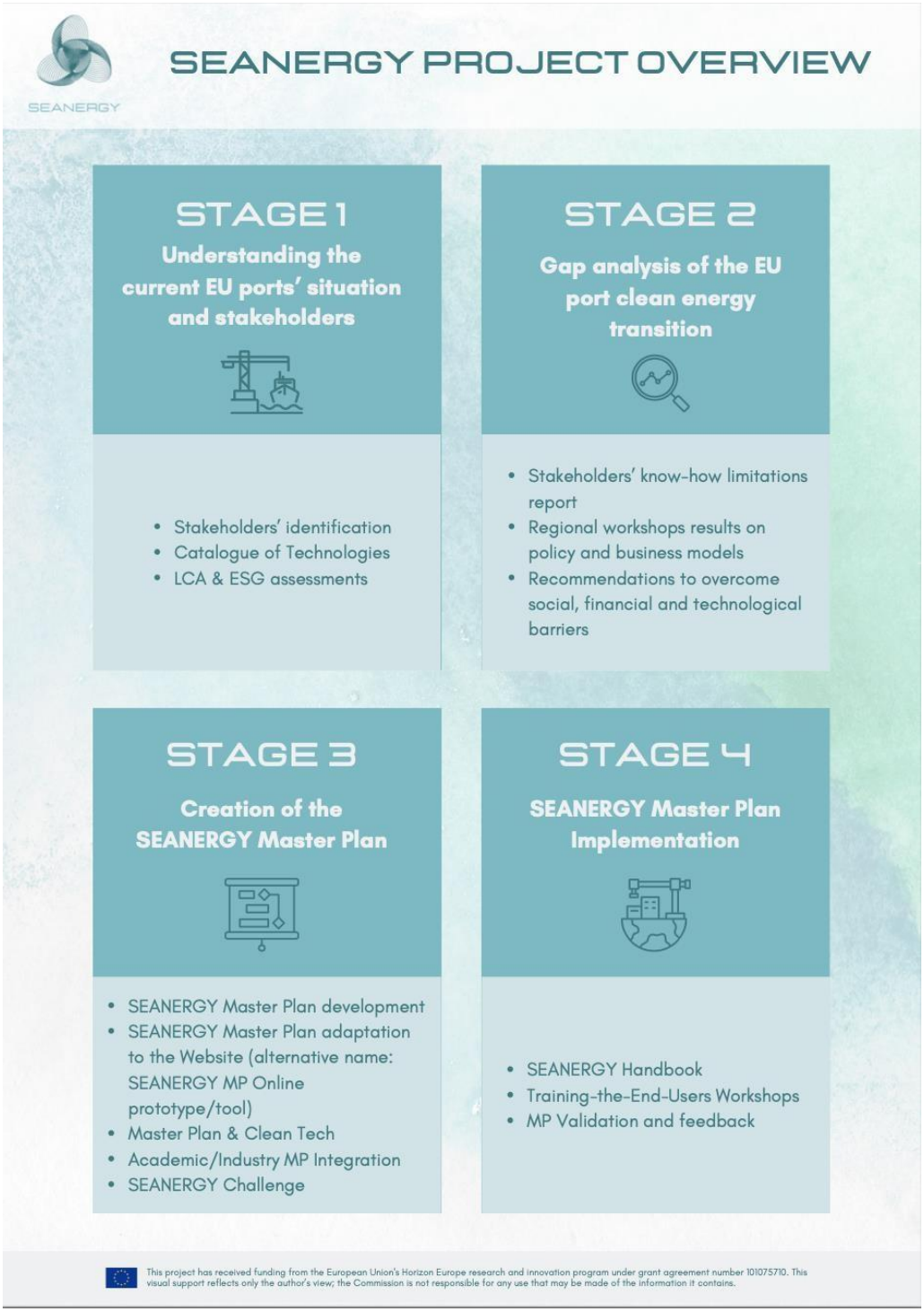


Figure 4.1.2.1 : Project Landmarks

This representation highlights the key milestones and achievements of the project. These landmarks serve as tangible evidence of our progress and of the positive impact SEANERGY has in the Maritime Sector in the EU.

4.1.3 HOW TO NAVIGATE THE SEANERGY MASTERPLAN

4.1.3.1 The Website

First of all, the SEANERGY Master Plan is an online tool that is available at the following link: https://seanergyproject.eu/master-plan/

Make sure you have a stable internet connection to ensure smooth access to the content.

Once the page loads, you will be greeted by the Masterplan homepage, which provides an overview of the project and its objectives.

You can select the preferred language between:

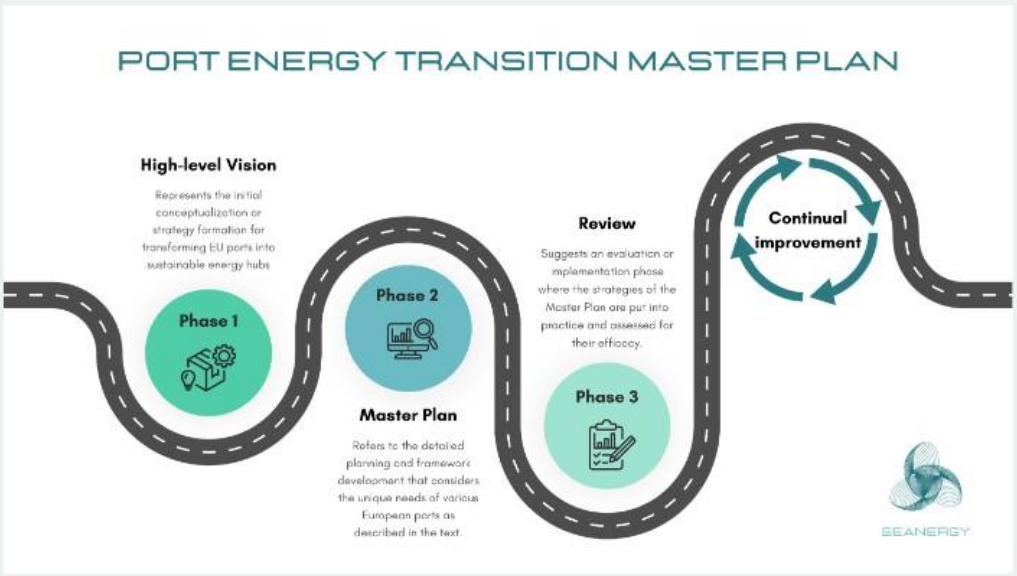
- ✓ English
- ✓ French
- ✓ Spanish
- ✓ German
- ✓ Italian
- ✓ Portuguese
- ✓ Dutch
- ✓ Greek
- ✓ Swedish

In addition to that, the main page of the SEANERGY Master Plan contains an introductive video-tool that explain the aim of the SEANERGY Project and the Masterplan Objectives.

The Figure below shows the main page of SEANERGY Master Plan Website.

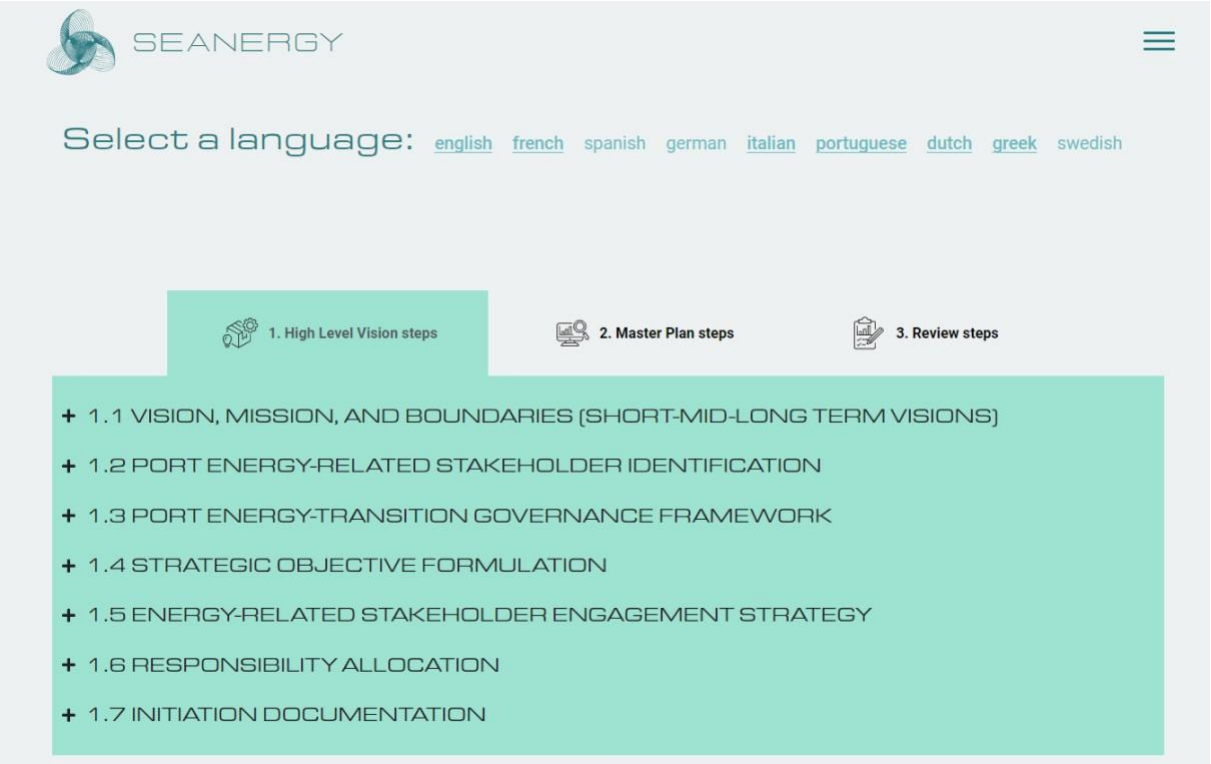
SEANERGY

MASTER PLAN



4.1.3.2 The Master Plan

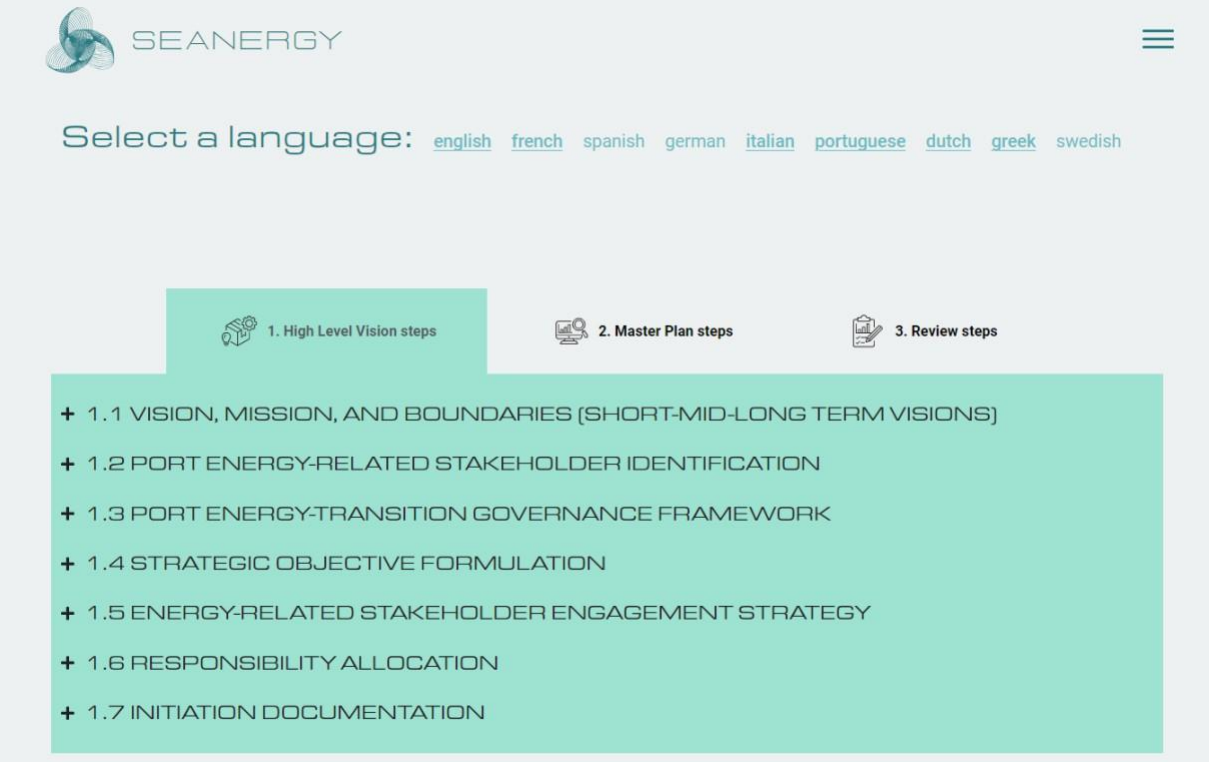
In the main page, below the video-tool, the users can find the Master Plan as shown in the figure below.



In order to have the access on the different contents of SEANERGY Master Plan the users can click on the various sections or modules of the Masterplan to access specific content. Each section may include descriptive texts, infographics, tables, and explanatory videos.

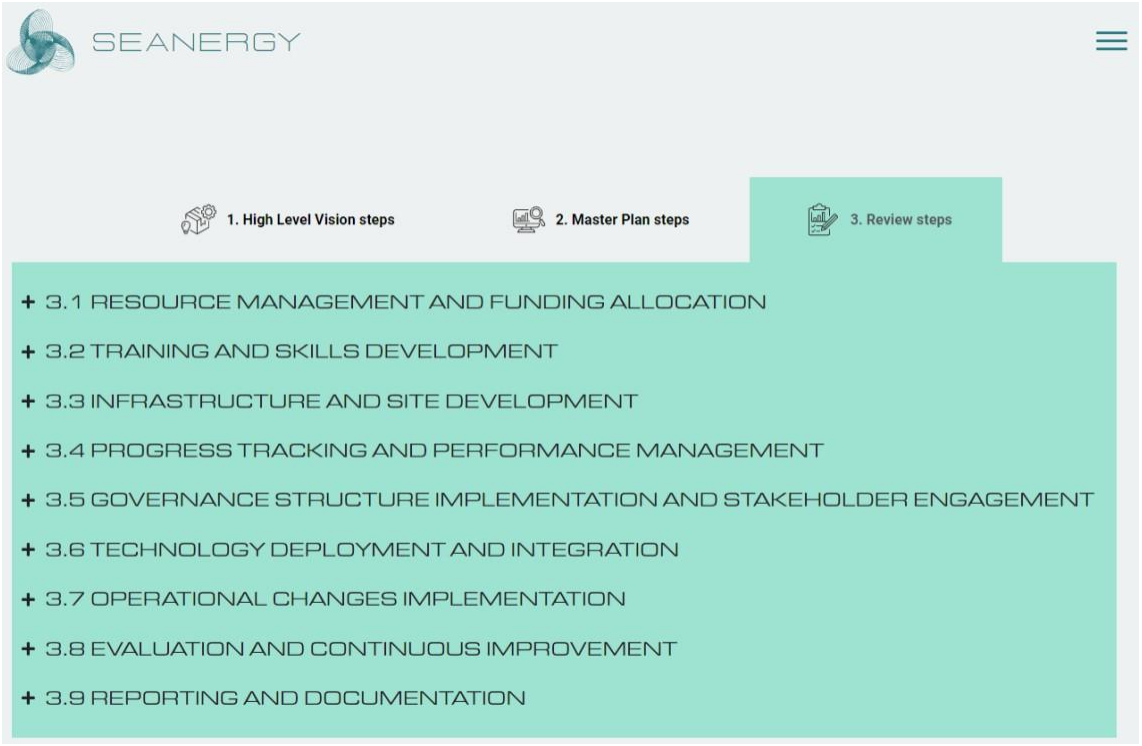
The Seanergy Masterplan on the website is divided **in three basic phases**:

1. **High-Level Vision steps**. This section establishes the strategic framework for the Port Energy Transition Master Plan. It sets out the vision, mission, objectives and identifies the key stakeholders in the port energy transition. This foundational phase is crucial for setting the direction and goals and framing various stakeholders' roles and responsibilities.



2. **Master Plan steps.** It serves as the Master Plan's core; this section articulates the detailed strategies and actions required for the transition to sustainable energy usage at ports. It includes comprehensive assessments of current operations, outlines necessary interventions, and sets targets for sustainable practices. The section also covers stakeholder coordination, financial planning, technology exploration, and methods for evaluation and standardization of practices. This part is designed to be both informative and actionable, providing a clear roadmap for implementation.

3. **Review steps.** The final section of the Master Plan focuses on evaluating the effectiveness of the implementation strategies. It discusses methods for adjusting the strategies based on feedback and highlights the importance of a continuous improvement cycle to refine the Master Plan. This section ensures that the Port Energy Transition Master Plan remains relevant and effective in achieving its objectives.



Each section is supplemented with methodologies, tools, and references derived from both the SEANERGY project outcomes and external sources, ensuring a comprehensive and evidence- based approach to the energy transition in ports.

The users by clicking on the different buttons of each phase can have all the information to carrying on the port green transition for their port.

Each subsection of the three step phases is composed by three components which provide detailed paths towards port green transition.

The components are :

- ***Step Details*** which helps the users to identify the mission, the governance and the most important stakeholders and instruments of every step of the greening process;
- ***Seanergy Tools and Guides*** *which* explains in a short way the Seanergy topic of the subcomponent and useful references from the Seanergy deliverables;
- ***External Tools and Guides*** which provides, rules and literature that can be useful as references for the users.

PHASE 1: HIGH LEVEL VISION STEP

To guide managers in the process of Port Energy Transition, the project has introduced an initial phase that explains the concept of port sustainability and the use of green energy. This phase focuses on laying the foundation by setting a clear and sustainable direction for ports, regardless of their location, size, or profile.

The phase provides detailed pathways for ports to transition to green energy through three sections: "Step Details," "SEANERGY Tools and Guides," and "External Tools and Guides."

The buttons to click in this first wide step are:

1.1 Vision, mission, and boundaries (short-and-mid-long-term visions)

- ✓ *Define a clear, sustainable vision for the ports, encompassing energy efficiency, use of renewables, and carbon neutrality.*
- ✓ *Craft a mission statement that embodies the transition to green energy and sustainable practices.*

1.2 **Port energy-related stakeholder identification**

- ✓ *Identify all shareholders and stakeholders, including port authorities, local government, investors, suppliers, and the community*
- ✓ *Analyze stakeholder needs and interests to ensure their concerns are addressed in the master plan*

1.3 Port energy-transition governance framework

- ✓ *Define the governance structure, including roles, responsibilities, and decision-making processes*
- ✓ *Set up a steering committee with representatives from key stakeholder groups to guide the project*
- ✓ *Set strategic objectives that align with the vision and mission*

1.4 Strategic objective formulation

- ✓ *Ensure objectives are specific, measurable, achievable, relevant, and time-bound (SMART)*

1.5 Energy-related stakeholder engagement strategy

- ✓ *Develop a stakeholder engagement plan, including communication strategies and feedback mechanisms*

- ✓ *Establish forums for stakeholder dialogue and participation.*

1.6 Responsibility allocation

- ✓ *Assign clear responsibilities to stakeholders for achieving the set objectives*
- ✓ *Establish accountability mechanisms to monitor the performance of all parties involved*

1.7 Initiation documentation

- ✓ *Document all initiation activities, decisions, and plans to maintain a clear record*
- ✓ *Ensure transparency and traceability of the initiation phase to support future audits and reviews*

PHASE 2: MASTER PLAN STEPS

The second phase of the green energy and sustainability transition in ports is the Operational Development Plan. This phase involves formulating detailed strategies to address the specific needs of the energy transition, including technology adoption, infrastructure adjustments, and operational changes.

Users can click on individual sections (buttons) in this second phase to access all the information needed for the development of the Master Plan. As with the other phases, each button provides a detailed pathway towards the green transition Master Plan, organized into three sections: "Step Details," "SEANERGY Tools and Guides," and "External Tools and Guides."

The buttons to click in the second step are:

2.1 Assessment of regulations and port energy-related policies

- ✓ *Review and analyze relevant environmental regulations, maritime laws, and energy policies that impact port operations and the transition to green energy;*
- ✓ *Ensure compliance and incorporate best practices from regional and global standards into planning;*
- ✓ *Establish a clear baseline using data from LCA and ESG assessments to understand current environmental impacts and energy use.*

2.2 Baseline identification on port energy consumptions and needs

- ✓ *Utilize the baseline to identify gaps and areas for improvement in port operations;*

2.3 Strategy formulation and target setting

- ✓ *Identify key interventions needed to achieve the Master Plan's goals, such as technology upgrades, infrastructural changes, and operational adjustments.*
- ✓ *Set quantifiable targets for energy efficiency, renewable energy integration, and emissions reduction.*

2.4 Methodological framework establishment

- ✓ *Define the methodology for planning, including using project management frameworks like PDCA (Plan-Do-Check-Act) to ensure continuous improvement*
- ✓ *Select appropriate technological options, considering feasibility, cost-effectiveness, and impact.*

2.5 Detailed plan development

- ✓ *Develop a comprehensive plan, including GANTT charts, milestones, and deliverables for each stage of the transition. Outline resources needed, including human, financial, and technological.*

2.6 Stakeholder alignment and collaboration

- ✓ *Involve stakeholders in the planning process through workshops and consultations to align objectives and gather insights.*
- ✓ *Coordinate with policy-makers, industry experts, and technology providers to ensure the plan's practicality and effectiveness.*

2.7 Capacity building and training programs

- ✓ *Plan for the development and delivery of training programs to equip stakeholders with the knowledge and skills needed for the transition.*

2.8 Financial planning

- ✓ *Develop a financial model to support the plan, identifying funding sources, investment needs, and cost-saving opportunities.*

2.9 Risk assessment and mitigation

- ✓ *Conduct a thorough risk assessment to identify potential challenges and uncertainties in the transition process. Develop strategies for risk mitigation and management.*

2.10 Technology and innovation exploration

- ✓ *Continuously explore and evaluate emerging technologies and innovations that can be integrated into the plan to enhance efficiency and sustainability.*

PHASE 3: REVIEW STEPS

The third and final phase of the project, as explained on the website, focuses on the review steps outlined in the Master Plan. This phase emphasizes the evaluation and implementation of strategies, ensuring they are effectively applied and continuously improved based on feedback and evolving needs.

By clicking on individual sections (buttons) in this phase, users can access a step-by-step methodology for reviewing and implementing green transition processes over the long term. Each button provides a detailed pathway towards a long-term strategy for becoming and remaining sustainably green ports. The content is organized into three sections: "Step Details," "SEANERGY Tools and Guides," and "External Tools and Guides." The buttons to click in this third step are:

3.1 Resource management and funding allocation

- ✓ *Ensure financial resources align with the SEANERGY project's goals. Implement financial controls and report mechanisms as outlined in WP3.*

3.2 Training and skills development

- ✓ *Follow through with the planned training modules and reskilling initiatives, incorporating the best practices from the project's knowledge-sharing platform*

3.3 Infrastructure and site development

- ✓ *Prepare and adapt port infrastructure in accordance with the technological and operational changes identified in the project deliverables*

3.4 Progress tracking and performance management

- ✓ *Develop a detailed monitoring plan to track the progress of implementation against the Master Plan's targets, incorporating feedback systems for continuous improvement*

3.5 Governance structure implementation and stakeholder engagement

- ✓ *Implement governance structures, ensuring all stakeholders are aware of their roles and that there is a clear decision-making process, as suggested by WP3 activities*

3.6 Technology deployment and integration

- ✓ *Proceed with the implementation of chosen technologies, ensuring they are in line with the recommendations from the stakeholders' know-how and the catalogue of technologies*

3.7 3.7 Operational changes implementation

- ✓ *Implement operational changes, monitoring their impact, and ensuring they contribute to the transition towards environmentally responsible behavior as outlined in the Grant Agreement*

3.8 Evaluation and continuous improvement

- ✓ *Regularly evaluate the implementation process, draw personalized recommendations from captured data, and use the feedback loop system for the Master Plan's enhancement*

3.9 Reporting and documentation

- ✓ *Document the implementation process comprehensively, as stipulated by WP3, ensuring transparency and accountability*

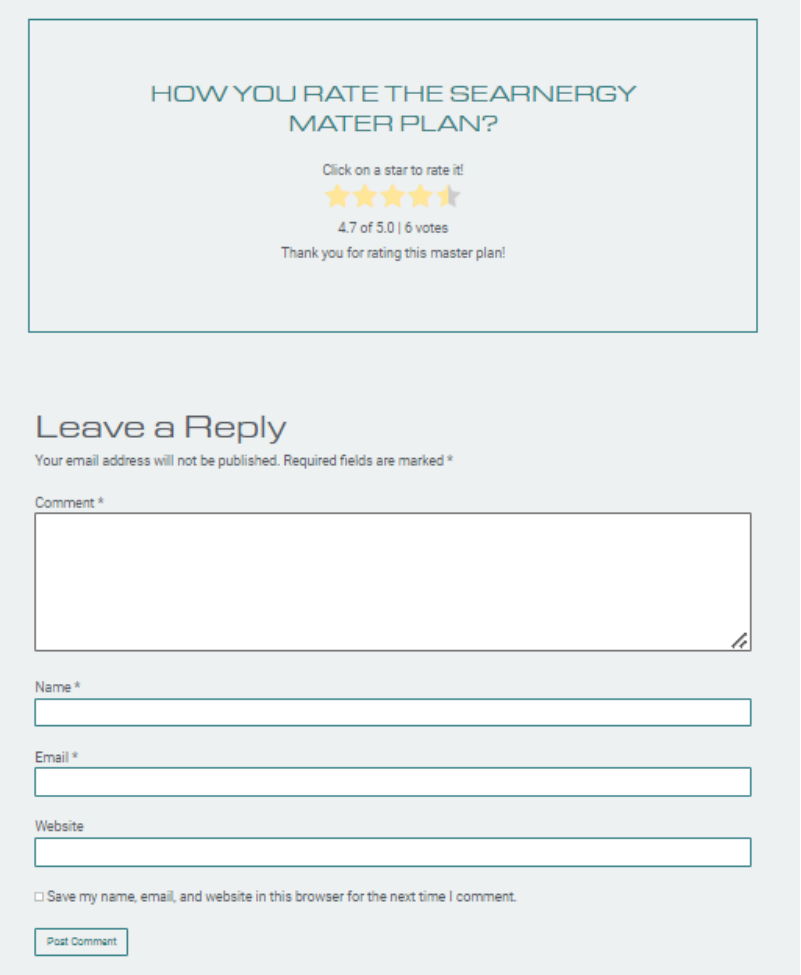
4.1.3.3 Others useful insights to surf on Master Plan Online Tool

INTERACTIVE MODULES

Some sections of SEANERGY Master Plan include interactive training modules. The users can surf on these sections in order to deepen their knowledge of the proposed technologies and sustainable practices.

FEEDBACK

The website offers a comment section in order to engage the users to provide recommendations, ideas and best practices for the Master Plan. In addition to that this section contributes to the continuous improvement of the Master Plan by providing feedback through the forms and contact options available on the site.



4.1.4 PRACTICAL CUSTOMISABLE TEMPLATES FOR PORT ENERGY TRANSITION STRATEGIES

Below is the list of factsheets included in Section 4.1.4, *Practical customizable templates for port energy transition strategies*, along with the names of the course coordinators, their respective organizations, and countries.

4.1.4.1 Energy Management in Ports

Course Coordinators:

Marina Arroyo (marroyo@fundacion.valenciaport.com)

Sandra Rosello (srosello@fundacion.valenciaport.com)

Roberta Montesano (roberta.montesano@rina.org)

Organizations and Countries:

Fundación Valenciaport (Spain)

RINA Consulting (Italy)

4.1.4.2.1 Holistic Review of Hydrogen in Ports and Supply Chain

Course Coordinator:

Dirk Fischer (d.fischer@argo-anleg.de)

Organization and Country:

Argo-Anleg GmbH (Germany)

4.1.4.2.2 Risks and Mitigation Strategies for Hydrogen Applications

Course Coordinator:

Dirk Fischer (d.fischer@argo-anleg.de)

Organization and Country:

Argo-Anleg GmbH (Germany)

4.1.4.3 Technologies and Techniques for Energy Transition in Ports

Course Coordinator:

Talha Isik (t.isik@argo-anleg.de)

Organization and Country:

Argo-Anleg GmbH (Germany)

4.1.4.4 Ports as Integrated Hubs for Energy Transition

Course Coordinators:

Anas Alamoush (asa@wmu.se)

Dimitra Chondrogianni (d.chondrogianni@dafninetwork.gr)

Organizations and Countries:

World Maritime University (Sweden)

DAFNI Network (Greece)

4.1.4.5 Key Policies, Regulations, and European Efforts Towards Energy and Fuel Efficiency in Ports

Course Coordinators:

Eldon R. Rene (e.raj@un-ihe.org)

Capucine Dupont (c.dupont@un-ihe.org)

Organization and Country:

IHE Delft (The Netherlands)

4.1.4.6 Local Master Plan Development

Course Coordinators:

Werner Auer (w.auer@ennshafen.at)

Ronny Lorch (rl@argo-anleg.de)

Organizations and Countries:

Ennshafen OÖ GmbH (Austria)

Argo-Anleg GmbH (Germany)

4.1.4.7 Tailoring the High-Level Master Plan to My Port

Course Coordinators:

Dimitra Chondrogianni (d.chondrogianni@dafninetwork.gr)

Petros Markopoulos (pmarkopoulos@dafninetwork.gr)

Organization and Country:

DAFNI (Greece)

4.1.4.8 Evaluating the Energy and Environmental Performance of Ports

Course Coordinators:

Roberta Montesano (roberta.montesano@rina.org)

Johann Ramirez (jramirez@zeroe-engineering.com)

Organizations and Countries:

Rina Consulting (Italy)

Zero-Emissions Engineering (Netherlands)

4.1.4.9 Continuous Improvement of Port Performance

Course Coordinators:

Fabio Ballini (fb@wmu.se)

Anas Alamoush (asa@wmu.se)

Monica Canepa (moc@wmu.se)

Dimitra Chondrogianni (d.chondrogianni@dafninetwork.gr)

Organizations and Countries:

World Maritime University (Sweden)

DAFNI Network (Greece)

4.1.4.10 Digital Communication Plan for the Promotion of Ports in Europe

Course Coordinators:

Elena Gascón (europa@atperson.com)

Esperanza Calleja (ecalleja@atperson.com)

Marina Arroyo (marroyo@fundacion.valenciaport.com)

Sandra Rosello (srosello@fundacion.valenciaport.com)

Organizations and Countries:

ATPERSON (Spain)

Fundación Valenciaport (Spain)

4.1.4.11 How to Finance the Clean Energy Transition of My Port

Course Coordinators:

Ronny Lorch (rl@argo-anleg.de) – main coordinator

Werner Auer (w.auer@ennshafen.at)

Organizations and Countries:

Argo-Anleg GmbH (Germany)

Ennshafen OÖ GmbH (Austria)

4.1.4.1 ENERGY MANAGEMENT IN PORTS

This factsheet provides port users with a valuable tool to assess and improve their energy management practices. By using the provided checklists, they may identify the current level of energy control within their ports, analyze the energy status of their facilities, and pinpoint potential areas for optimization. They can use it in section 2.2 of SEANERGY MP. This information enables ports to make informed decisions about energy efficiency initiatives, reduce operational costs, and contribute to a more sustainable maritime industry.

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

- Identify the level of energy control in ports;
- Analyze the energy status and detect possible improvements

2) Checklist of the energy control level in a port:

	Yes	No
An organized file is available to those responsible for energy management, containing contracts for all energy supplies and other related documents such as invoices, technical documentation, etc.		
The consumptions billed by the supplying companies are recorded in order to be able to carry out checks and optimisations		
An annual historical record of consumption of all energy supplies is kept up to date		
A monthly historical record of consumption of all energy supplies is kept up to date		
The historical records not only record total consumption and cost but also allow different concepts to be broken down such as consumption by period in the case of electricity or penalties for power or reactive power		
There are meters (electricity, thermal, fuel consumption) to control the consumption of dependent users (concessionaires)		
There are meters (electricity, thermal, fuel consumption) to discriminate the consumption of the different installations of the Port Authority		
In the event of not having meters, or in those points of the installation where the relevance of the consumption or its characteristics do not compensate for the cost of installing meters, estimates are made		
Network analysers are available at key points of the installation		
The meters/analysers are integrated into a network allowing data recording		
The meters/analysers are They are integrated into a network that not only allows data recording but also remote management, alarm configuration, report scheduling, etc.		

3) Checklist to analyze the energy status of port authority facilities and detect possibilities for improvement:

Envelopes		
	Yes	No
The facade walls and enclosures in contact with the ground comply with the thermal transmittance limits		
The roofs comply with the thermal transmittance limits		
The floors comply with the thermal transmittance limits		
The openings comply with the thermal transmittance limits		
The openings and skylights comply with the modified solar factor limits		

Interior lighting		
	Yes	No
The energy efficiency values of the installation comply with the limits		
The power of the lamp sets - auxiliary equipment comply with the limits		
There are control systems appropriate to each area		
The maintenance plans include lamp replacement operations with the replacement frequency		

External lighting		
	Yes	No
Ɛ and/or average illuminance of the facilities complies with the regulations		
Lamps comply with the regulations		
Luminaires comply with the regulations		
Drive systems comply with the regulations		
Regulation and control systems comply with the regulations		

Thermal generation systems		
	Yes	No
Thermal generation facilities meet the requirements		
Consumption control and accounting systems meet the requirements		
Operational tests have been carried out at least once		
An energy management programme is in place		

Fluid distribution and/or conditioning facilities		
	Yes	No
The fluid distribution and/or conditioning facilities comply with the requirements		
Operational tests have been carried out at least once		

Vertical or horizontal communication systems		
	Yes	No
There are variable speed drives in the motors of these devices		
High efficiency lighting is used or the lighting in the cabins is regulated according to presence		

Office automation and data centers		
	Yes	No
Energy consumption requirements are taken into account when purchasing this equipment		
Data centers are arranged in cold and hot aisles		
Data centers are cooled with systems that incorporate free cooling devices		
Heat recovery is carried out in the data centers for other systems		

Other		
	Yes	No
Energy consumption requirements are taken into account for the purchase of this equipment		
These devices are included in the inventories of consumer equipment and are taken into account for energy consumption assessments		

4.1.4.2.1 HOLISTIC REVIEW OF HYDROGEN IN PORTS AND SUPPLY CHAIN

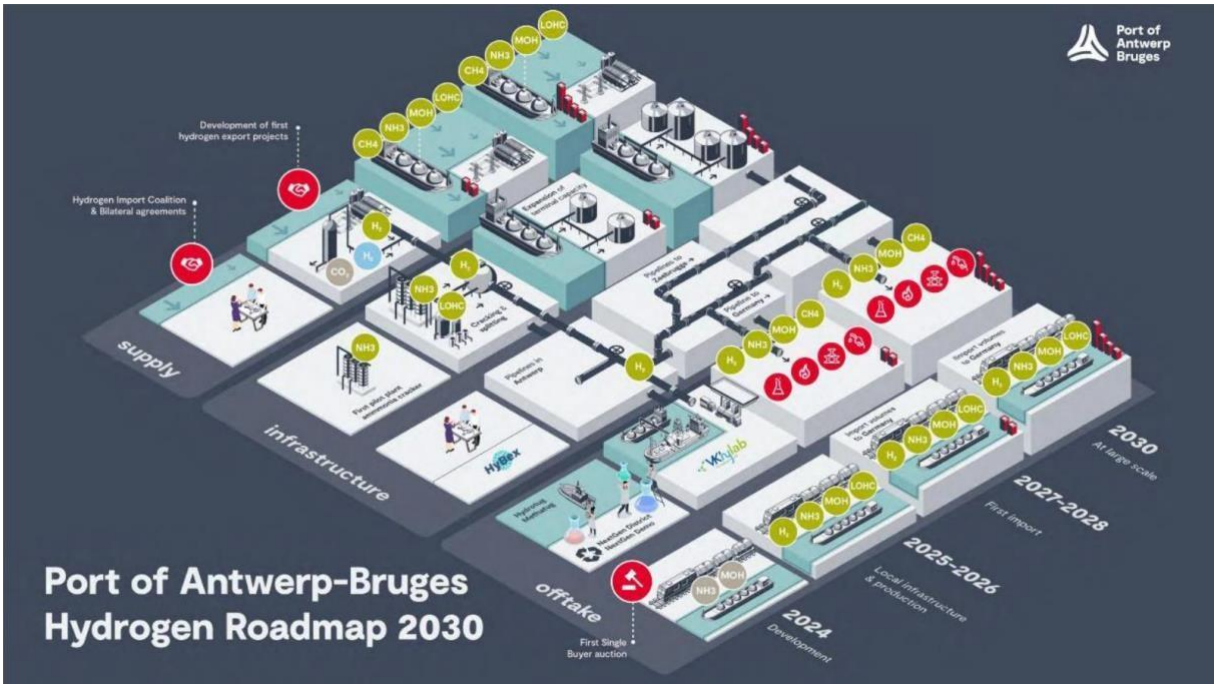
This factsheet empowers port users to explore hydrogen's potential, understanding its supply chain, identifying applications, assessing benefits in order to explore its production methods, as well as the challenges that navigating and its storage/transportation may bring. It also guides ports in integrating hydrogen with existing infrastructure for a sustainable future. This factsheet can be useful for section 2.10 of the SEANERGY MP.

Objectives of this factsheet

On completing/reading this factsheet the relevant port authorities will be able to:

Evaluate the hydrogen supply chain: Develop a deeper understanding of the hydrogen supply chain, including production, storage, and transportation logistics.

(Please review the chapter and follow the links below each picture for deeper understandings)



Source: *Patrick Van Cauwenberghe, Port of Antwerp-Bruges 2024*

Identify hydrogen application options:

Recognize and assess various options for integrating hydrogen applications within ports.

1) Understand benefits of hydrogen for the port and maritime sector
2) Identify and define own future potential
3) Understand different hydrogen production methods
4) Differentiate pros and cons of storage and transportation of hydrogen
5) Learn how integration with existing port and supply chain infrastructure can be successful by Stakeholders and all project participants (to-do sheet)

1. Understand benefits of hydrogen for the port and maritime sector

Please identify your own benefits in a working group by using a „brainstorming method" from the point of view of each individual stakeholder. Collect and summarize than follow the MASTERPLAN. This shall allow to understand, create and communicate your own benefits.

2. Identify and define own future potential

Same as item 1 but here from the commercial and economic point of view (keep or better create new jobs, reduce energy costs, make better environmental attraction to bring people to the ports (workers and families) etc. for example.

3. Understand different hydrogen production methods

Although green hydrogen is a popular trend nowadays, it is actually less than 5% are available yet, that is the reason why it is tough to convince investors to venture in this energy generation. It works the same as private thinking. Green hydrogen requires other technologies but combined with potentials this is possible. Understanding the different opportunities, you shall individually identify which technology or plural out of it are helpful for your port's needs. For example, on shore wind generates H2 on shore or offshore? It makes a difference if it is a shore port or inland port. Other example such technology needs more space! Knowing this aspects and conditions plus production methods and hardware, software employment etc. help to identify which method is best. or it may be your port do

not produce onsite and buy from the neighborhood nearby. The challenge is hat energy as of today won't come central from power stations in the future. The approach is a decentralization. But it is not necessary nor mandatory that each port generates its own green energy. Eventual it is not possible. But knowing the technology and Regulations etc. help.

Further references:

ISO/AWI 22734-1. hydrogen generators using water electrolysis – Industrial, commercial, and residential applications – Part 1: General requirements, test protocols, and safety requirements.

ISO/AWI TR 22734-2. Hydrogen generators using water electrolysis – Part 2: Testing guidance for performing electricity grid service.

Literature:

[1] ISO 22734:2019. Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications

[2] ISO/TR 15916:2015(E) – Basic considerations for the safety of hydrogen systems

[3] Hydrogen as an Energy Carrier. Technologies, Systems, Economy. Author: Carl- Jochen Winter, Joachim Nitsch (Eds.) ISBN-13: 978-3-642-64872-4

[4] HyResponse. Deliverable D2.1-Description of selected FCH systems and infrastructure, relevant safety features, and concepts (2014).

[5] HyResponse. Introduction to FCH applications and hydrogen safety. Compiled by S. Tretsiakova-McNally; reviewed by D. Makarov (Ulster University)

Source:

https://seshydrogen.com/en/h2-safety-2-electrolyzer/

Guideline "Building a hydrogen economy using the example of inland ports"

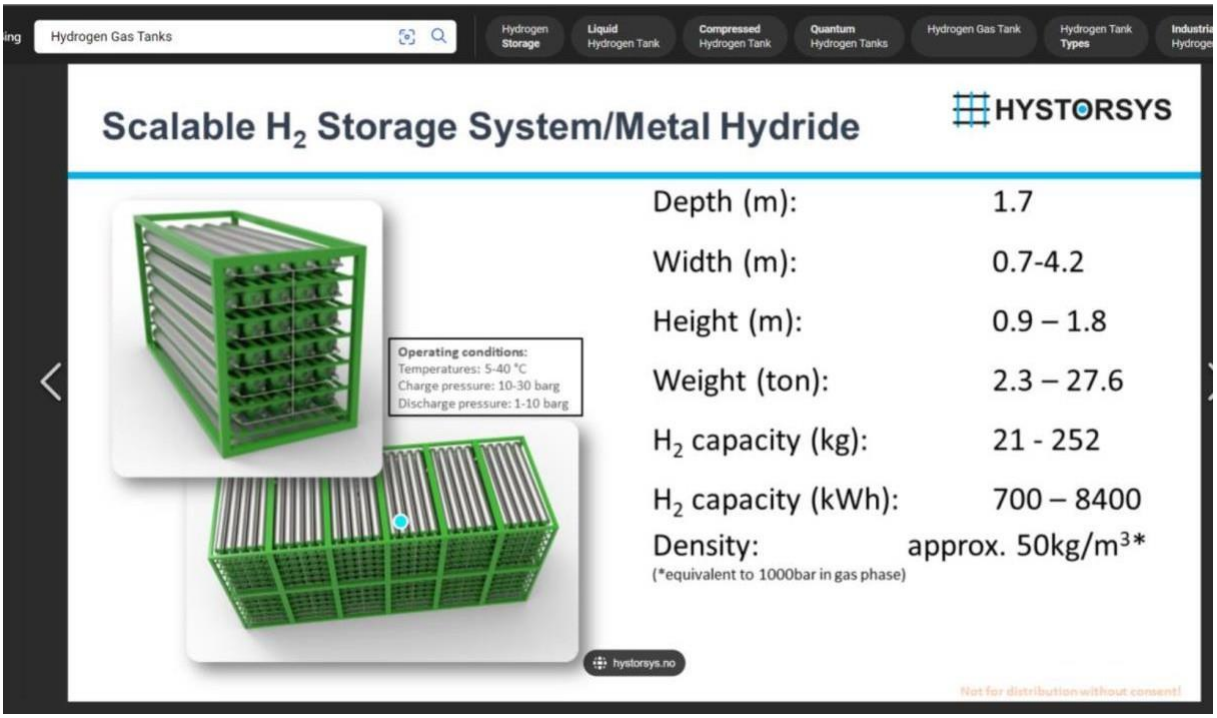
Source:

https://www.kodis.iao.fraunhofer.de/content/dam/iao/kodis/documents/Leitfaden_Aufbau-einer-Wasserstoffwirtschaft-am-Beispiel-von-Binnenhaefen.pdf

4. Differentiate pros and cons of storage and transportation of hydrogen

There are many major storage applications applicable for your port such as caverns for instance. Hereby is an overview of alternatives with serious verification whether these solutions are the best for the short, mid and long-terms. A suggestion is identifying in a matrix the preselected solutions in this document and follow the MASTERPLAN phase 2 to implement the follow-up of your decision correctly.

Example storage for a low-pressure storage vs. high pressure:



Source: *Hystorsys* Retrieved from: https://www.hystorsys.no/mh-storage/

5. **Learn how integration with existing port and supply chain infrastructure can be successful by Stakeholders and all project participants (to-do sheet).**

Identify the ecosystem

Key questions:

1) Which roles in the value chain can be filled in the immediate vicinity of the port?

2) Which players are of particular strategic importance for the port?

3) Are there companies in the immediate vicinity with increased energy requirements that could be possible H2 consumers?

4) Are there companies in the port with experience and capacities in the handling and storage of hazardous goods?

5) Which potential H2 sources and transport routes are generally possible? possible?

6) What are the strengths of the port's environment?

Building a network

Key questions:

1) How can a network be organized and who takes on the role of the “caretaker(s)”? of the “caretaker(s)”?

2) Which committed, well-known and/or well-invested actors can become “Driving forces” of the network?

3) What goals do the stakeholders have and how can these be incorporated into a joint rough concept?

4) Which supra-regional players could close gaps in value creation?

5) How can (funding) policy stakeholders be involved in the project?

6) What existing H2-related stakeholder networks and activities are there in the wider in the wider area that could be linked to activities in the port?

Planning the use cases

Key questions:

1) Which use cases offer the greatest added value?

2) How can the economic viability of the use cases be assessed?

3) Are there particularly suitable locations in the port environment for applications and associated parts of the H2 infrastructure?

4) Are there public funding programs that can support use cases?

5) How should the use case be classified in the value chain and which partners (upstream and downstream) do I need for implementation?

6) How can such use cases be integrated into an overall strategic concept and linked together?

Reference: *H2HN Development prospects for the port of Heilbronn through H2*

© Fraunhofer IAO

Real-life case scenario. Initial situation and project objective practice.

The aim of the "H2 Port Heilbronn" study was to develop exemplary implementation paths towards a hydrogen economy with local stakeholders and thus make a contribution to climate protection. A key result of the project was the development of the guideline "Building a hydrogen economy using the example of inland ports". This case is intended to support decision-makers, port operators and their direct environment in finding starting points for a transformation towards a hydrogen economy.

Source: https://www.kodis.iao.fraunhofer.de/de/projekte/H2HN.html

4.1.4.2.2 RISKS AND MITIGATION STRATEGIES FOR HYDROGEN APPLICATIONS

This factsheet is crucial for port authorities exploring hydrogen. It complements the previous factsheet by identifying potential risks associated with hydrogen applications and offers practical mitigation strategies once you decide to use hydrogen as your chosen energy source. By understanding these risks and implementing effective measures, ports can make informed decisions, ensure safety, and successfully integrate hydrogen technology into their operations. It can help you enhance your strategy when your port is in step 2.9 of the SEANERGY MP.

Objectives of this factsheet

On completing/reading this factsheet the relevant port authorities will be able to:

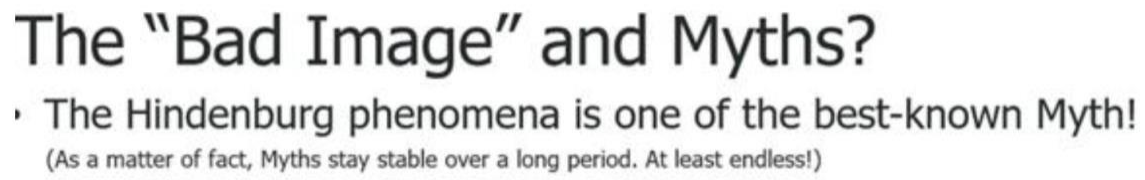
Evaluate the hydrogen supply chain:

Gain awareness of the risks associated with hydrogen use and learn effective strategies for risk management and mitigation.

1. Myths, bad image:
2. Material properties and risk assessment
3. Risk mitigation and trainings

1. Myths, bad image:

Carry out research and ask various sources, learn from experts. Fear is most-commonly based on myths, wrong communication ending in a bad image.



Source: airships.net

2. Material properties and risk assessment

Learn more about H2 material properties by trainings and onsite visits of production plants and companies which daily work with H2. Best practise skills are best to get a better feeling, trust, respect and skill knowledge to learn "if you handle it right" it isn't riskier than fuel etc. A good practical training allows respectful handling and reducing "bad image".

The image below represents a methodology developed by DNV that can be very useful for risk mitigation.

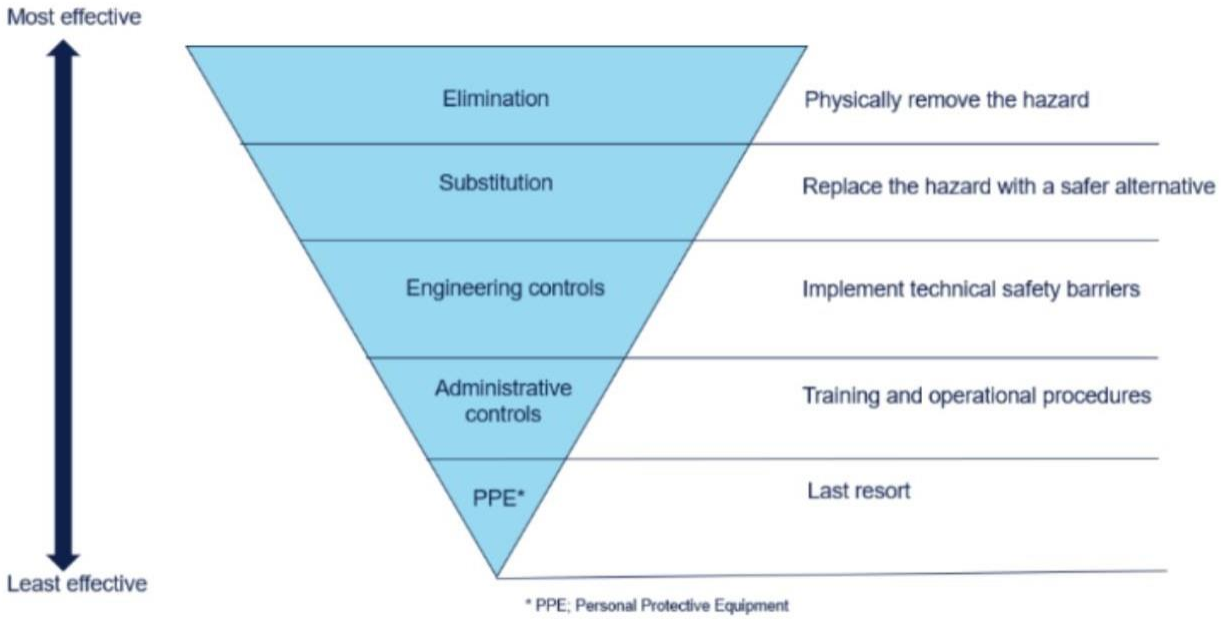


Figure 4-1 The Hierarchy of Risk Control Measures (Source: DNV).

Source: *www.dnv.com*

3. Risk mitigation and trainings.

There are plenty opportunities to learn from experts. Use the links in the references and connect to the experts. An example of this type of events was the Duty Congress at ZBT, which took place in Duisburg in September 2024. https://www.zbt.de/nc/aktuell/news-anzeige/detail/News/2-heavyduty-congress-wasserstoffbasierte-antriebe-im-schwerlastverkehr/

Above, there is expert Christian Machens" demonstrating H2 properties on the Ch2ance Heavy Duty Congress. Photo taken by Talha Isik.

Another resource that can help to mitigate is software which simulate accidents and advise you earn how to handle hydrogen safe and quickly. For further information on this issue, please check module 2 of the SEANERGY Academic Programme Open Course.

4.1.4.3 TECHNOLOGIES AND TECHNIQUES FOR ENERGY TRANSITION IN PORTS

This worksheet is a valuable resource for port users because it explores various future technologies for reducing emissions. It details options like electrification, renewable energy production, and alternative fuels for ships and ports. By understanding these technologies, port users can make informed decisions about adopting sustainable practices and preparing for the future. It is related to 2.10 section of the SEANERGY MP.

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

(i) Develop a basic understanding of future technologies

(ii) Identify and apply appropriate technologies for specific use cases

(iii) propose technologies for different port types

2) Decarbonization Technologies for ships and ports

1. Electrification of Ports

Electrification of the port logistics

The electrification of different consumers is the most efficient way to reduce the power demand due to highest energy efficiency. This includes the whole port logistics where the electrification is possible e.g., the cranes, forklifts, trucks, vehicles etc.

Shore Power for Vessels

Vessels generate emissions at ports for the power supply of onboard systems by running an auxiliary engine. Using electrical shore power from port shall be provided as power supply for the onboard systems.

Integration and optimization of onshore electrical grid

For high electrical energy demand of ports, the integration to onshore electrical grid is necessary. The dynamic energy consumption of the port logistic and the external ships supply can be optimized with the power consumption with the grid.

2. Production of Renewable Energy

Regarding higher energy demands the ports will produce their own energy. Dependent on regional opportunities, following technical solutions are possible:

Solar Power

Utilization of buildings rooftops and unused areas for solar panels.

Floating Solar Power

Usage of additional areas on the water for floating solar panels

Tidal and Wave Energy

Certain regions with high tidal amplitudes or continuous waves can use the kinetic energy of water to generate relative constantly electricity

On-/Offshore Wind Energy

Coastal areas have good wind conditions so that wind turbines on land and sea have high efficiencies

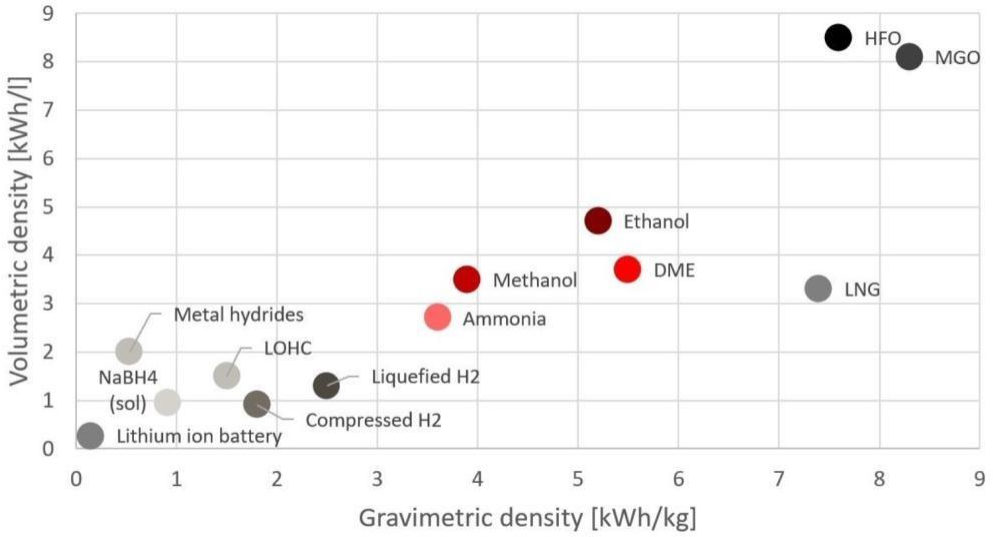
3. Energy Storage Systems (ESS)

Renewable energy production are volatile systems, so an independent storage system is needed to decouple flexible energy production and consumption. There are different possibilities for an energy storage system :

- **Batteries**
- **Thermal Energy Storage**
- **Pumped Hydro Storage**
- **Flywheel Energy Storage**
- **Compressed Air Energy Storage**
- **Green Hydrogen**

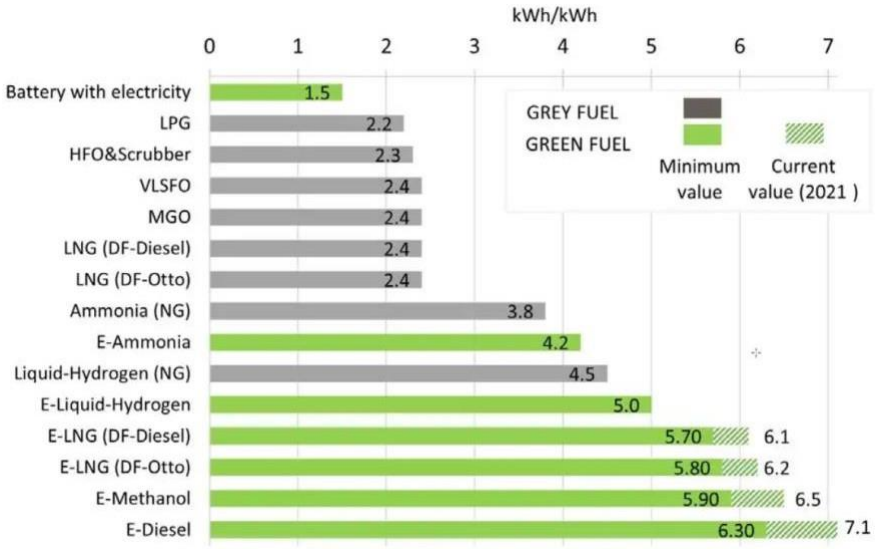
4. Fuel Technologies for Vessels

The energy storage infrastructure of ports has always been adjusted to ship technologies. Actually, there are different possible alternative fuel technologies for vessels with different characteristics which are reported in the figure below:



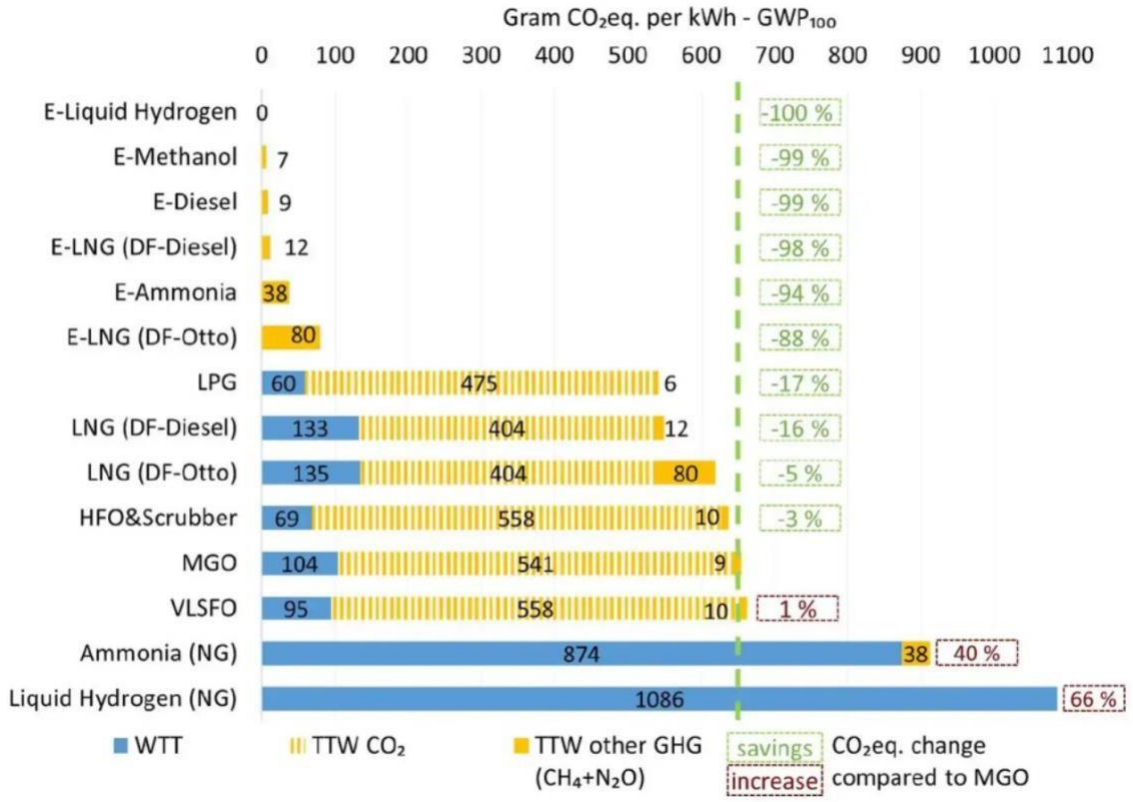
Energy Density of alternative Fuels

Source: *https://www.royalihc.com/dredging/dredging-innovations/fuels-and-transition-zero-emission-vessels*



Well-to-Wake (WTW) Energy consumption

Source :
https://issuu.com/tomkleppesto/docs/energy_transition_in_shipping_130622/s/16082052



WTT (Well-to-Tank) – TTW (Tank-to-Wake) CO2 Emissions

Source:
https://issuu.com/tomkleppesto/docs/energy_transition_in_shipping_130622/s/16082052

The chart below (developed by the SEANERGY Consortium partner ANLEG) reviews the advantages and disadvantages of different currently available technologies.

Technology	Advantage	Disadvantage
Battery	+ Highest Efficiency	– High Weight – Low Energy Density
LNG	+ Available Technology + Ready Infrastructure	– Only 25% CO2 Reduction not enough for IMO Target (50%) – Cooling down to -161°C – Methane slipping
Methanol (E-Fuel)	+ 99% CO2 Reduction + Available Technology + Applicable in existing combustion engines + Adjustable Infrastructure + High energy Density	– Highest energy consumption for production – Not emission free
Ammonia	+ No CO2 Emission + Best energy efficiency + Experience with storage and transport (agriculture)	– Toxic and high environmental impact when leaked – N2O generation during combustion
Hydrogen	+ Zero Emission Technology + High Tank to Wake efficiency (Fuel Cell) + Base Molecule for Ammonia and Methanol	– Lower Energy Density
Biofuel	+ CO2 Neutral + Conventional storage, distribution and technology	– Local Emissions – High Land Use and Water consumption for production
Carbon Capture Storage (CCS)	+ Eliminate/Reduce of CO2 with actual technology + Utilization (CCSU) of CCS CO2 for methanol production	– Energy Intensive – Expensive – Limited Storage Capacity

3) Short-, Mid- and Long-Term Technologies for ships and ports

Short Term

Fuel Saving Technologies

There are different fuel saving technologies and improvements to reduce the fuel consumption and the corresponding CO2 emissions.

Electrification

The vessels for lightweight carriers and short trips can be electrified with a corresponding loading infrastructure. With actual battery and loading technologies and green electricity certain ship travels can realized with zero emissions.

LNG

In short term LNG ships will dominate to reduce the actual CO2 emissions. It is a known, available and cheap technology with existing infrastructure.

Dual Fuel Technology

Alternative Fuels like Ammonia, Methanol and Hydrogen are coming into the market. Due to missing infrastructure the ships are designed with a dual fuel technology with renewable and classical fuel to guarantee sustainability during the transition process.

Methanol

Methanol as E-Fuel is an available sustainable technology. Due to high energy demand of the production process the scaling up of green methanol may be complicated.

Gaseous Hydrogen as Key Element

Hydrogen will be key element for the energy transition. Hydrogen can be produced in case of energy surplus to stabilize the electrical grid, as a long-term energy storage, generate port electricity by fuel cell, hydrogen as direct fuel for vessels or as key molecule for ammonia and methanol.

Mid Term

Carbon capture technologies - CCS

Vessels have a lifetime of approximately 30 years. To fulfil the CO2 emissions reduction target, it is expected to implement the carbon capture technology with using existing technologies. The emitted and saved CO2 emissions will be kept on the ships and unloaded on the ports to forward it to a final storage. For this the CCS infrastructure of the ports needs to be built up.

Multiple Fuel Strategy – Ammonia, Methanol, Hydrogen, CCS

Actually, there is no single a fuel strategy to focus. The potential Therefore, the ports need to be flexible regarding the different fuel technologies.

Import of fuel as energy and fuel storage

Europe as high energy consuming continent cannot provide its own energy demand by its own energy production. For this reason, green energy import with multiple usage possibility is necessary during the transition phase.

Long Term

Accomplish of Zero Emission Technologies:

1. **Batteries**
2. **Hydrogen**
3. **Ammonia**
4. **Methanol**

Suitable Technologies for different port types

This summary chart is useful for port users who are in the second level of the SEANERGY MP. It has been developed by the SEANERGY Consortium partner ANLEG.

Atlantic Ports - Long travel distances - High Tonnages	**Battery**	-
	LNG	O
	Methanol	+
	Ammonia	+
	Hydrogen	O
	CCS	+
Mediterranean Ports - Transit Region for Suez Canal - Intermediate Distances	**Battery**	-
	LNG	O
	Methanol	+
	Ammonia	+
	Hydrogen	+
	CCS	+
Island Ports - limited land place and infrastructure - short/long distances (regional differences) - sometimes multiples islands with continuous ship travels	**Battery**	-/+
	LNG	O
	Methanol	+
	Ammonia	+
	Hydrogen	O
	CCS	-
Inland Waterways - short distances - less tonnages	**Battery**	O/+
	LNG	O
	Methanol	O
	Ammonia	+
	Hydrogen	+
	CCS	O

4.1.4.4 PORTS AS INTEGRATED HUBS FOR ENERGY TRANSITION

This factsheet highlights the importance of effective port management for decarbonization and energy transition. It discusses key practices like regulations, incentives, stakeholder management, and strategic planning. It also emphasizes the crucial relationship between ports and surrounding areas, stressing the need for collaboration and sustainable development. It helps ports get in line with section 1 of the MP – *High-level vision*

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

I. Recognise best port management practices for decarbonization and energy transition
II. Understand the relationship between ports and their surrounding areas
III. Develop knowledge and skills for managing stakeholders in port energy transition

2) Port management practices for decarbonisation and energy transition

1. Regulations and Standards

Regulations and standards set legal frameworks and requirements for ports to achieve decarbonization and energy efficiency goals. Public authorities manage these regulations, ensuring compliance with international and national environmental laws.

2. Incentives and Economic Support

Incentives, such as tax benefits, subsidies, and grants, are provided to encourage ports and stakeholders to adopt green technologies and practices. These financial supports make it more economically viable for ports to transition to cleaner energy.

3. Disincentives

Disincentives, such as penalties or increased tariffs for high emissions, are implemented to discourage the use of non-renewable energy sources and promote cleaner alternatives. This approach ensures that non-compliance with environmental standards has economic consequences.

4. Voluntary Agreements

Voluntary agreements are collaborative arrangements between ports and stakeholders to achieve energy transition goals without binding regulations. These agreements rely on mutual cooperation and commitment to sustainability objectives.

5. Compulsory Agreements

Compulsory agreements are mandatory contracts that enforce specific actions and measures for energy transition. These agreements ensure that all parties involved adhere to the set standards and regulations for decarbonization.

6. Capacity Building

Capacity building involves enhancing the skills, knowledge, and resources of port authorities and stakeholders to effectively implement and manage energy transition projects. This includes training programs and educational initiatives to raise awareness and expertise in sustainable practices.

7. Information Sharing and Raising Awareness

Information sharing and raising awareness involve disseminating knowledge about best practices, technological innovations, and benefits of energy transition. This tool helps in creating a culture of sustainability and informed decision-making among stakeholders.

8. Strategic Plans

Strategic plans outline long-term goals, pathways, and targets for port energy transitions. These plans provide a roadmap for achieving sustainability objectives and integrating decarbonization measures into port operations and development.

9. Inventory, Monitoring, and Reporting

Inventory, monitoring, and reporting involve tracking emissions, energy use, and progress towards decarbonization goals. Regular reporting ensures transparency and accountability in the implementation of energy transition measures.

3) The importance of the relationship between ports and the surrounding areas

Relationships of Port Areas and Near-Port Areas

Port areas and near-port areas are intricately linked, creating a symbiotic relationship that significantly impacts both regions. The proximity of near-port areas to ports facilitates the efficient transfer of goods and resources, enhancing the overall logistical and operational efficiency of port activities. This close relationship is essential for optimizing supply chain processes, reducing transportation costs, and improving the competitiveness of port operations. Additionally, near-port areas often host complementary businesses such as warehouses, logistics companies, and industrial facilities, which further integrate with port activities to create a seamless flow of goods and services. Moreover, the economic vitality of port areas heavily influences the development and prosperity of adjacent near-port regions. As ports expand and modernize to handle increasing volumes of cargo and accommodate larger vessels, near-port areas benefit from the resultant economic spillover. This includes job creation, infrastructure development, and increased investment in local businesses. The interplay between port and near-port areas necessitates coordinated planning and development efforts to ensure that growth in one area supports and enhances the other, fostering sustainable and mutually beneficial progress.

Integrating Ports within Island Settlements

Integrating ports within island settlements presents unique challenges and opportunities. Due to their geographical isolation, island ports play a crucial role in connecting island communities to the broader national and international markets. The integration of ports within these settlements must consider the limited land availability and the need to balance economic development with environmental preservation. Effective integration strategies focus on optimizing the use of available space, implementing advanced logistical solutions, and promoting sustainable practices to minimize the ecological footprint of port activities. Island ports serve as lifelines for their communities, providing essential goods, facilitating tourism, and supporting local industries such as fishing and agriculture. Integrating ports within island settlements requires careful planning to ensure that port operations do not disrupt the local way of life or degrade the natural environment. This includes implementing measures to reduce air and water pollution, managing waste effectively, and preserving coastal ecosystems. By prioritizing sustainability and community engagement, ports can become

harmonious elements of island settlements, driving economic growth while safeguarding the unique cultural and environmental heritage of these regions.

4) Life cycle management of stakeholders engaged in port energy transition

Management of stakeholders is executed using five the following five stages:

1. Identify Stage

The identification stage involves recognizing and listing all relevant stakeholders who have an interest or influence in the Port Energy Transition Project (PETP).

Key Points:

- **Mapping**: Stakeholder mapping is used to generate a comprehensive list of stakeholders, detailing their characteristics and potential impact on the project.
- **Initiation**: Identifying stakeholders at the beginning of the project is critical for success.
- **Characteristics**: Understanding stakeholders' interests, power, and influence helps in managing them effectively throughout the project lifecycle

2. Prioritize Stage

The prioritization stage ranks stakeholders based on their importance and influence on the project to determine the level of attention and resources each one requires.

Key Points:

- **Criteria:** Stakeholders are evaluated based on their power, interest, and influence on the project.
- **Ranking:** Stakeholders are categorized to ensure that the most influential ones are managed with higher priority.
- **Resource Allocation:** This stage helps allocate appropriate resources and efforts to engage critical stakeholders effectively

3. Visualize Stage

Visualization involves creating graphical representations of stakeholders' positions and their levels of influence to aid in strategic planning and communication.

Key Points:

- **Graphical Tools**: Tools like the stakeholder circle or power/interest matrix are used to visually present stakeholder information.
- **Engagement Planning**: Visual aids help in understanding the stakeholder community and planning the right level of engagement.
- **Clarity**: Visualization clarifies the relationship and importance of each stakeholder, guiding the engagement strategy

4. Engage Stage

Engagement involves interacting with stakeholders to achieve mutually acceptable outcomes and ensure their active participation in the project.

Key Points:

- **Tactics and Approaches:** Engagement tactics are customized based on stakeholders' needs, power, and interest.
- **Evaluation:** Building profiles of engagement and developing an engagement index based on collected data.
- **Communication Plan:** Developing a plan to communicate effectively with stakeholders, ensuring continuous engagement and feedback.

5. Monitor Stage

The monitoring stage involves continuously assessing stakeholder engagement and making adjustments to strategies as necessary to keep the project on track.

Key Points:

- **Continuous Assessment:** Regularly evaluating stakeholders' engagement levels and their impact on the project.
- **Adaptation:** Updating stakeholder analysis to reflect changes in their influence or interest.
- **Feedback Loop:** Ensuring there is a mechanism for stakeholders to provide feedback and for the project team to respond appropriately

4.1.4.5 KEY POLICIES, REGULATIONS AND EUROPEAN EFFORTS TOWARDS E&F IN PORTS

This worksheet is valuable for port authorities as it guides them through the energy transition process. It provides insights into port roles in energy, self-assessment tools, and guidance on critical raw materials and circular economy implementation. By utilizing this resource, ports can position themselves for a more sustainable future. It gives practical aid to applying 2.1 of the SEANERGY MP.

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

(i) Apply energy transition concepts in their routine activities and using the existing knowledge of European policies, they will be able to comprehend on the required frameworks to achieve energy transition in their ports;

(ii) Analyse the use of critical raw materials, normative and policies assessment, new EU directives, local regional policies, etc., with the help of a checklist; and

(iii) Develop a framework to implement a circular economy action plan model within an existing port setting, i.e. with the help of questions and an assessment matrix.

2) Applying the energy transition concept in ports – Textual description and a form to complete

Ports can contribute to the energy transition in various ways, including for the country and for the port itself. Please consider the following information's:

a) **Energy transport facilities, such as ports**, can serve as gateways for the import or export of energy products, as well as their temporary storage. This is predicated on the principal of economies of scale that ports provide for the transportation of energy products, particularly in bulk.

b) **Ports can serve as energy transformation platforms**, providing a location for the energy industry to conduct its operations. This is based on the principle of economies of agglomeration, which suggests that energy activities are facilitated by the proximity or adjacency of suppliers and consumers.

c) **Ports can serve as energy generation platforms**, that offer their users both conventional and alternative energy sources. This is based on the principle of economies of scope, which reaps the benefits of the diverse energy provision and user base. Ports are composed of coal plants (common) and nuclear power facilities (less common). However, its now the time to look at your companies' initiatives, corporate social responsibility (CSR) actions, goal of meeting the sustainable development goals (SDGs), and document (in writing) all the ongoing measures with respect to energy transition in your port:

Form to complete by the port-related authorities

A. What are the shifts made so far from traditional, carbon-intensive energy sources to renewable energy sources?

(i)

(ii)

(iii)

B. What are the different electrification actions done to meet the energy transition requirements?

(i)

(ii)

(iii)

C. What are the forms of renewable energy generated at your port?

(i)

(ii)

(iii)

D. Do the ships arriving at your port use alternative fuels? If yes, what fuels do they use?

(i)

(ii)

(iii)

E. List the different smart energy systems in your port.

(i)

(ii)

(iii)

F. What efforts have been initiated to promote circular economy and the waste to energy concept?

(i)

(ii)

(iii)

G. What are the different green corridors that have been initiated in the shipping routes known to your port?

(i)

(ii)

(iii)

3) Checklist to analyse the use of critical raw materials, normative and policies assessment, new EU directives, local regional policies, etc.

3a) Checklist 1 – Critical raw materials (Answer with a Yes/No)	Yes/No
Does your port use any of the rare earth elements (REEs): Neodymium, praseodymium, dysprosium in electronics, wind turbines, and electric vehicle batteries? Does your port use lithium, cobalt, and nickel in any of your facilities? Do you use any of the platinum group metals (PGMs) in any of your facilities or day to day operations?	
3b) Checklist 1 – Critical raw materials (Listing)	
List the different (identified) critical raw materials used in your port, or port operations: (i) (ii) (iii) (iv) (v) (vi)	
3c) Checklist 2 – Policies, EU directives and their compliance by your port (Answer with a Yes/No)	**Yes/no**
a) European Green Deal (2019) b) EU Climate Law (2021) c) Fit for 55 Package (2021) d) TEN-T Regulation (Trans-European Transport Network) e) Alternative Fuels Infrastructure Directive (AFID) f) Fuel EU Maritime Initiative (2021) g) Revised Renewable Energy Directive (RED II) h) Energy Efficiency Directive (EED) i) Ports Regulation (EU Regulation No. 2017/352) j) Sustainable and Smart Mobility Strategy (2020)	

k) Horizon Europe Research Program (Green shipping and sustainable fuels) l) Cohesion and Recovery Funds	
3d) Checklist 2 – Policies, EU directives and their compliance by your port – List the different policies, directives and regulations you would like to fulfil in your port by 2030?	
a) b) c) d) e) f) g)	

4) Developing a framework to implement a circular economy action plan model within an existing port setting

The Green Deal (GD) was introduced by the European Commission in 2019, and the circular economy is a critical component of the future sustainability of European society. Figure 1 shows the 9R circular economy model developed by the PBL Netherlands Environmental Agency (2017). Furthermore, the GD acknowledges that ports are of the utmost significance in the pursuit of their sustainability objectives. Hence, in order to develop the framework and implement a circular economy model in your port setting, kindly fill in this checklist:

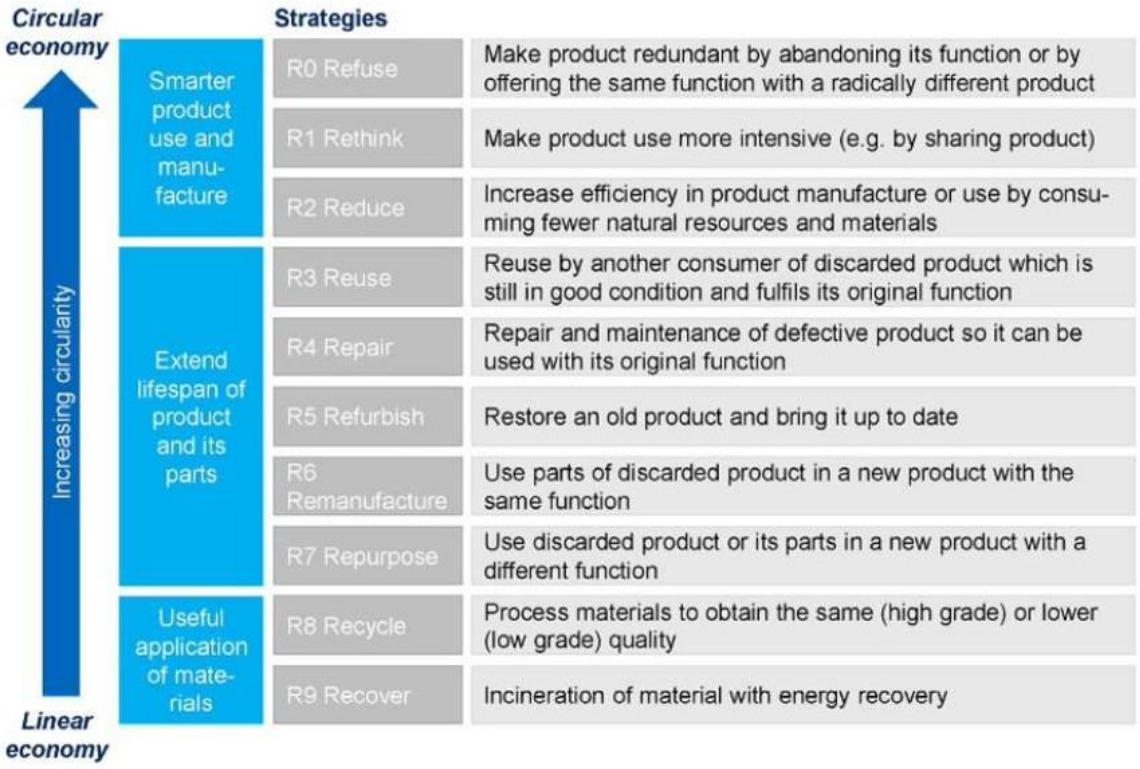


Figure 1. The 9R circular economy model recommended by the PBL Netherlands Environmental Agency (2017):

Source: https://grow-circular.eu/knowledge-base/9r- framework/

4a) Circular economy measures in the port (from a linear to a circular economy, R9-R0)	**Yes/No**
R9) Are you recovering resources from the different wastes (solid, liquid, gaseous emissions, metals, and IT related materials) generated at your port?	
R8) Are you recycling your waste materials (e.g. motors, generators, power units, etc) at your port or with the help of other service providers?	
R7) Are you repurposing your waste materials/old products/abandoned equipment's, vehicles, etc.?	
R6) Are you remanufacturing using your old materials, daily use instruments or equipment's, etc.?	

R5) Are you refurbishing your old products (computers, telephones, communication devices, machinery, vehicles, etc) at your port or with the support of other service providers?	
R4) Are you repairing your old port related monitoring instruments, materials, vehicles, machineries, IT related instruments, etc, among others?	
R3) Are you reusing of your old products/discarded components/machineries/IT related instruments at your port or are they reused by other users in your country?	
R2) Are you optimizing the use of raw materials, or energy, in your daily port related activities? (i.e. reducing)	
R1) Are you sharing resources, knowledge and actively cooperating with other companies or ports or different stakeholders to minimize waste and improve your efficiency? (e.g. adopting a rethinking strategy)	
R0) Has your port made any product or technology redundant by just abandoning them?	
4b) Circular economy measures in the port (from linear to circular economy, R9-R0) – List briefly the top 5 circular economy measures taken by your port/company/organisation, and what are their benefits so far? (i) (ii) (iii) (iv) (v)	

4.1.4.6 LOCAL MASTER PLAN DEVELOPMENT

This factsheet is valuable for port authorities as it provides a comprehensive guide for developing inland port development plans, focusing on energy transition and environmental compliance. This will help you to adapt the SEANERGY MP to an inland waterway port reality.

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

(i) develop a basic knowledge of establishing an inland port development plan with the support of the SEANERGY master plan;

(ii) improve the existing knowledge and experience on inland port business regarding energy-related items;

(iii) identify options for fulfilling the future challenges of inland ports regarding energy.

2) Compliance Check

- Make a comprehensive legal compliance check for your port assets or processes, which are under your responsibility.
- Do not forget to consider the expectations of the market, your clients or other stakeholders.
- Establish a comprehensive status-quo evaluation of the relevant emission data or environmental items of your plants and processes.
- Go into a gap-analysis and check the compliance status between the requirements of the legal framework / client and stakeholder expectations and your real situation of the port.

3) Plannings of measures

- Create a strategic and operation port development plan based on your long-term vision on how to fulfil the medium- and long-term targets regarding your transition plan to close the identified gaps (based on SWOT analysis and select the most urgent measures and prioritize them).

- Integrate this local master plan regarding energy and environmental items into your company´s strategic plannings, documents and management procedures.
- Establish a master plan of concrete energy and environmental measures in accordance with the strategy to fulfil the required targets.
- Work on detailed technical projects for the short-term range and bring them to technical readiness under considerations of available and proofed technologies of the market.
- Do not forget for risk assessment loops within the technical plannings – is the selected technical measure the best available technique to close a gap – today and even for the long- term range?
- Make sure that all necessary authority permissions for your measures are present.

4) Economic considerations and CBA (cost benefit analyses)

- Establish a state-of-the art business plan for each identified and technical mature measure to integrate it into your short-term budgets
- Consider the value of your business plannings according to your internal procedures of your governance/ownership
- Look for suitable funding programs (national and international) to get your planned investment into an economic feasible status
- Make risk assessment scenarios for your planned investments (normal case – best case – worst case) regarding incomes from the market for the necessary payback time of your investment; will the clients accept your infrastructure investments even in the future?

5) Realization and ongoing work

- Get your investment done
- Make measurements after completion if the proposed effects regarding environmental improvements have been realized.
- Establish a surveillance for the long-term run of the environmental performance of your investment.

- Go into the next open projects of your strategic plan and repeat the process for the next planned investment in the sense of a PDCA-cycle for your local masterplan realization.
- By this, establish a medium- and long-term improvement development based on a masterplan for fulfilling the environmental compliance of your port.

4.1.4.7 TAILORTING THE HIGH-LEVE MASTER PLAN TO MY PORT

This factsheet empowers port authorities to select and implement suitable technologies by guiding them through technology selection, identifying impactful areas, and fostering stakeholder engagement for energy transition. Thanks to the information contained herein ports can make informed decisions, enhance operations, and contribute to their overall success and sustainability. These insights help ports to adapt sections 1.1, 1.3, 1.7, 2.1, 2.4 and 2.5 of the SEANERGY MP.

Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

(i) to select appropriate technologies for their port

(ii) to identify the different impactful areas/opportunities within the port

(iii) to engage the stakeholders and the port community

i) Select appropriate technologies .....

ii) Identify the impactful areas and opportunities

A. Environmental sustainability
1) Energy efficiency Current status: • Energy consumption metrics: _____ • Use of renewable energy sources: Yes/No Opportunities for improvement: • Installing solar panels or wind turbines • Upgrading to energy-efficient lighting and machinery • Implementing energy management systems
2) Air quality management Current status: • Monitoring systems in place: Yes/No • Current air quality levels: _____ Opportunities for improvement: • Implementing more efficient engines and equipment • Switching to alternative fuels (e.g., LNG, electric) • Promoting shore power for vessels
3) Water quality management Current status: • Water quality testing frequency: _____

- Current contaminants of concern: _____

Opportunities for improvement:

- Enhancing waste management systems
- Installing advanced filtration systems
- Enforcing stricter regulations on water pollution

4) Waste management

Current status:

- Waste segregation and recycling programs: Yes/No
- Volume of waste generated monthly: _____

Opportunities for improvement:

- Reducing single-use plastics
- Increasing recycling and composting efforts
- Partnering with waste-to-energy facilities

B. Economic development

1) Port infrastructure development

Current status:

- Condition of existing infrastructure: _____
- Recent upgrades or expansions: _____

Opportunities for improvement:

- Expanding berths and terminals
- Modernizing docking facilities
- Improving road and rail connectivity

2) Cargo handling efficiency

Current status:

- Average cargo handling time: _____
- Bottlenecks in cargo flow: _____

Opportunities for improvement:

- Investing in advanced cargo handling equipment
- Implementing automation and robotics
- Optimizing logistics and supply chain processes

3) Technological advancements

Current status:

- Adoption of digital technologies: Yes/No
- Key technologies in use: _____

Opportunities for improvement:

- Implementing IoT for real-time monitoring
- Adopting blockchain for secure transactions
- Utilizing big data analytics for decision making

C. Innovation and future planning

1) Research and development

Current status:

- Investment in R&D: Yes/No
- Key projects underway: _____

Opportunities for improvement:

- Partnering with academic institutions
- Fostering innovation hubs within the port
- Exploring new technologies and methodologies

2) Strategic partnerships

Current status:

- Existing partnerships: _____
- Areas for potential collaboration: _____

Opportunities for improvement:

- Collaborating with other ports for best practices
- Partnering with technology providers
- Engaging with government and non-profit organizations

iii) Port stakeholders engagement

A. Identifying stakeholders

1) Stakeholder mapping

- Government agencies: _____
- Port users (shipping lines, cargo owners): _____
- Community groups: _____
- Environmental groups: _____
- Employees and labor unions: _____
- Investors and financiers: _____
- Suppliers and contractors: _____
- Media and press: _____

B. Communication strategies

1) Direct communication • One-on-one meetings • Telephone calls • Emails **2) Digital communication** • Website updates • Social media (Facebook, Twitter, LinkedIn) • Newsletters **3) Public communication** • Press releases • Public announcements • Workshops • Focus groups
C. Engagement activities
1) Regular meetings and forums • Regulatory review meetings • Annual strategic planning sessions • Bi-annual port efficiency workshops • Annual sustainability report release • Annual employee feedback surveys • Financial performance briefings • Annual supplier forum • Annual press briefings
2) Community outreach programs • School visits and port tours • Scholarships and internships for students • Sponsorship of local events
3) Feedback mechanisms • Annual stakeholder satisfaction survey • Physical suggestion boxes at key port locations • Digital suggestion portals on the port website • Focus groups

Source: This chart was developed by the SEANERGY Consortium Partner DAFNI.

4.1.4.8 EVALUATING THE ENERGY AND ENVIRONMENTAL PERFORMANCE OF PORTS

This factsheet helps to implement step 3 of the SEANERGY MP. It is aimed at empowering port authorities to implement ESG and LCA KPIs, enhancing their understanding of sustainability. By prioritizing relevant KPIs, ensuring transparency, driving sustainable practices, and attracting stakeholders, ports can make informed decisions and contribute to a more resilient and responsible maritime industry.

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

- Identify the main ESG KPIs.
- Identify the main LCA KPIs.
- Monitoring Transparency and traceability level

2) ESG KPIs

Source: https://www.sciencedirect.com/science/article/abs/pii/S2213624X2200027X

Group	Section	Metrics	Unit
Environmental	Emissions	Air pollutant emission	PM10 (µg/m3)
		Environmental management system	Yes/No
	Resources	Energy consumption	MWh/activity
		Effluent management	Δ%/year
		Natural resources protection	Yes/No
		Environmental reports	Yes/No
Social	Regional Dialogue	Regional development planning	Yes/No
		Social development	Yes/No
		Social actions	Yes/No
		Useless areas management	Yes/No
	Collaboration	Diversity and inclusion	Yes/No or % share
		Career development	Yes/No

Group	Section	Metrics	Unit
	Health and Safety	Work conditions	Yes/No
		Health and safety	Yes/No or % share
Governance	Management	Financial performance	Δ%/year
		Operational performance	Δ%/year
		Data management	Δ%/year
		Ethics and corruption	Δ%/year
	Board	Share distribution	Yes/No
		Regionality	Yes/No
	Presence	Intermodality e connectivity	% share
		P&D	Yes/No
		Internationalization	Yes/No

3) LCA KPIs

Source:https://backend.orbit.dtu.dk/ws/portalfiles/portal/328759440/1_s2.0_S2666822X2300014X_main.pdf

Group	Section	Metrics	Unit
Economic	Cost	CAPEX *(Capital expenditures)*	€
		OPEX *(Operating expenditures)*	€
		Maintenance Cost *(expenses to ensure the correct and reliable operation of an asset)*	€
		Port Charges *(Fees paid to port authorities)*	€

Group	Section	Metrics	Unit
		Fuel Cost	€/NM
	Miscellaneous	Energy Consumption *(Total energy needed)*	kWh
		Cargo Carried *(Cargo carried from loading to discharging)*	TEU/ship
Environmental	Emissions	CO2 *(CO2 emissions)*	Kg of CO2/tkm
		NOx (NOx emissions)	Kg of NOx/tkm
		SOx *(SOx emissions)*	Kg of SOx/tkm
		PM *(PM10 emissions)*	Kg of PM10/tkm
		Acoustic – Noise *(Noise emitted)*	dB
		Light Pollution *(Brightening of the night sky caused by operations)*	Lumens/shipment
		Waste *(Amount of waste produced)*	Kg
	Other	Terminal area per Cargo Unit *(land needed to perform operations as function of the cargo moved)*	m2/cargo unit
		Energy Consumption *(Total energy needed for movement)*	kW/cargo unit
		Use of Renewable Energy Sources *(Percentage of energy consumed that comes from environmental-friendly energy sources)*	%

3) Transparency and Traceability tracking

Flow	Unit	Quantity	Comments	Source
e.g. Electricity consumption	MWh/year	...	e.g. monitored by digital monitoring system	file NAME_XXXX

Flow	Unit	Quantity	Comments	Source
e.g. Waste generation	Tons/year	....	e.g. waste to disposal, monitoring monthly	Report n° xxxx
....	....	....	....	....
....	....	....	....	....
....	....	....	....	....

Source : This chart was developed by the SEANERGY Consortium Partners RINA & ZERO-E.

4.1.4.9 CONTINUOUS IMPROVEMENT OF PORT PERFORMANCE

This factsheet has been designed to help port authorities achieve continuous improvement and sustainability, thus to implement section 3.8 of the SEANERGY MP. It provides guidance on implementing the PDCA cycle, promoting low-carbon transitions, developing decarbonization roadmaps, integrating sustainability into supply chains, and utilizing the PERS framework. Case studies showcase successful port initiatives, illustrating the potential benefits of these strategies. By leveraging this resource, ports can make informed decisions, enhance their operations, and contribute to a more sustainable and resilient future.

1) Objectives of this factsheet

On completing/reading this factsheet, the relevant port authorities will be able to:

I. Understand and apply continuous improvement principles to enhance port performance.
II. Evaluate monitoring and accountability frameworks in port operations
III. Analyze operational outcomes using feedback loops for informed decision-making

2) Continuous Improvement for Port Energy Transition

The Importance of Energy Efficiency and Carbon Emission Reduction

Ports are significant energy consumers and sources of greenhouse gas emissions. Improving energy efficiency helps reduce operational costs and environmental impact, making ports more sustainable and competitive in the global market.

Strategies like Renewable Energy Integration and Energy Recovery Initiatives:

Implementing renewable energy sources such as solar, wind, and marine energy into port operations can significantly lower carbon footprints. Additionally, energy recovery initiatives, such as capturing waste heat, contribute to overall energy efficiency and sustainability goals.

Utilizing the PDCA (Plan-Do-Check-Act) Cycle for Energy Management:

The PDCA cycle is a continuous improvement tool that helps ports systematically manage and optimize their energy usage. By planning energy initiatives, implementing them, checking the results, and acting on feedback, ports can ensure ongoing improvement in energy efficiency and emission reductions.

3) Innovative Strategies for Sustainable Port Development

Promoting Low-Carbon Transitions:

Low-carbon transitions involve reducing the dependency on fossil fuels by shifting towards cleaner energy sources. This strategy is crucial for meeting international climate targets and improving the environmental performance of ports.

Incorporating Marine Renewable Energy Sources and Emission Reduction Technologies:

Utilizing marine renewable energy, such as offshore wind and tidal energy, helps reduce ports' reliance on traditional energy sources. Emission reduction technologies, like electrification of equipment and vessels, further aid in lowering greenhouse gas emissions.

Environmental Issues in Ports

Addressing Greenhouse Gas Emissions and Energy Efficiency:

Ports are under increasing pressure to minimize their greenhouse gas emissions. Enhancing energy efficiency through better infrastructure, equipment upgrades, and optimized operations is essential for reducing the environmental impact of port activities.

Transitioning to Sustainable Energy Sources such as Solar, Wind, and Marine Energy:

Shifting to renewable energy sources is vital for ports aiming to achieve long-term sustainability. By investing in solar panels, wind turbines, and harnessing marine energy, ports can significantly cut down on carbon emissions and move towards greener operations.

4) Roadmap for Decarbonizing Seaports

Developing Time-Phased Control Mechanisms for Port Decarbonization:

A phased approach to decarbonization allows ports to set realistic and achievable goals over time. Control mechanisms, such as regular monitoring and adjustments, ensure that ports stay on track to meet their decarbonization targets.

The Significance of Roadmap-Based Approaches to Achieve 'Net-Zero' Emissions:

A well-structured roadmap is essential for guiding ports through the complex process of reducing emissions to 'net-zero'. It provides a clear framework for implementing changes, tracking progress, and ensuring that all stakeholders are aligned towards the common goal of sustainability.

5) Sustainability in Port Supply Chains

Integrating Sustainability into Port Operations:

Sustainability must be a core component of all port operations, from cargo handling to logistics and infrastructure development. This integration ensures that ports operate efficiently while minimizing their environmental impact.

Key Sustainability Factors: Location, Infrastructure, Planning, and Governance:

The sustainability of a port is influenced by several factors including its geographic location, the quality and efficiency of its infrastructure, strategic planning, and effective governance. These elements must be managed cohesively to ensure the long-term sustainability of the port and its operations.

6) Port Environmental Review System (PERS)

A European Port Sector Standard for Environmental Management:

PERS is a recognized environmental management standard specifically designed for ports. It helps ports systematically manage their environmental responsibilities and improve their overall environmental performance.

Benefits Include Cost Savings, Compliance with Legislation, and Improved Management Control:

By adopting PERS, ports can achieve significant cost savings through better resource management, ensure compliance with environmental legislation, and enhance overall control over environmental impacts and risks.

7) Case Studies: Continuous Improvement in EU Ports

Port of Rotterdam: Carbon-Neutral Goal by 2050 with Initiatives like Shore Power Systems and a Green Hydrogen Hub:

The Port of Rotterdam is committed to becoming carbon-neutral by 2050. Key initiatives include the implementation of shore power systems, which allow ships to turn off their engines while docked, and the development of a Green Hydrogen Hub to support sustainable energy production and consumption.

Port of Antwerp: Environmental Projects like EcoCombis and Comprehensive Waste Management:

The Port of Antwerp has launched several environmental projects, including the use of EcoCombis, which are longer and more efficient trucks that reduce emissions. The port also focuses on comprehensive waste management to minimize its environmental footprint.

Port of Lisbon: Social Inclusion and Workforce Development through the 'Blue Growth' Strategy:

The Port of Lisbon emphasizes social responsibility through its 'Blue Growth' strategy, which promotes social inclusion and workforce development. This strategy supports the local community and ensures that port operations contribute positively to social and economic growth.

4.1.4.10 DIGITAL COMMUNICATION PLAN FOR THE PROMOTION OF PORTS IN EUROPE

The factsheet evaluates the current state of digital communication in European ports. It also helps ports to improve their online presence, digital marketing strategies, and communication of decarbonization and sustainability initiatives. The analysis highlights strengths such as active social media profiles, well-designed websites, and effective use of multimedia. However, it also identifies weaknesses like inconsistent social media posts, lack of SEO optimization, and repetitive content. The factsheet provides opportunities for improvement, such as increasing the use of emerging networks, implementing dynamic blogs, and creating specific content on sustainability. Overall, the factsheet is can be used as a tool to implement Section 1.5 and 2.6 of the SEANERGY MP, in order to leverage stakeholders' engagement to maximise the impact of their green energy transition process.

1. CURRENT SITUATION

Digital communication is essential for the management and promotion of European ports. This section evaluates the current situation of digital communication in the ports of Rotterdam, Bergen, Marseille, Valencia and Barcelona, identifying strengths, weaknesses, opportunities and threats. The analysis focuses on their online presence, the effectiveness of digital marketing strategies and the communication of decarbonisation and sustainability actions.

The analysis was carried out studying the following aspects:

- Presence on social networks: Evaluation of profiles on social networks (Facebook, Twitter, LinkedIn, Instagram, etc.)
- Website: Analysis of accessibility, content, updates and SEO.
- Digital content: Review of blogs, publications, videos and informative material.
- Decarbonization activities: Evaluation of the communication of sustainability initiatives.

In this way, a SWOT has been elaborated on the digital communication of the mentioned ports:

Strengths:

- Active profiles on social networks with regular posts.
- Well-designed and updated websites with news and events sections.
- Use of multimedia such as videos and infographics to attract the public. Live events and webinars that have been popular.
- Decarbonization initiatives are well documented and have a positive impact.

Weaknesses:

- Variable quality and consistency in social media posts.
- Lack of SEO optimization on some websites and inconsistent content updating. Repetitive content and lack of a cohesive editorial calendar.
- Lack of monitoring and analysis of results in marketing campaigns. Inconsistent communication of progress and results in decarbonization initiatives.

Opportunities:

- Increasing the use of emerging networks and paid campaigns for greater visibility.
- Implementing dynamic blogs and optimize the mobile experience on websites.
- Creating specific content on sustainability and collaborating with influencers. Planning campaigns focused on sustainability and use of data analysis.
- Developing specific sections and publishing case studies on decarbonization initiatives.

Threats:

- Competition from other ports with more advanced digital communication strategies.
- Rapid evolution of web technologies that can leave outdated ports behind.
- Little differentiated content that reduces relevance compared to innovative competitors.
- Competition from more aggressive and better financed campaigns.
- Disinterest or distrust of the audience without transparent and regular communication of results.

For all these reasons different clear areas of improvement are detected in the digital communication of ports. To maximize the impact of their activities, especially in terms of decarbonization and sustainability, it is essential to implement a more coherent and proactive digital communication strategy. Through better content optimization, increased audience engagement, and well- planned marketing campaigns, these ports can significantly improve their presence and effectiveness in the digital realm.

Below is a digital communication plan for European ports taking into account several aspects: objectives, audience, strategy, tactics, measurement and analysis, and an action schedule.

2. OBJECTIVES

The objectives should be SMART, i.e.:

- Specific
- Measurable
- Achievable
- Result-oriented
- Time-limited

The optimal situation would be to have general objectives of each port and specific objectives for each target of each port.

3. TARGET AUDIENCE

Port Community: Exporters and Importers, Shipping companies and Maritime Agents, Customs and Border, Terminals, Freight Forwarders, Logistics Operators and Hauliers, Depots, Maritime and Port Authorities, Technical - Nautical Services, Marinas, Rail operators...

Other types of Stakeholders: Investors, business partners and potential collaborators.

Academia: Universities, Chairs and researchers on logistic-port issues Local community: Residents in port areas.

Tourists: Visitors interested in tours and port activities.

Media: Journalists and media specialized in economy, transportation and sustainability.

International Institutions, Government entities and NGOs: Interested in sustainability and economic development projects.

4. STRATEGY

Content Marketing:

Content Marketing refers to the creation and distribution of relevant, valuable and consistent content to attract and retain a clearly defined audience and ultimately drive profitable customer action. For ports, this means developing a variety of content that can include blog articles, infographics, case studies, videos and guides that address topics related to logistics, sustainability, decarbonisation initiatives, and technological innovations in the sector. port. The goal is to provide useful and educational information that positions ports as thought leaders in the industry and builds trust and loyalty among users.

For an effective digital communication strategy in maritime ports, it's crucial to tailor both the channels and messages to each target audience. This involves selecting the appropriate platforms and formats for each segment, ensuring that the content is relevant and engaging. Personalizing communication not only maximizes impact but also ensures that strategic objectives are met efficiently.

Social Media Marketing:

Social Media Marketing involves the use of social platforms such as Facebook, Twitter, LinkedIn, Instagram, and YouTube to interact with the audience and promote port activities. This strategy encompasses creating social media profiles, regularly posting engaging content, engaging with followers, promoting events and achievements, and using paid advertising to expand reach if needed. For ports, this may include disseminating news about operations, infrastructure improvements, sustainability initiatives, and special events. Social media also allows ports to get direct feedback from the community and respond to queries and concerns in real time.

Email Marketing:

Email Marketing consists of sending regular newsletters to a list of subscribers to keep them informed about the activities and achievements of the ports. This strategy is effective in nurturing long-term relationships with stakeholders, clients, and the community in general. Newsletters may include updates on infrastructure projects, sustainability initiatives, upcoming events, case studies, and educational articles on relevant topics in the port industry. The key is to segment the mailing list to send personalized and relevant content to each group of recipients, thus increasing open rates and engagement.

Public Relations:

Public Relations involves collaboration with the traditional media to disseminate news and reports about ports. This may include writing and distributing press releases, organizing press events, creating opportunities for interviews with port leaders, and managing communications crises. For ports, this strategy is vital to building and maintaining a positive public image. Effective Public Relations ensures that ports' achievements and progress are recognized by a wider public, increasing visibility and improving public perception of their impact on the local economy and community.

5. TACTICS

The following tactics used should ensure that the objectives set out in previous sections are met:

1) **Content Creation**

Blog Articles: Publishing articles on the port's blog is an effective way to provide detailed information on topics of interest.

-Example 1: An article titled "Decarbonisation in Ports: A Sustainable Approach for the Future" could detail current and future initiatives to reduce carbon emissions in the ports of Rotterdam, Barcelona, Marseille and Bergen.

-Example 2: Another article, "Cutting Edge Technology in Ports: How Innovation is Transforming Logistics," could explore the latest technologies implemented in these ports,

such as automated loading and unloading systems, and the use of artificial intelligence to optimise operations.

Success Stories: Showing success stories is an excellent way to highlight significant achievements and advances.

-Example 1: A success story could focus on the implementation of a solar energy plant in the port of Barcelona, showing how it has reduced dependence on non- renewable energy sources.

-Example 2: Another case could highlight a natural habitat restoration project in the port of Marseille, highlighting the environmental benefits and collaboration with local communities.

Infographics: Infographics are visual tools that can simplify the understanding of complex processes.

-Example 1: An infographic titled "The Decarbonisation Cycle in the Port of..." could illustrate the stages of the emissions reduction process, from the implementation of clean technologies to continuous monitoring.

-Example 2: Another infographic could show "The Economic Impact of European Ports", highlighting key data and statistics on employment, trade and economic development.

2) Social Media

Platforms Used: LinkedIn, Twitter, Facebook, Instagram and Youtube are key platforms to reach different audiences.

-Example: LinkedIn can be used to share technical articles and success stories, Twitter for quick updates and news, Facebook and Instagram for visual content and live streams, and YouTube for longer and more detailed videos

Posting Schedule: Posting content regularly helps maintain audience interest and engagement.

-Example: A publication schedule that includes at least three publications per week, distributed evenly, can guarantee a constant presence on the networks.

Formats: Variety in content formats is crucial to maintaining attention.

-Example: Publish images of recent events, videos of ongoing projects, stories showing daily life in the port, and live broadcasts of inaugurations or special events.

Hashtags: Using relevant hashtags increases the visibility of posts.

-Example: Use hashtags such as #PortsOfEurope, #PortDecarbonization, #Sustainability, and #PortTourism to reach audiences interested in these specific topics.

3) Email Marketing

Monthly Newsletter: Sending regular newsletters keeps the audience informed and engaged.

-Example: A monthly newsletter that includes news about recent developments, upcoming events, important achievements, and links to blog articles and success stories.

Segmented Campaigns: Targeting specific messages to different segments of the audience improves relevance and effectiveness.

-Example: Send emails about new investment opportunities to investors, news about community initiatives to the local community, and tourist events to potential visitors.

4) Public Relations

Press Releases: Press releases are essential to announce important news and maintain transparency.

-Example: Write and distribute press releases about the inauguration of a new terminal in the port of Rotterdam or about an international collaboration in the port of Bergen.

Press Events: Organizing press events is a great way to get media coverage.

-Example: Organize a guided tour for journalists in the port of Barcelona to show new facilities and sustainable technologies.

Collaborations with Media: Working with specialized media can increase credibility and reach.

-Example: Write opinion articles for magazines specialized in transportation and sustainability, highlighting the advances and challenges in the port industry.

6. MONITORING AND ANALYSIS

Setting SMART objectives (Specific, Measurable, Achievable, Relevant, and Time- bound) is essential for effectively measuring and tracking a digital communication strategy. These clear goals provide the metrics needed to assess performance and make informed adjustments, ensuring continuous improvement and the successful achievement of strategic objectives.

KPIs:

- **Reach on Social Networks**: Number of followers, likes, shares and comments.
- **Engagement**: Interaction rate in publications and campaigns.
- **Web Traffic**: Increase in traffic to the ports' official website.
- **Email Subscribers**: Growth in the newsletter subscriber list.
- **Media Coverage**: Number of mentions and articles published in the media.

7. TIMELINE

A well-structured communication schedule is crucial for effective strategy execution. It ensures that messages are aligned with local, regional, and national holidays, maximizing their relevance and impact. Consistency in content delivery is essential to avoid periods of high activity followed by gaps of inactivity, which can disrupt engagement. To support this planning, using agile tools such as Gantt charts is recommended. These tools provide clear visualization and efficient management of the content calendar, ensuring a balanced and timely distribution of information and maintaining audience interest.

8. ANNEX – Free tools to use

1. Google Analytics:

- Google Analytics is a web analytics platform offered by Google. It allows users to deeply analyze the traffic on their website and understand user behavior. Some of the key functionalities include:
- Traffic Monitoring: Provides detailed data on the number of visitors, traffic sources (organic, direct, referral), and geographic locations.
- Behavior Analysis: Allows us to understand how users interact with the website, including pages visited, time spent, and actions taken (downloads, completed forms).
- Customizable Reports: Offers customizable reports and dashboards to effectively visualize key data.
- Goals and Conversions: Makes it easy to set goals and track conversions, such as sales, registrations or downloads.

2. Metricool:

- Metricool is a social media management and analysis tool that allows users to optimize their presence on social platforms. Its main features are as follows:
- Social Network Management: Allows you to schedule posts on multiple platforms such as Facebook, Twitter, Instagram and LinkedIn.
- Results Analysis: Provides detailed metrics on post performance, including reach, interactions (likes, comments, shares), and follower growth.
- Competitors Report: Allows you to compare the performance of your social networks with those of direct competitors.
- Schedule Optimization: Suggestions on the best times to publish based on analysis of historical data.

3. Mailchimp:

Mailchimp is an email marketing platform that makes it easy to create, manage and analyse email campaigns. Its features include:

- Campaign Design: Allows you to design attractive emails with customisable templates and a drag-and-drop editor.
- Audience Segmentation: Facilitates the segmentation of email lists to send specific messages to different audience segments.
- Automation: Allows you to configure automated workflows based on user actions, such as welcomes, purchase tracking, or abandoned cart reminders. Results Analysis: Offers detailed reports on open rates, click rates, user behavior and overall campaign performance.

4.1.4.11 HOW TO FINANCE THE CLEAN ENERGY TRANSITION OF MY PORT

The factsheet presents a strategy on how to finance energy transition steps in a middle-sized port in Euope. It also provides a case study to find funding for onshore power infrastructure. It shows a practical application of sections 2.8 and 3.1 of the SEANERGY MP.

1) Objectives of this factsheet

This fact sheet provides a short overview the following Case Study: “Financing shore power infrastructure at exemplary port X” with the following objectives:

- Port X mid-size port in Europe
- Aiming for a shore power facility to reduce the local pollution and greenhouse
- emissions in the port area
- Seeking for solutions that could create additional benefits
- 5m € of total budget / potential additional budget for further solutions

1. Introduction

Port X, a medium-sized European port, is embarking on an innovative green transformation project to reduce its environmental footprint while diversifying its energy supply. The project focuses on installing shore power infrastructure to supply electricity to docked ships, eliminating the need for diesel engines, and deploying an electrolyze to use surplus renewable energy for the production of green hydrogen and oxygen. Both hydrogen and oxygen offer new revenue streams and operational efficiencies for the port, creating a sustainable and financially viable solution.

2. Project Scope and Cost Estimation

The project has two main components:

Shore Power Infrastructure: This will enable ships to plug into the local power grid, thereby turning off their auxiliary engines while docked. This reduces air pollution, greenhouse gas emissions, and noise in the port.

Electrolyze for Hydrogen and Oxygen Production: An electrolyze will convert surplus renewable energy into green hydrogen and oxygen by splitting water molecules through electrolysis. The hydrogen can be used for port operations, sold to nearby industries, or used in transportation. The oxygen can be stored or sold for industrial and medical uses, adding another revenue stream.

The total estimated cost of the project is €6.5 million:

Shore Power Infrastructure: €5 million, including design, construction, and integration with port systems.

Electrolyze Installation: €1.5 million for a medium-sized electrolyze capable of producing both hydrogen and oxygen.

3. Financing Strategy

To fund the project, Port X will use a combination of European grants, port authority resources, and private investment.

European Union Funding: Connecting Europe Facility (CEF)

Objective: Port X applies for funding through the Connecting Europe Facility (CEF), an EU program supporting the development of sustainable infrastructure, including renewable energy and low-carbon technologies.

Rationale: The project aligns with CEF goals by supporting the reduction of maritime emissions and advancing green hydrogen production. The dual production of hydrogen and oxygen further enhances its value.

Requested Grant Amount: €3 million (approximately 46% of the total cost).

Funding Focus: CEF funds will support the installation of shore power systems and the electrolyzer, given their contribution to lowering emissions and advancing renewable energy use.

Port Authority's Equity Contribution

Investment: The port will contribute €2 million from its own reserves, which have been built up from past surpluses, port dues, and environmental fees.

Use of Funds: This investment will cover preliminary expenses, such as feasibility studies, environmental assessments, and site preparations.

Private Sector Partnership: Energy Utility Investment

Involvement: A local energy utility company will invest €1.5 million in the project. The utility will handle the distribution of electricity and manage the operation of the electrolyzer.

Business Model: The utility expects to generate revenue from both selling electricity to docked ships and selling hydrogen and oxygen produced by the electrolyzer. The oxygen produced offers a new market opportunity, especially in industries that require high-purity oxygen, such as steel production, water treatment, and healthcare.

Revenue Streams: The utility will recover its investment through the sale of shore power, hydrogen, and oxygen over long-term contracts with customers in the port and surrounding industrial areas.

4. Implementation Plan and Contractual Agreements

Shore Power and Hydrogen/Oxygen Production Integration

Energy Source: The port will source renewable electricity from local wind and solar farms or the national grid. The shore power system will prioritize docked ships, but during periods of low demand, surplus electricity will power the electrolyzer.

Hydrogen and Oxygen Usage:

Hydrogen: Green hydrogen will be used to fuel port machinery, such as hydrogen-powered trucks and cranes. Surplus hydrogen will be sold to nearby industries or transportation companies adopting hydrogen-powered fleets.

Oxygen: The high-purity oxygen produced as a byproduct can be sold to industrial buyers in sectors like manufacturing, chemical processing, and medical services. This adds a valuable revenue stream that enhances the financial viability of the project.

Power Purchase Agreements (PPAs)

Shore Power Contracts: The port will establish long-term agreements with shipping lines, ensuring regular use of shore power facilities. The competitive pricing compared to onboard diesel generation will incentivize ship operators to utilize the system.

Hydrogen and Oxygen Offtake Agreements: The port will also negotiate long-term contracts with industrial users for both hydrogen and oxygen. Local industries, logistics companies, and municipal services that are transitioning to hydrogen will be prime customers. Oxygen will also be supplied to sectors such as steel manufacturing and healthcare facilities.

Financial and Environmental Risk Management

Revenue Streams: The combination of shore power, hydrogen, and oxygen production diversifies the port's revenue sources. This reduces financial risk by not relying solely on one output and opens multiple income opportunities.

Environmental Compliance: The project will significantly reduce CO2 emissions in the port area and contribute to EU climate goals. By producing green hydrogen and capturing oxygen for industrial use, the port will further reduce the need for fossil fuels in multiple sectors, increasing its environmental contribution.

Risk Mitigation: Contracts will include flexible terms, allowing price adjustments based on market conditions for hydrogen and oxygen. The port will also invest in storage infrastructure to manage fluctuations in supply and demand for hydrogen and oxygen.

4.1.5 Conclusion

The SEANERGY Handbook streamlines complex technical information from the Master Plan, making it accessible to users within the port environment. This user-friendly resource guides stakeholders, port staff, and future professionals through the steps of port energy transition.

Furthermore, the HB offers practical templates to support ports in data collection, performance analysis, monitoring, financing, planning, and innovative action implementation. These tools provide tailored guidance for stakeholders at various stages of the energy transition process. By providing specific tips and comments based on individual port needs, the recommendations hereby are to stay always relevant and applicable. This supports training and reskilling initiatives, equipping stakeholders with the tools necessary to successfully implement the SEANERGY Master Plan in ports throughout the EU.

Our handbook is also valuable for academic courses, providing future professionals with hands-on training and educational content. The templates can be used by students in the SEANERGY Academic-Industry Course Modules to apply theoretical knowledge to practical scenarios.

By utilizing the toolkit provided in the handbook, ports can develop comprehensive sustainability strategies aligned with the EU Green Deal objectives. This directly contributes to a more sustainable and resilient future for ports and the wider maritime industry.

Therefore, the SEANERGY Handbook empowers ports to implement energy transition strategies efficiently and effectively, while mitigating risks and improving their overall sustainability performance. Thus, it enables ports and stakeholders to assess the broader implications of their decisions in green energy transition, aware of the potential benefits and drawbacks of different strategies.

Fundamentally, by using the SEANERGY Handbook, ports can take action to achieve their sustainability goals and implement practical strategies for energy transition before 2030 and beyond.