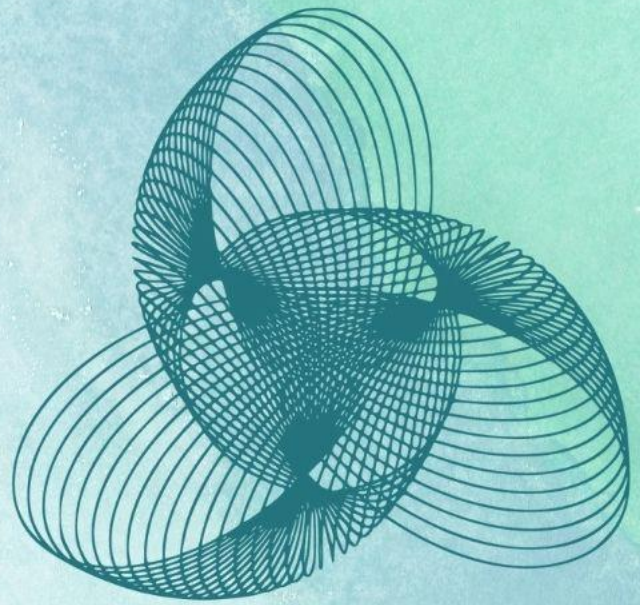

SEANERGY

the Sustainability EducationAl programme for greeNER fuels and enerGY on ports

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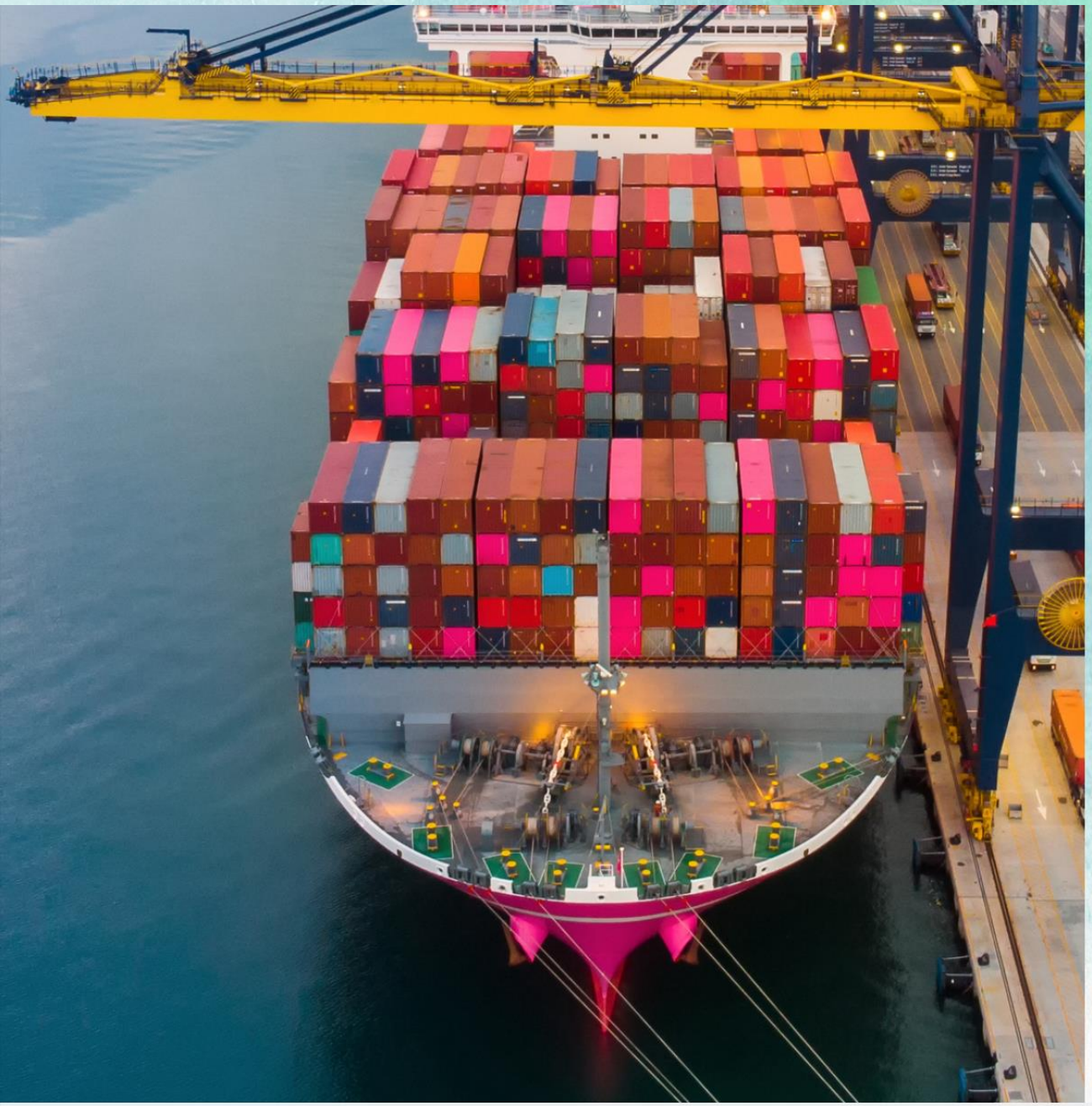

BACKGROUND

SEANERGY

The ports industry is one of the economic pillars of the European community as most imported and exported goods pass through ports. On average, 74% of goods imported and exported go through seaports.

However, ports are responsible for a significant rise of environmental impacts, for example through carbon emissions, soil and water pollution as well as loss of biodiversity.

SEANERGY will create a Master Plan that aims to solve this challenge.

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12 EUROPEAN PARTNERS

JOINING FORCES TO TRANSFORM PORTS INTO CLEAN ENERGY HUBS

The SEANERGY project aims to go towards zero-emission ports, becoming clean energy hubs for integrated electricity systems, hydrogen, and other low-carbon fuels, as much as testbeds for waste reuse and the circular economy through the creation of the SEANERGY Master Plan.

SEANERGY

KEY FACTS

12
PARTNERS

9
COUNTRIES

30
MONTHS

4
STAGES OF DEVELOPMENT

€ 2.49
MILLIONS IN FOUNDING

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magellan circle
EUROPEAN AFFAIRS CONSULTANCY

IHE DELFT
Institute for Water Education under the auspices of UNESCO

ENNSHAFEN

RINA

ATPERSON

DAFNI
Network of Sustainable Greek Islands

WMU WORLD MARITIME UNIVERSITY

FUNDACIÓN VALENCIAPORT

ANLEG
Advanced Technologie

ZERO-E ENGINEERING

FutureProof Shipping

ECO IMAGINATION

THE CONSORTIUM

SEANERGY

The SEANERGY project is led by Magellan circle and formed by Ennshafen, Atperson, Anleg, DAFNI, World Maritime University, Rina, Institute for Water Education, Fundacion Valenciaport, Zero-E Engineering, Future Proof Shipping and Eco Imagination

9 European Countries

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GOAL

The SEANERGY project will develop by Spring 2025 a Master Plan that will present goals, objectives, training modules, and directions for short-, medium- and long-term operations that will allow stakeholders to assess, plan and execute activities to transform ports into clean energy hubs.

The SEANERGY Master Plan will become the main reference for all EU port institutions in their energy and fuel transition.

IMPACT

SEANERGY

2030

Reduce emissions by 55%

2050

Reach net zero emission

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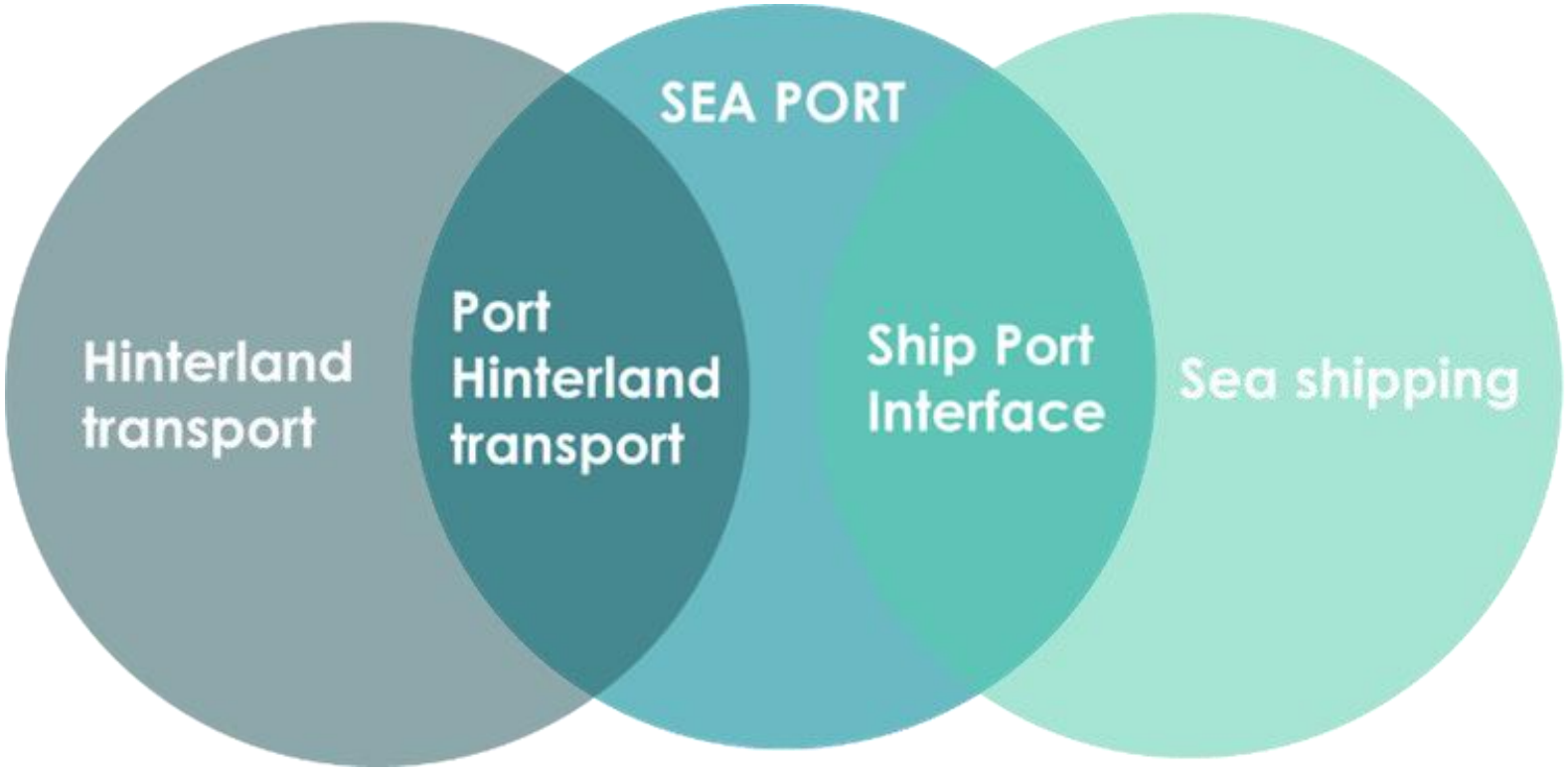
Scope of SEANERGY



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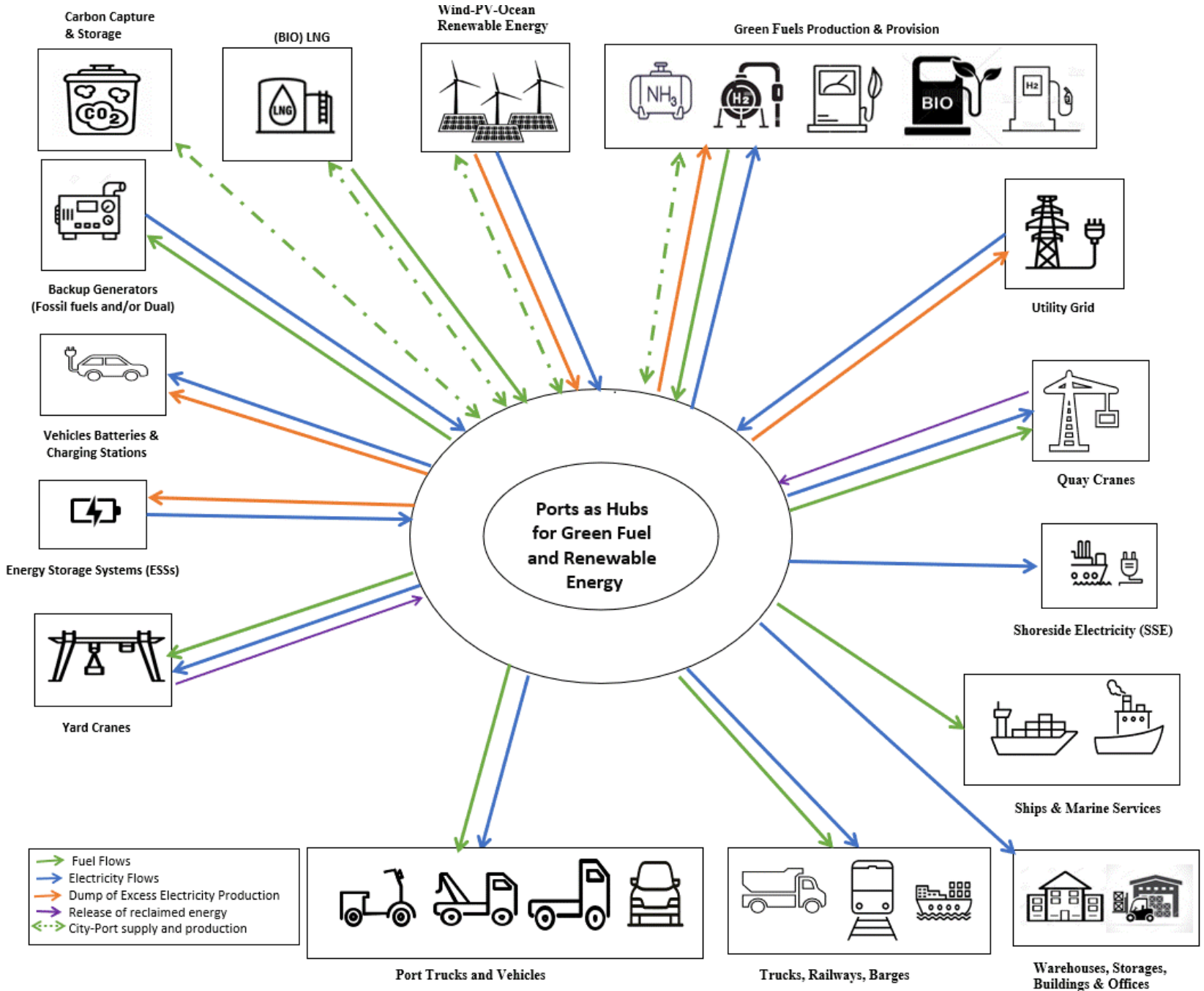
Framework of SEANERGY



PROJECT DEVELOPMENT

STAGE 1

Understanding the current EU ports' situation and stakeholders.

STAGE 2

Gap analysis of the EU port clean energy transition.

STAGE 3

Creating the SEANERGY Master Plan.

STAGE 4

Implementing the SEANERGY Master Plan.

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What is achieved so far in SEANERGY? – STAGE 1 & STAGE 2

SEANERGY

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

EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA)

D1.1 Report on Stakeholders Framework & Database

A framework for the management of ports' stakeholders involved in the energy transition to green fuels and renewable energy

Lead Partner: World Maritime University (WMU)

Author(s): Fabio Ballini, Anas S. Alamoush, Monica Canepa

Date: 9/1/2023

This document is the SEANERGY project **"Report on Stakeholders Framework & Database"** (contract no. 101075710) corresponding to **D1.1 (Month 4)** led by **"World Maritime University".**

This project has received funding from the European Union's Horizon Europe research and innovation program under grant agreement number 101075710. This visual support reflects only the author's view. The Commission is not responsible for any use that may be made of the information it contains.

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

EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA)

D.1.2: Catalogue of technologies for Maritime and Coastal Communities and Ports

Lead Partner: Fundación Valenciaport (FV)

Author(s): Josep Sanz Argent, Marina Arroyo Bovea

Date: 15 March 2023

This document is the SEANERGY project **"Catalogue of technologies for Maritime and Coastal Communities and Ports"** (contract no. 101075710) corresponding to **D1.2 (Month 4)** led by **"Fundación Valenciaport (FV)".**

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

EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA)

D.1.3: Results of demo-ports' LCA & ESG sustainability assessments

Lead Partner(s): Zero Emissions Engineering B.V. (ZERO-E) and World Maritime University (WMU)

Author(s): Ana Gomez, Johann Ramirez, Lorena Peña, Fabio Ballini, Peyman Ghaforian, Natalia Calderon

Date: 31 July 2023

This document is the SEANERGY project **"Results of demo-port's LCA & ESG sustainability assessments"** (contract no. 101075710) corresponding to **D1.3 (Month 8)** led by **"Zero Emissions Engineering B.V. (ZERO-E)".**

This project has received funding from the European Union's Horizon Europe research and innovation program under grant agreement number 101075710. This visual support reflects only

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

EUROPEAN CLIMATE, INFRASTRUCTURE AND ENVIRONMENT EXECUTIVE AGENCY (CINEA)

D2.1 Report of stakeholders' know-how limitations

Lead Partner: World Maritime University (WMU)

Author(s): Fabio Ballini, Anas S. Alamoush, Peyman Ghaforian Masodzadeh, Monica Canepa, Eldon R. Rene, Capucine Dupont, Reza Karimpour

Part one: Role of Ports in Maritime Energy Transition: Trends, Drivers, Barriers, and Solutions
Author(s): Fabio Ballini, Peyman Ghaforian Masodzadeh, Anas S. Alamoush, and Monica Canepa

Part two: Cultural analysis and social inclusion approach: The role of women in the port and port logistics
Author(s): Eldon R. Rene and Capucine Dupont

Part three: Key tools and certifications for the port energy transition
Author(s): Reza Karimpour

Date: 31/07/2023

This document is the SEANERGY project **"Report of stakeholders' know-how limitations"** (contract no. 101075710) corresponding to **D2.1 (Month 8)** led by **"World Maritime University".**

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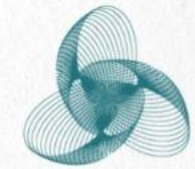
D1.1 - Stakeholders' expected role / interest in energy transition

	Stakeholders' groups	Expected role (take from excel sheet)
1	**Port managing body**	Conduct environmental impact assessments (EIA), and societal impact assessments including safety and security, to understand the implications of ETP on the natural environment and society. Ensure effective and economical use of resources (profitability). Provide financial support. Inclusion of green solutions in revamping projects of present technologies and assets. Support regulatory and operational gaps related to green solutions and their application to green projects. Provide incentives and share information. Create and manage the Stakeholders collaboration scheme
2	**Shareholders**	Investment and promotion in projects to support renewable energy and green fuel use in ports
3	**Port services providers**	Support the identification of any logistical and operational difficulties due to the installation of new technologies and new energy production plants. Adapt their practices to new technologies implemented in the ports. Reduce their own carbon footprint by transitioning from fossil fuels
4	**Concessionaires**	Be involved in the new energy transition project and encourage reporting any economic/technical and logistical problems. Cooperate to reduce their own carbon footprint, host clean energy units in buildings, and co-invest with port managing companies or authorities. Reduce their own carbon footprint by transitioning from fossil fuels
5	**Maritime authority**	Green licensing. Promotion of innovative project development that makes ports greener. In case of regulatory gaps, simplify procedures to enable the carrying out of the green and energy transition.
6	**Carriers**	Be involved in the use of new technologies and new fuels and report any economic/technical and logistical problems. Adapt ships and crew to new port procedures and infrastructure. Reduce carbon footprint in ports through the use of low carbon options (e.g. alternative fuels and onshore power supply)
7	**Employees and trade unions**	Be involved in the use of new technologies and new fuels and report any economic/technical and logistical problems. Train, reskill, and upskill labor to run the new green and energy technologies. Ensure occupational health and safety of employees, and protect their rights
8	**Port users**	Be involved in the new project and encourage to report any economic/technical and logistical problems. Provide feedback on how proposed actions affect user experience. Reduce their own carbon footprint by transitioning from fossil fuels
9	**Passengers**	Inform them about the port transition to greener and energy efficiency and the CO2 abated therein. Inform them about the value of selecting greener transport. Ask for feedback on how proposed actions affect user experience. Ensure that the ETP that their amenity and safety are not compromised

10	**The financial community**	Development of investment to support future energy and green technology investment projects. Return on investment.
11	**Local community and societal groups of interest**	Acceptance of new technologies. Be informed about the value of the energy transition projects and encourage their involvement to report arising issues, e.g., Economic, technical, social, environmental, and logistical problems. Ensure that the ETP does not affect their amenity and the environment.
12	**Regulators Local**	Implementation at the local level of the national regulations and proposal of initiatives "bottom-up" for the promotion of innovative solutions for the ports' energy transition (decarbonization). Green licensing. Ensuring that ETP complies with national/international rules and regulations
13	**Regulators national**	Transposition of the European directives and indications, and emanation of laws and incentives in order to support the development and the construction of new plants and technologies to make ports greener and decarbonized. Ensuring that ETP complies with national/international rules and regulations
14	**Regulators regional**	Promotion of green solutions development for ports through research projects and guidelines. Stimulation of the countries to promote green fuel use and integrate renewable energy sources inside the ports. Ensuring that ETP complies with national/international rules and regulations
15	**Regulators international**	Introduce decarbonization of ports and energy transition into their activities. Identify the potential regulatory gaps and solutions to overcome them
16	**International organizations and trade associations**	Support, coordinate, and collaborate with ports for the proper conduct of port energy transition (decarbonization). Conduct seminars and workshops to exchange experience and technology transfer among world ports
17	**Media**	Focus on the opportunities linked to the energy transition of individual ports and the benefits and changes in the environmental and socioeconomic context. Promote best practices and green branding of ports
18	**Research and education**	Increase research and dissemination of port energy transition technologies, and provide solid technical, economic, and social knowledge. Feasibility studies about the technologies, Development of knowledge, training, demonstration, and testing of available decarbonization technologies
19	**Technology Developers and Manufacturers**	Ensure successful procurement and supply of materials. Support the ports that want to include green technologies and fuels through tailor-made technical solutions. Implementation of own solutions in order to overcome the potential obstacles in the project planning and building phases. Test and validate innovative solutions for decarbonisation from concept to a commercial stage
20	**Energy providers**	Ensure successful procurement and supply of materials. Support to the development of new infrastructure to promote the integration of renewable energy and the use of green Fuels. Secure electrification of ports, and upgrade local grids.
21	**Energy and technology adoption and projects managers, including consultants**	Ensure successful procurement and supply of materials. Carry out their respective duties professionally. Ensure safe, efficient, and successful implementation of the energy transition technologies during the project. Communicate with stakeholders, update stakeholders' profiles
22	**Consumers**	Indirectly influence their logistics service providers to use green port services than other ports with higher footprint (not yet green). Normal and regular transactions



D.1.2: Catalogue of technologies for Maritime and Coastal Communities and Ports

SEANERGY

The catalogue is:

- divided into ten subsections representing different equipment categories used in the maritime sector.
- It offers a comprehensive resource for ports and maritime companies to guide their decarbonization strategies and investments.
- over 90 technologies included, a wide range of solutions for sustainable energy generation and decarbonization.

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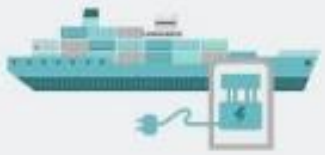
D.1.2: SEANERGY website catalogue interface

SEANERGY



Vessels electricity

ICE, fuel cell

Cargo Handling Equipment (CHE)

Trucks

Other Mobile

Fuel producers

Fuel production technologies

Carbon Capture

Energy efficiency

Electricity production

D.1.2: Sample of vessels' electricity section

Vessels electricity

Type of solutions

Type of vessels

- Cruise
- Containerships
- Ro-ro
- Ro-pax
- Other/all

Manufacturer:
Volterion

Model:
Mobile SPO

Availability:
Commercial

Comments:

Shore power connections used to be installed permanently in sockets set into the quay.

Source: https://www.igus.es/info/industrias-ochain-reel

Manufacturer:
olterion

Model:
martSTACK

vailability:
ommercial

Comments:

Flow-Battery-Stacks that consist of multiple electrochemical cells which are stacked together.

Source: https://www.volterion.com/en/stacks-en-neu/

Manufacturer:
WATTALPS

Model:
Battery model

Availability:
Commercial

Comments:

Patented immersion cooling.

Source: https://www.wattalps.com/wp-content/uploads/2021/11/FTRA0003-UK.pdf

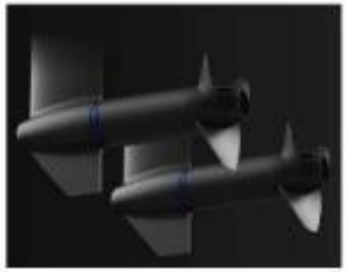
Manufacturer:
Zparq

Model:
OEM motor

Availability:
pilot

Comments:

High power, high efficiency submerged electric motor system for propeller-driven watercraft.



Source: https://zparq.se/#products

D.1.2: Some examples of Vessels' electricity technologies

#	Type of solution	Type of vessel	Manufacturer	Model	Availability	Price range	Comments	Source
1	Cable management	Other/all	Igus	Mobile SPO	Commercial	-	Shore power connections used to be installed permanently in sockets set into the quay	https://www.igus.eu/info/industries-echain-reel
2	Electronics	Other/all	Volterion	smartSTACK	Commercial	-	Flow-Battery-Stacks consist of multiple electrochemical cells which are stacked together	https://www.volterion.com/en/stacks-en-neu/
3	Electronics	Other/all	WATTALPS	Battery model	Commercial	-	Patented immersion cooling	https://www.wattalps.com/wp-content/uploads/2021/11/FTWA0003-UK.pdf
4	Electronics	Other/all	Zparq	OEM motor	Pilot	-	High power, high efficiency submerged electric motor system for propeller-driven watercraft	https://zparq.se/#products
5	Electronics	Other/all	Skeleton	SkelCap supercapacitor	Commercial	-	Ultracapacitors to store energy during heave-up movements, and then discharge the energy when needed	https://1188159.fs1.hubspotusercontent-na1.net/hubfs/1188159/02-DS-220909-SKELCAP-CELLS-1D-1.pdf
6	Electronics	Other/all	Elestor	Bromine flow battery	Pilot	-	Low-cost electricity storage systems with an extensive lifespan, based on hydrogen bromine flow battery	https://www.elestor.nl/
7	Batteries	Other/all	CORVUS	BOB Container	Commercial	-	Standardized modular battery room solution available in 10-foot and 20-foot ISO high-cube container sizes	https://corvusenergy.com/products/energy-storage-solutions/corvus-bob-container/
8	Electronics	Containerships	Igus	IMSPO	Commercial	-	Self-propelled and can be positioned anywhere along the berth	https://www.igus.eu/info/industries-mobile-shore-power-outlet-long-travel
9	Batteries	Other/all	Shift	Pwr-Swäp	Commercial	-	"Pay-As-You-Go" service delivering clean and reliable renewable energy with no risk	https://shift-cleanenergy.com/pwr-swap/
10	Other	Other/all	Generic	-	Commercial	-	-	-

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D.1.2: Some examples of ICE fuel cell technologies

#	Type of solution	Subclass	Application	Fuel	Power range (kW)	Manufacturer	Model	Availability	Price range	Comments	Source
1	Fuel cell	Fuel cells - PEM	Domestic vessels	Hydrogen	200	Ballard	FCWAVE	Commercial	-	World's first DNV Type Approved Fuel Cell for marine applications	https://www.ballard.com/docs/default-source/spec-sheets/fcwavetm-specification-sheet.pdf?sfvrsn=6e44dd80_12
2	Internal combustion engine (ICE)	Engine - 4 strokes	Domestic vessels	Hydrogen	2700	Anglo Belgian Corporation	16DZD BEHYDRO	Commercial	-	Operating on 85% hydrogen gas and 15% conventional fuel	https://www.abc-engines.com/en/markets/marine-propulsion/product/16dzd-behydro
3	Fuel cell	Fuel cells - PEM	Domestic vessels	Hydrogen	100	NedStack	MT-FCPI-100	Commercial	-	Zero-emission shipping enabler	https://nedstack.com/en/pemgen-solutions/maritime-power-installations/pemgen-mt-fcpi-100
4	Fuel cell	Fuel cells - PEM	Domestic vessels	Hydrogen	500	NedStack	MT-FCPI-500	Commercial	-	Compact and robust LT-PEM power supply option for inland waterways or in short-sea domain	https://nedstack.com/en/pemgen-solutions/maritime-power-installations/pemgen-mt-fcpi-500
5	Fuel cell	Fuel cells - PEM	Domestic vessels	Hydrogen	200	PowerCell	Marine System 200	Commercial	-	Designed to accomplish compact integration together with high power output	https://powercellgroup.com/product/marine-system-200/
6	Fuel cell	Fuel cells - PEM	Domestic vessels	Hydrogen	400	TECO 2030	FCM 400	Pilot	-	Compact system size (less than 2/3 of a comparable diesel genset), which simplifies retrofitting	https://teco2030.no/solutions/teco-marine-fuel-cell/
7	Fuel cell	Fuel cells - SOFC	Domestic vessels	Flex (Ammonia, Methanol, etc.)	2000	Alma Clean Power	-	Pilot	-	Clean power systems for ocean industries and other remotely located power needs	https://almacleanpower.com/what-we-do

D.1.2: Some examples of CHE technologies

#	Type of terminal	Type of equipment	Technology	Fuel	Model	Availability	Price range	Comments	Source
1	Container	RTG	Pure electric	Electric	Kalmar Zero-Emission RTGs	Commercial	-	Safe working load SWL 41 t	https://www.kalmarglobal.com/equipment-services/rtg-cranes/zero-emission/
2	Container	Straddle carrier	Hybrid	Diesel/Electric	Kalmar FastCharge™ Straddle Carrier	Commercial	-	Lifting capacity 40/50/60 t	https://www.kalmarglobal.com/equipment-services/straddle-carriers/fastcharge-straddle/#
3	Container	Other	Pure electric	Electric	Kalmar Electric RMG	Commercial	-	Safe working load SWL 41 t	https://www.kalmarglobal.com/equipment-services/rail-mounted-gantry-cranes/
4	Other	Other	Fuel cell	Hydrogen	Fuel Cell H2	Commercial	-	Energy generator	https://www.gaussin.com/h2-powered-generator
5	Container	RTG	Hybrid	Diesel/Electric	ARTG System Version 2.0	Commercial	-	Total load 50,8t	https://www.konecranes.com/sites/default/files/2021-01/Hybrid%20Retrofit_2020%20%2802%29.pdf
6	Container	RTG	Pure electric	Electric	B-RTG	Commercial	-	Battery packs available: liquid-cooled with 4 or 8 hours	https://www.konecranes.com/sites/default/files/2022-08/Battery%20RTG_Tech%20Spec_EN.pdf
7	Container	Straddle carrier	Hybrid	Diesel/Electric	Battery Konecranes Noell Straddle Carrier	Commercial	-	6 battery modules, for total 4-hr capacity	https://www.konecranes.com/sites/default/files/2022-06/Battery_Konecranes_Noell_Straddle_Carrier_EN.pdf
8	Container	Other	Hybrid	Diesel/Electric	Generation 6 Mobile Harbor Cranes	Commercial	-	Maximum lifting capacity of 200 t	https://www.konecranes.com/sites/default/files/2022-04/KC_GEN6_brochure_web_EN_FINAL_220222.pdf
9	Container	Straddle carrier	Hybrid	Diesel/Electric	SPRINTER CARRIERS	Commercial	-	Maximum lifting capacity 60 t	https://www.konecranes.com/sites/default/files/download/kc-spc-en-01.pdf
10	Container	Terminal tractors	Pure electric	Electric	Kalmar ERG420-450	Commercial	-	Lifting capacities up to 45 tonnes	https://www.kalmarglobal.com/equipment-services/reachstackers/electric-reachstacker/
11	Container	Terminal tractors	Pure electric	Electric	YT203-EV terminal tractor	Commercial	-	Vehicles can use any charger with a	https://www.terbergspecialvehicles.com/en/development/electric/

D.1.2: Some examples of truck technologies

SEANERGY

#	Technology	Type	Fuel	Power range (hp)	Fuel Storage	Manufacturer	Model	Availability	Price range	Comments	Source
1	Hybrid	Tractor	Diesel	220 - 360	-	SCANIA	HEV/PHEV	Commercial	-	Up to 42 tonnes	https://www.scania.com/group/en/home/products-and-services/trucks/plug-in-hybrid-truck.html
2	Pure Electric	Tractor	Electric	645	773 kWh	Nikola/IVECO	TRE	Commercial	-	Up to 42 tonnes	https://nikolamotor.com/tre-bev
3	Fuel Cell	Tractor	Hydrogen	-	-	Volvo Truck		Pilot	-	Up to 65	https://www.volvotrucks.es/es-es/news/press-releases/2022/jun/volvo-trucks-showcases-new-zero-emissions-truck.html
4	Pure Electric	Tractor	Electric	-	-	Volvo Trucks		Commercial	-	Finding the right flows and transport patterns, close to easily accessible charging infrastructure	https://www.worldcargonews.com/news/electric-drayage-trucks-start-calling-at-gothenburg-70812
5	Pure Electric	Tractor	Electric	560	12 kWh	Toyota/Kenworth	T680 FCEV	Commercial	-	Range of about 300+ miles when fully loaded to 82,000 lbs. with no downtime between shifts for charging	https://www.kenworth.com/about-us/news/toyota-kenworth-prove-fuel-cell-electric-truck-capabilities-with-successful-completion-of-truck-operations-for-zanzeff-project/
6	Pure Electric	Tractor	Electric	-	-	TransPower	ElecTruck	Commercial	-	Technological innovations in energy storage, power conversion, and vehicle control	https://transpowerusa.com/
7	Pure Electric	Tractor	Electric	-	-	Orange EV	e-TRIEVER	Commercial	-	Batteries can charge fully in as little as 2 hours	https://orangeev.com/electric-trucks/

D.1.2: Some examples of electricity production technologies

#	Type of solution	Manufacturer	Power	Availability	Price range	Comments	Source
1	Solar	Tesla	400 W	Commercial	-	Dimensions 74.4" x 41.2" x 1.57" (including frame)	https://www.tesla.com/solarpanels
2	Solar	Electromur	990 MWh/year	Pilot	-	The project is expected to make Gandia the first European port to be energy self-sufficient	https://www.offshore-energy.biz/spains-gandia-to-house-europes-1st-energy-self-sufficient-port/
3	Wind	Vestas	15 MW	Commercial	850000 €/MW	Swept area of 43,742 m2 and a capacity factor of over 60% from the 115.5m blades	https://www.vestas.com/en/products/offshore/V236-15MW
4	Solar	Victron Energy	20-360 W	Commercial	2000 €/kWp	Exceptional low-light performance and high sensitivity to light across the entire solar spectrum	https://www.victronenergy.com.es/upload/documents/Datasheet-BlueSolar-Monocrystalline-Panels-ES.pdf
5	Solar	Jinko	635 W	Commercial	1850 €/kWp	23,23% efficiency, 85% max. bifaciality	https://www.jinkosolar.com/en/site/tigerneo#s1
6	Storage	Siemens Energy	-	Commercial	250-500€/kWh	BlueVault™ Energy Storage Solutions aimed for vessel energy storage	https://www.siemens-energy.com/global/en/offerings/storage-solutions/battery-energy-storage/bluevault.html
7	Storage	IHE	-	Pilot	-	Hydropower pump storage from tidal energy in inland lagoons. Being developed at IHE, lab-scale.	https://www.un-ihe.org/
8	Other	EcoWave Power	-	Commercial	-	Floaters draw energy from incoming waves by converting the rising and falling motion of the waves into an clean energy generation process	https://www.ecowavepower.com/
9	Solar	Generic	500W	Commercial	2000€/kWp	-	-
10	Wind	Generic	1000W	Commercial	1000€/kW	-	-
11	Storage	Generic	-	Commercial	325€/kWh	-	https://www.nrel.gov/docs/fy21osti/79236.pdf

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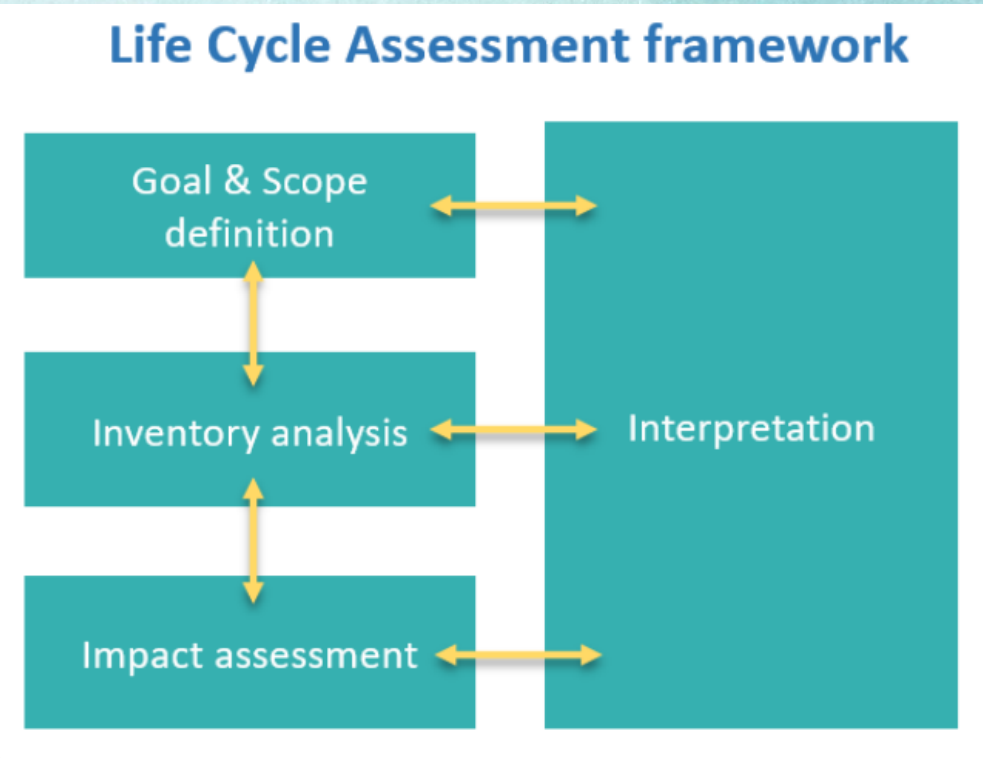
D1.3: LCA assessment framework



Main purpose: analyse the use of energy to quantify the carbon footprint and GHG emissions generated by standard operations in the daily activities

Methodology: LCA evaluates environmental impacts of products or services, adhering to ISO 14040 and ISO 14044 standards.

4 Phases of LCA:

- **Goal & Scope**: Set objectives and study range, defining the functional unit (FU) for calculations (e.g., volume, weight).
- **Inventory Analysis** (LCI): Collect data based on the scope, covering all inputs and outputs.
- **Impact Assessment** (LCIA): Calculate environmental impacts using various methodologies (e.g., IPCC, ReCiPe). Measures are in terms of FU (e.g., kgCO2eq/FU).
- **Interpretation**: Analyze results, identify opportunities and make recommendations.

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D1.3: Some results

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Port of Valencia LCA

The Port of Valencia in Spain covers 5.6 km² and handles various cargo types with specialized facilities. It has 12,000+ meters of docks, 30+ gantry cranes, and 300 hectares of storage.

The functional unit (FU) for the LCA is 1 TEU (Twenty-foot equivalent unit), a standard for cargo capacity. In 2021 and 2022, the port processed 5.6 million and 5.05 million TEU, respectively.

Life Cycle Inventory (LCI)

Life Cycle Impact Assessment(LCIA)

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D1.3: Some results

Port of Valencia LCA
Life Cycle Inventory (LCI):

Data Sources: Provided by Fundacion Valenciaport, Emissions report (2016), Carbon footprint guide (2020)

Key Equipment and Consumption:
- Tugboats, vessels use marine gas oil, measured in kWh
- Cranes, forklifts use certified renewable energy
- Trucks, other handlers use diesel, measured in liters
- Assumed average distances and consumption rates for trucks

Key Assumptions:
- Fuel conversion to kg for SimaPro software using calorific values
- Trucks make 1,430,000 trips/year, consuming 5,720,000L diesel/year
- Renewable energy mainly from wind, hydro, and PV
- Electric forklifts have 75% energy savings compared to diesel

Data Entry into SimaPro:
- Fuel consumption converted to kg or kWh
- Ecoinvent v3.9.1 database used for emissions calculation

Major Fuel Consumption Figures for SimaPro:
- Tugboats: ~3.17 million kg diesel
- Vessels: ~7.71 million kg diesel
- Trucks: ~4.86 million kg diesel
- RTG Electric Crane: ~342,000 kWh
- Port Facilities: ~8.87 million kWh

Notes:
Some data, especially for renewable energy types, was limited or approximated. LCI data aids in calculating environmental impacts.

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D1.3: Some results

Port of Valencia LCA
Life Cycle Impact Assessment(LCIA)

IMPACT CATEGORY	TOTAL	UNIT
Global warming	7.9410086	kg CO2 eq
Stratospheric ozone depletion	0.0000010	kg CFC11 eq
Ionizing radiation	0.7195070	kBq Co-60 eq
Ozone formation, Human health	0.0141776	kg NOx eq
Fine particulate matter formation	0.0010799	kg PM2.5 eq
Terrestrial ecotoxicity	5.3584793	kg 1,4-DCB
Freshwater ecotoxicity	0.1021261	kg 1,4-DCB
Marine ecotoxicity	0.0332151	kg 1,4-DCB
Human carcinogenic toxicity	0.0012436	kg 1,4-DCB
Human non-carcinogenic toxicity	0.0852916	kg 1,4-DCB
Fossil resource scarcity	5.8419633	kg oil eq
Water consumption	0.0204112	m^3

After introducing the LCI datasets (in the previous page) into the SimaPro software, the results obtained for the Life Cycle Impact Assessment of the Port of Valencia were summarized in this Table, which shows the total emissions of the port in each impact category per unit of TEU.

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D1.3: Some results

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- Diesel-powered sources at the Port of Valencia constitute around 70% of the total CO2-eq emissions per TEU.
- These sources include commercial vessels, diesel-fueled RTG cranes, terminal tractors, and trucks.
- In contrast, at Syros Port, the majority of CO2-eq emissions per ship are associated with marine diesel used by vessels.
- In Valencia, though energy and fuels are integral to daily operations, mitigating environmental impact may require increased operational efficiency and potentially adopting renewable energy sources.
- In Syros, given the impact of marine diesel, alternatives may include route efficiency, engine maintenance, engine or vessel upgrades, or adopting renewable energy sources like hydrogen or natural gas

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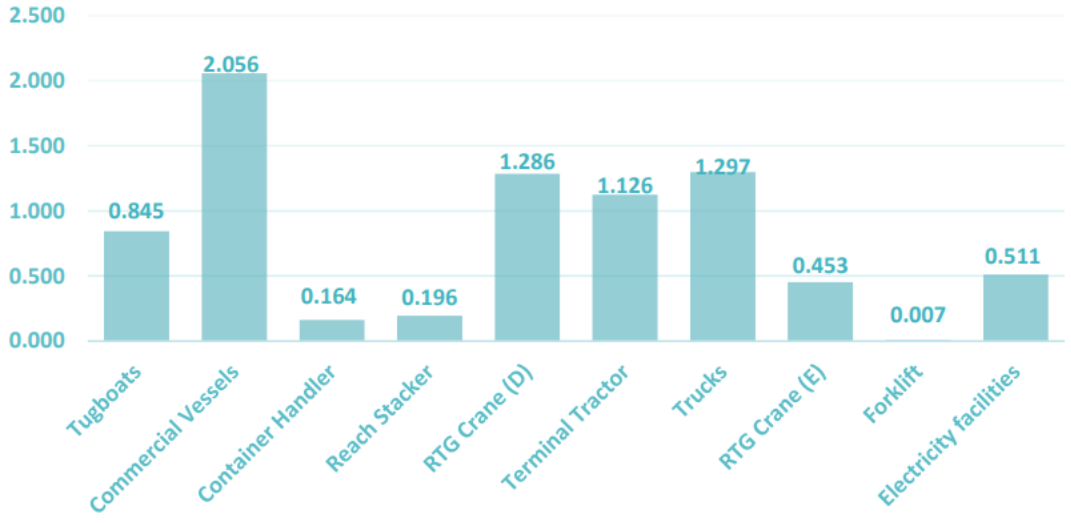
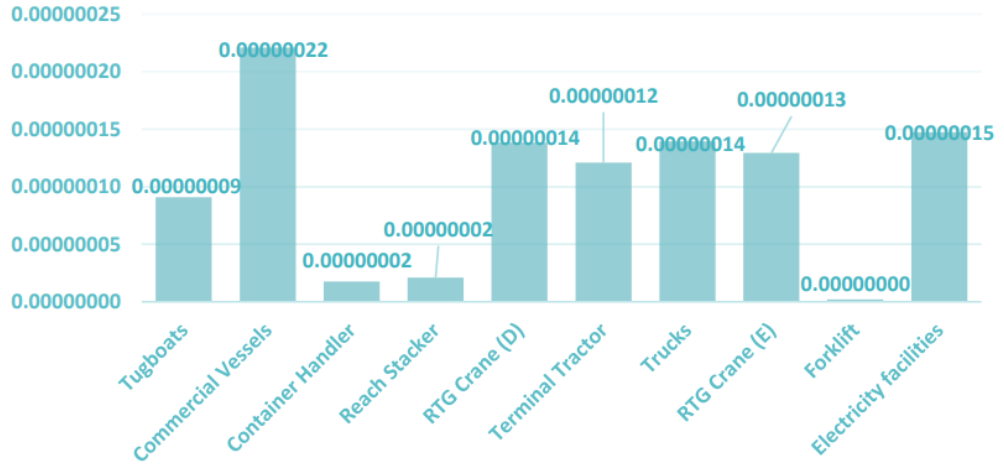
GLOBAL WARMING KG CO2 EQ



STRATOSPHERIC OZONE DEPLETION KG CFC11 EQ



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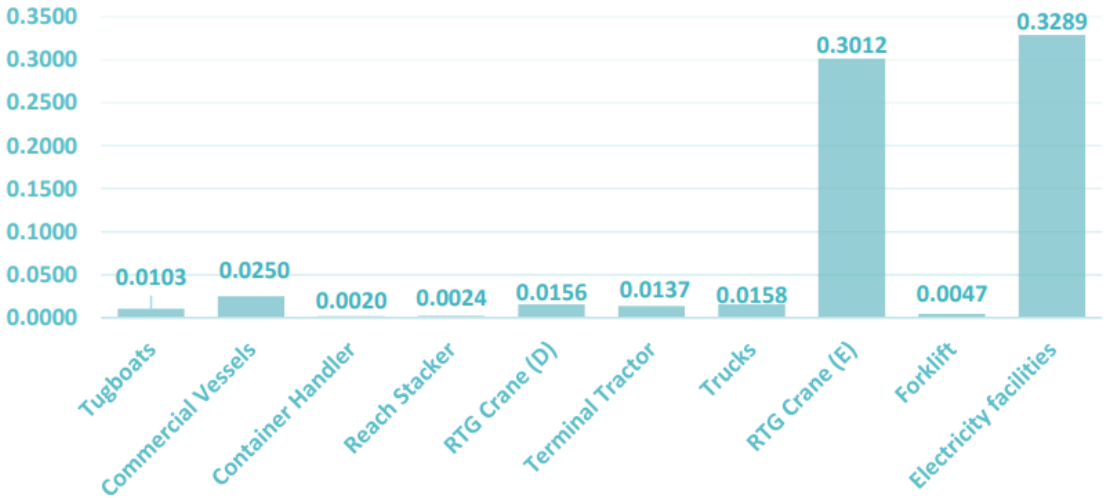
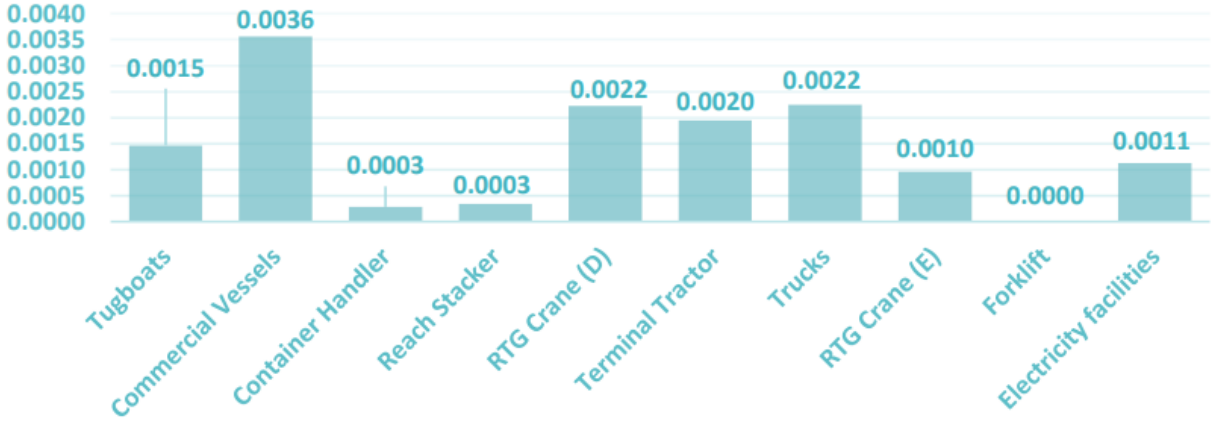
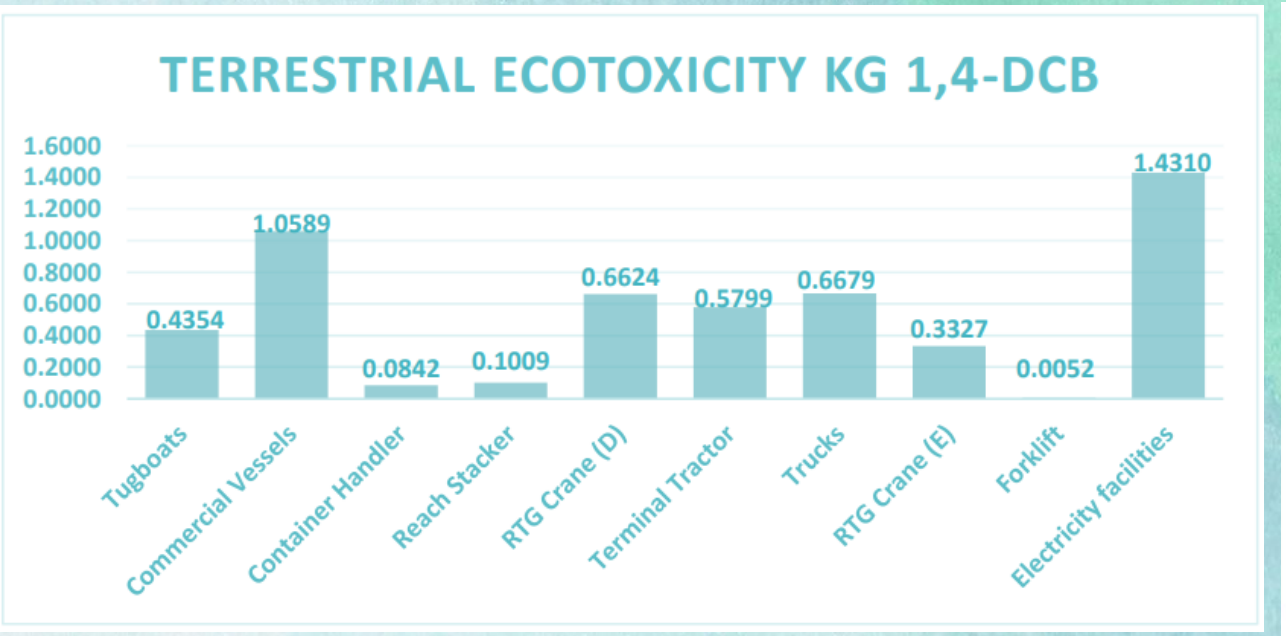
IONIZING RADIATION KBQ CO-60 EQ



OZONE FORMATION, HUMAN HEALTH KG NOX EQ





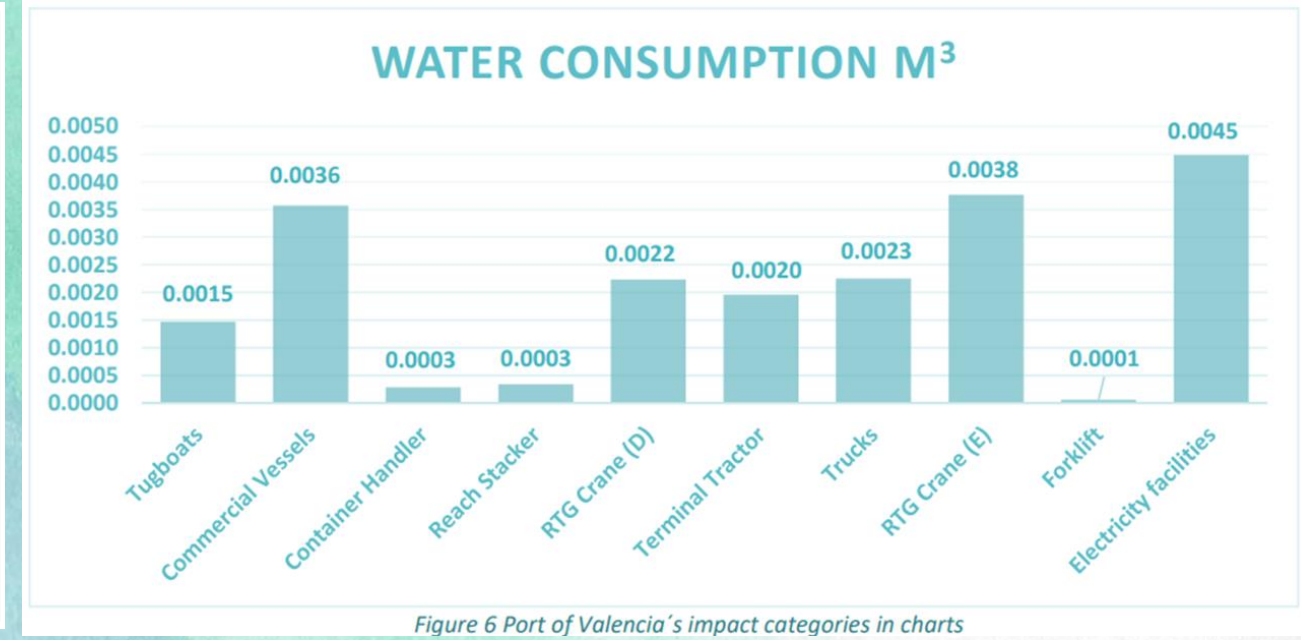


Figure 6 Port of Valencia´s impact categories in charts

Three Logistics Stages: Port hinterland transport, Port storage, Ship-port interface

Energy Sources: Renewable energy for electricity, Diesel for land transportation (trucks)

Key Points:

- Equipment at the ship-port interface (cranes, forklifts) is electric, reducing impact.
- High energy consumption occurs in container movement (upload/download of TEUs).
- If cranes and forklifts used fuel, the impact would be higher (e.g., Syros Port).
- Trucks are the primary source of environmental impact due to fuel consumption.

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Table 5 Port of Valencia´s total CO2 emissions

SOURCE	TOTAL EMISSIONS (kgCO2)
Tugboats	10,140,000
Commercial Vessels	24,669,000
Container Handler	916,484.7069
Reach Stacker	1,098,229.1854
RTG Crane (D)	7,207,680.9655
Terminal Tractor	6,310,468.4892
Trucks	15,558,000
RTG Crane (E)	2,540,496.7069
Forklift	39,490.8457
Electricity facilities	2,865,311.0668
TOTAL	**71,345,161.9664**

Table 6 Suggested Port of Valencia´s CO2 emissions

SOURCE	TOTAL EMISSIONS (kgCO2)
Tugboats	7,395,000
Commercial Vessels	17,986,790
Container Handler	916,484.7069
Reach Stacker	1,098,229.1854
RTG Crane (D)	7,207,680.9655
Terminal Tractor	6,310,468.4892
Trucks	15,558,000
RTG Crane (E)	2,540,496.7069
Forklift	39,490.8457
Electricity facilities	2,865,311.0668
TOTAL	**61,917,951.96**

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Summary of CO2 Emissions and Reduction Strategies at Port of Valencia:

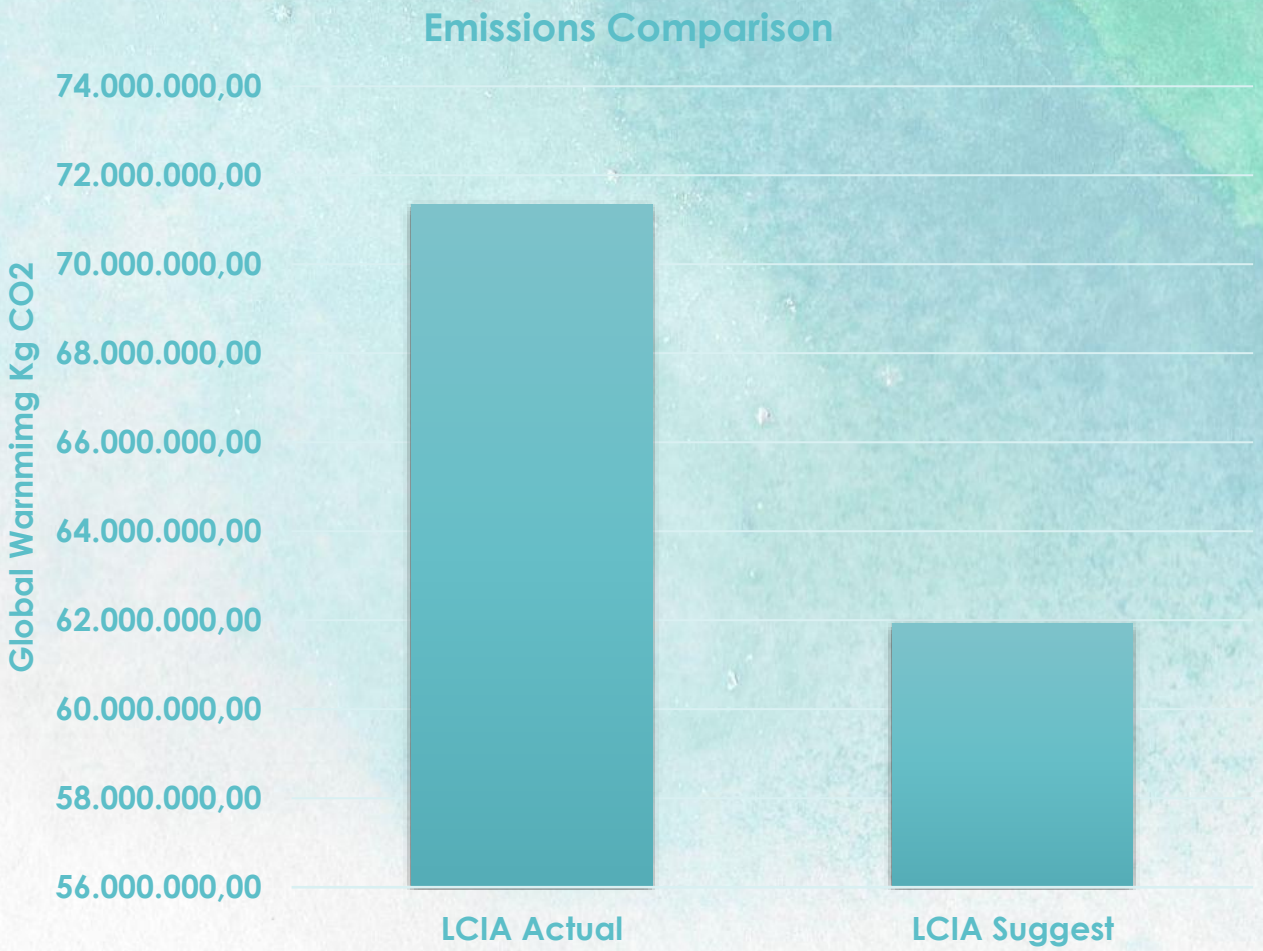
Recommendations for Emission Reduction:

1. Switch trucks to renewable Liquefied Natural Gas (LNG); reduces CO2 by 30%.
2. Use 100% certified renewable electricity for port machinery; consider Hydrogen as an alternative.
3. Adopt electric container handlers and Reach Stackers with better fuel efficiency.

Alternative Emission Calculations (Using LNG):

- New Total CO2 Emissions: 61,917,952 kgCO2 , Reduction in CO2 emissions for just tugboats and commercial

By implementing these measures, Port of Valencia can achieve significant CO2 reductions.



Finally, the implementation of environmentally friendly fuels, such as biodiesel, or liquefied natural gas of renewable origin, as well as the electrification of the machinery used in the port, powered by a renewable energy mix (as is currently done), allows a significant reduction of emissions within the port, especially those associated with kg CO_2

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D2.1 Report of stakeholders' knowhow limitations

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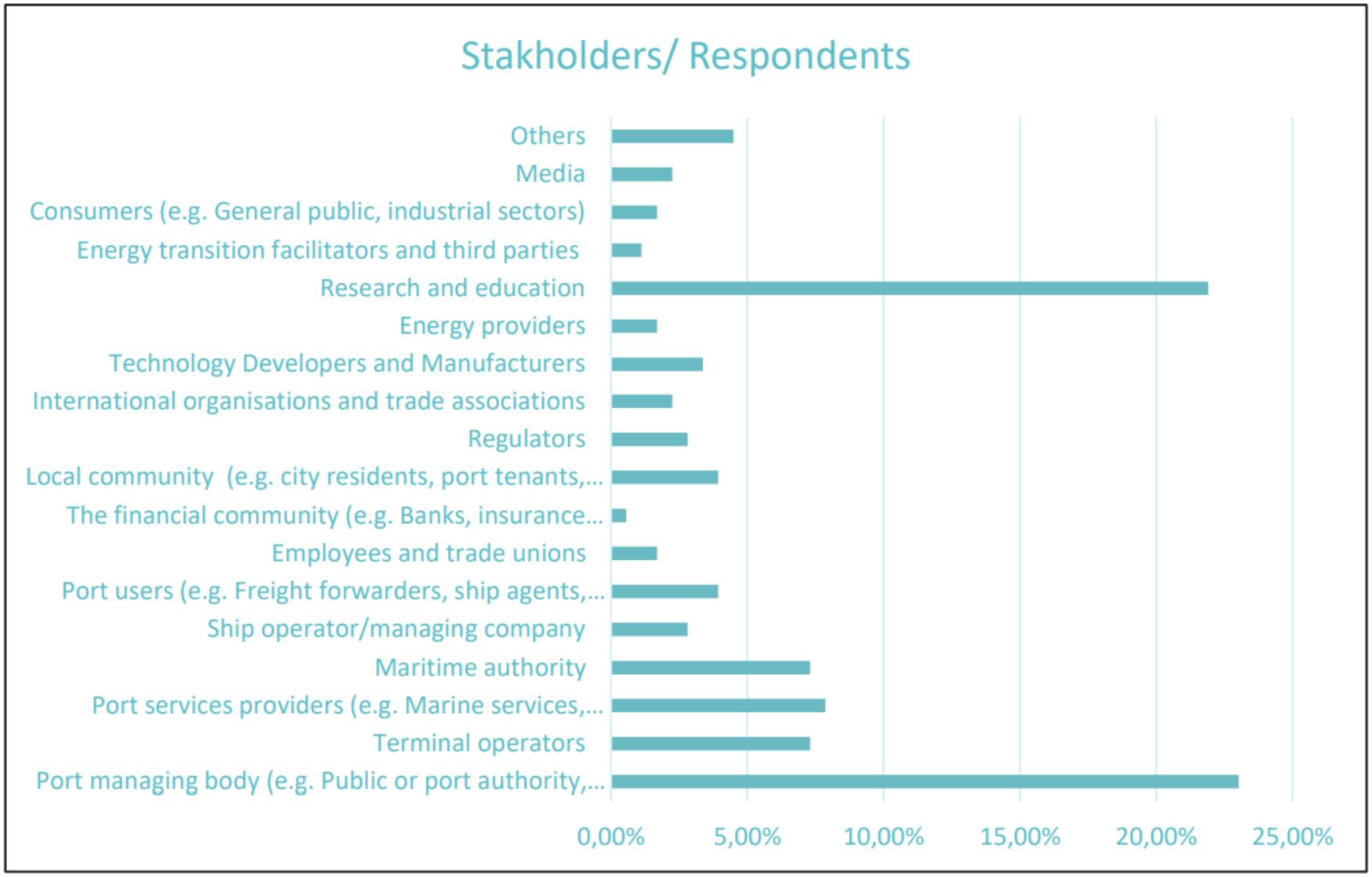


Figure 6: Overall perspective of stakeholders on the ranking of barriers to energy transition in ports

More Information is available in:

https://seanergyproject.eu/

WHAT'S HAPPENING

NEWS

August 21, 2023

Challenges of the SEANERGY project management and coordination

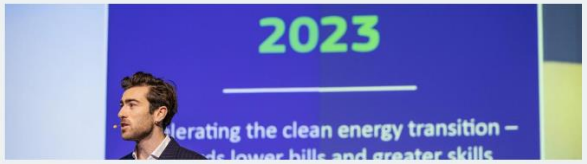
Read more →

July 28, 2023

Role of women in ports — Questionnaire

The questionnaire aims to investigate cultural and social inclusion in ports, focusing on the roles of women in ports.

Read more →



July 28, 2023

EUSEW Panel: Career opportunities in the energy transition: the skills you need for the green economy

The EUSEW Policy Conference is the biggest conference dedicated to renewables and efficient energy use in Europe. The 17th edition of the Policy Conference took place in a

July 15, 2023

Valencia demoport workshop — Port decarbonization

On Thursday July 6th took place the Valencia demoport workshop at Fundación Valenciaport's headquarters. The event, which was titled "Decarbonization in ports", gathered over 30 professionals from Valencia's port ecosystem, including terminal operators, port authority members

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