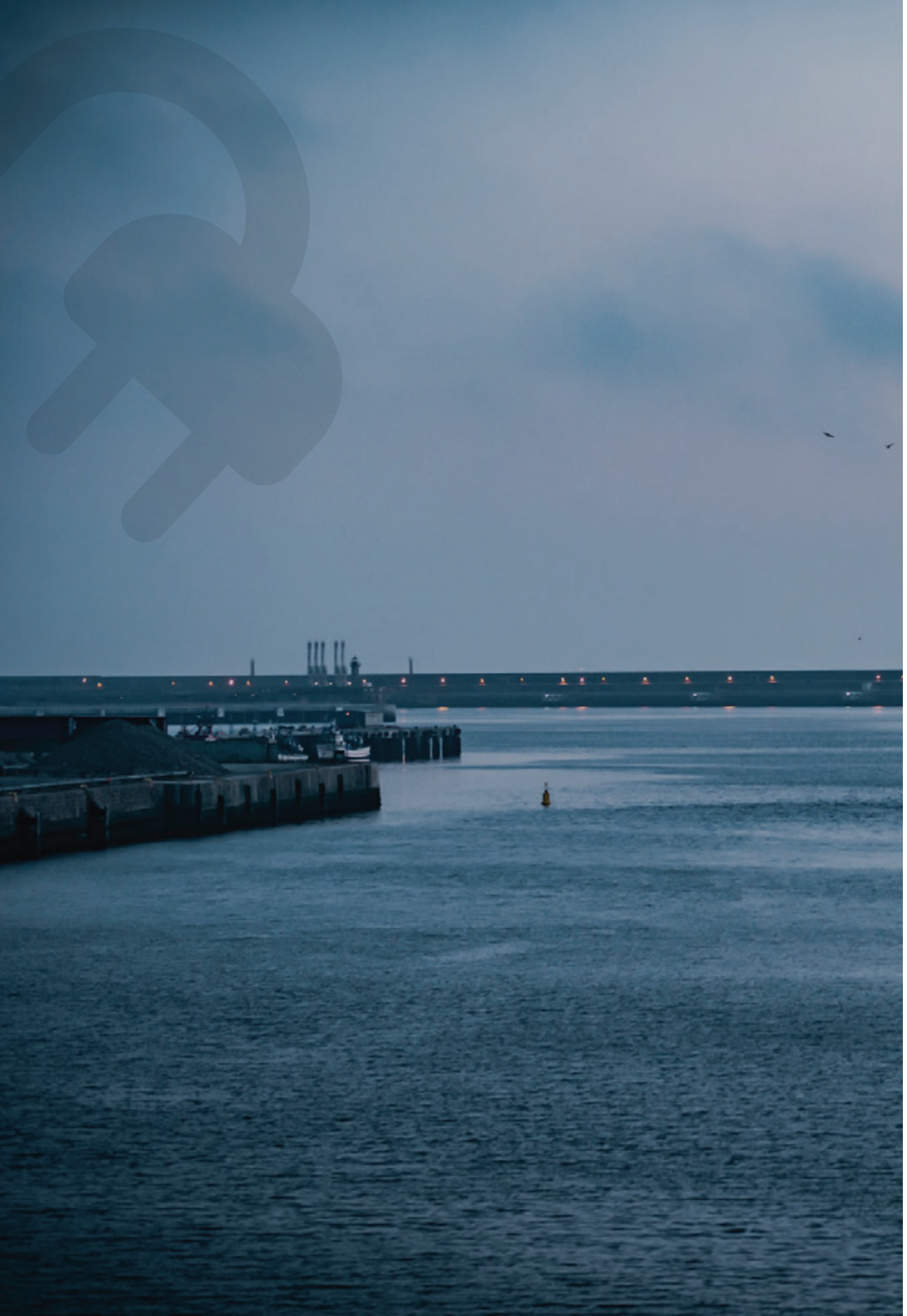
EALING STUDIES
Results in focus

Co-funded by
the European Union

EALING
European flagship Action for coLd IronING in ports



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GLOSSARY OF TERMS

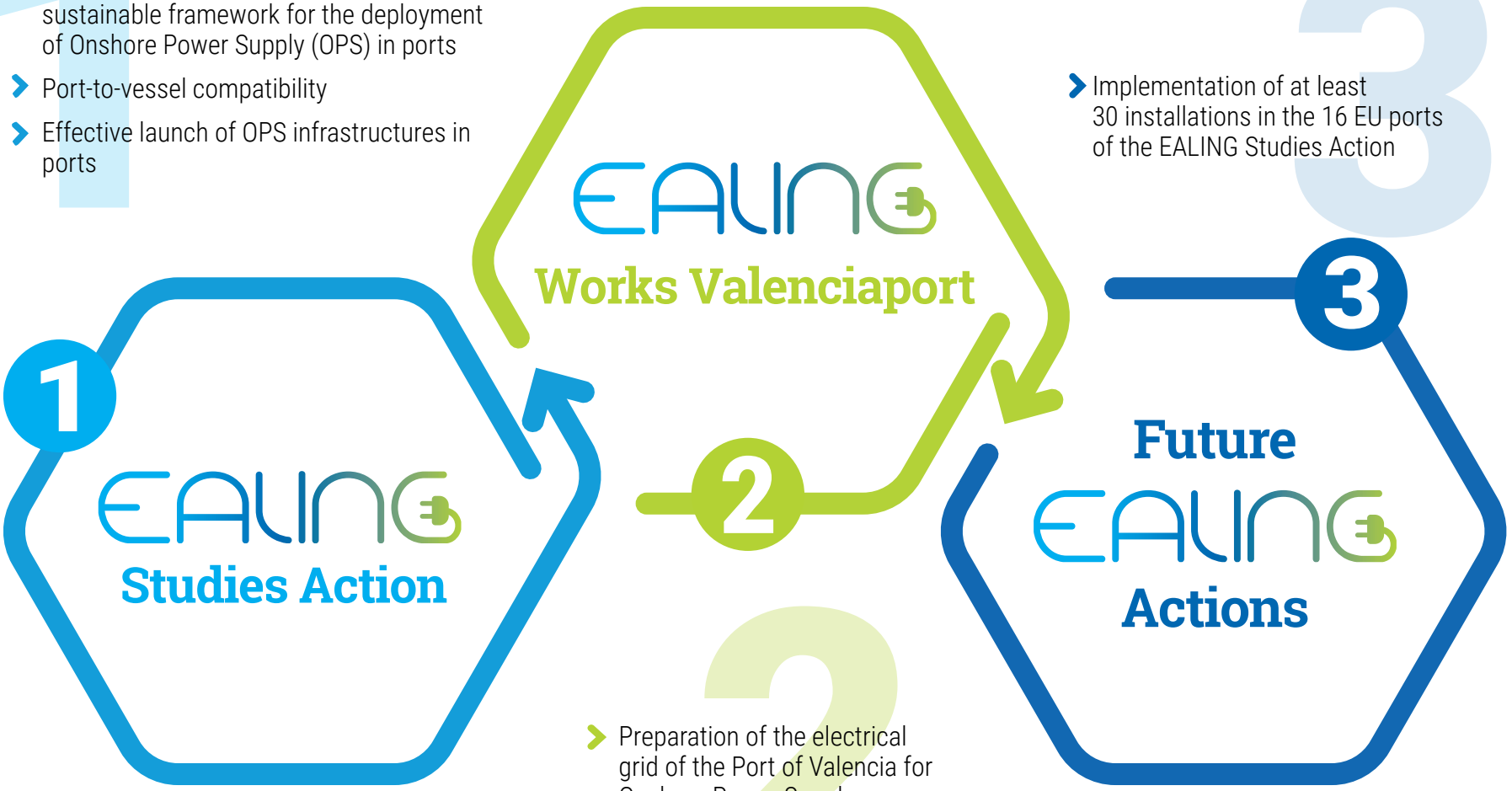
CBA: Cost-Benefit Analysis
CO_2: Carbon Dioxide
DCS: Data Collection System
EIA: Environmental Impact Assessment
ELFO: Extra light fuel oil
EMSA: European Maritime Safety Agency
FEED: Front-End Engineering Design studies
FVPV: Financial Net Present Value
GHG: Greenhouse Gas
HV: High Voltage
ITU: Intermodal Transport Unit
LPG: Liquefied petroleum gas
LSCI: Liner Shipping Connectivity Index
LV: Low Voltage
LVSC: Low Voltage Shore Connection
MRV: Monitoring, Reporting and Verification
NOx: Nitrogen Oxides
OPS: Onshore Power Supply equivalent to SSE
PM: Particulate Matter
SCI: Site of Community Interest
SDGs: Sustainable Development Goals
SEA: Strategic Environmental Assessment
SOx: Sulphur Oxides
SSE: Shore-Side Electricity, used in this document as equivalent to OPS
TEN-T: Trans-European Transport Network

Ealing Global Project

EALING Studies has been the first phase of the EALING Global project, which aims to accelerate the effective deployment of OPS (Onshore Power Supply) solutions in the EU maritime ports, including the Action "EALING Works Valenciaport and a subsequent phase to implement at least 30 installations in 16 EU ports.

1

- Common EU harmonised, interoperable and sustainable framework for the deployment of Onshore Power Supply (OPS) in ports
- Port-to-vessel compatibility
- Effective launch of OPS infrastructures in ports



3

- Implementation of at least 30 installations in the 16 EU ports of the EALING Studies Action

2

- Preparation of the electrical grid of the Port of Valencia for Onshore Power Supply

Ealing Studies Action - activities

EALING Studies aimed at providing a suitable answer to the need of moving towards a more competitive and sustainable TEN-T Maritime Network, answering to key challenges concerning environment and sustainability. The activities carried out in each of the consortium's ports were aimed at carrying out all the necessary studies to accelerate the implementation of OPS in their facilities.

Harmonised Framework for the electrification of the participating TEN-T maritime ports

Detailed analysis on the current status of technical, legal and regulatory framework – at Member States' and EU level – concerning the implementation of OPS in EU ports and recommendations focused on how to implement a workable and coordinated framework boosting the development of OPS in ports of the TEN-T Network.

Maritime fleet adaptation

Study of the maritime electrification standards across the ports of the consortium and the vessels operating in these ports, providing operational recommendations for a harmonised technical, legal and regulatory framework on maritime fleet adaptation for electrification.

Technical studies for the electrification infrastructure of the participating TEN-T maritime ports

Technical studies for the electrification infrastructure necessary for the ports of the consortium, which included the development of front-end engineering design (FEED) studies and other necessary technical studies that fed into the tender specifications of the future equipment and infrastructure.

Environmental studies

Environmental studies, the scope of which depended on the needs of each port. They took into account the provisions stated in the Strategic Environmental Assessment (SEA) Directive (2001/42/EC) and the Environmental Impact Assessment (EIA) Directive (2014/52/EU), contributing, if necessary, to obtain the permits on the projected works for the future OPS infrastructure in the ports of the consortium.

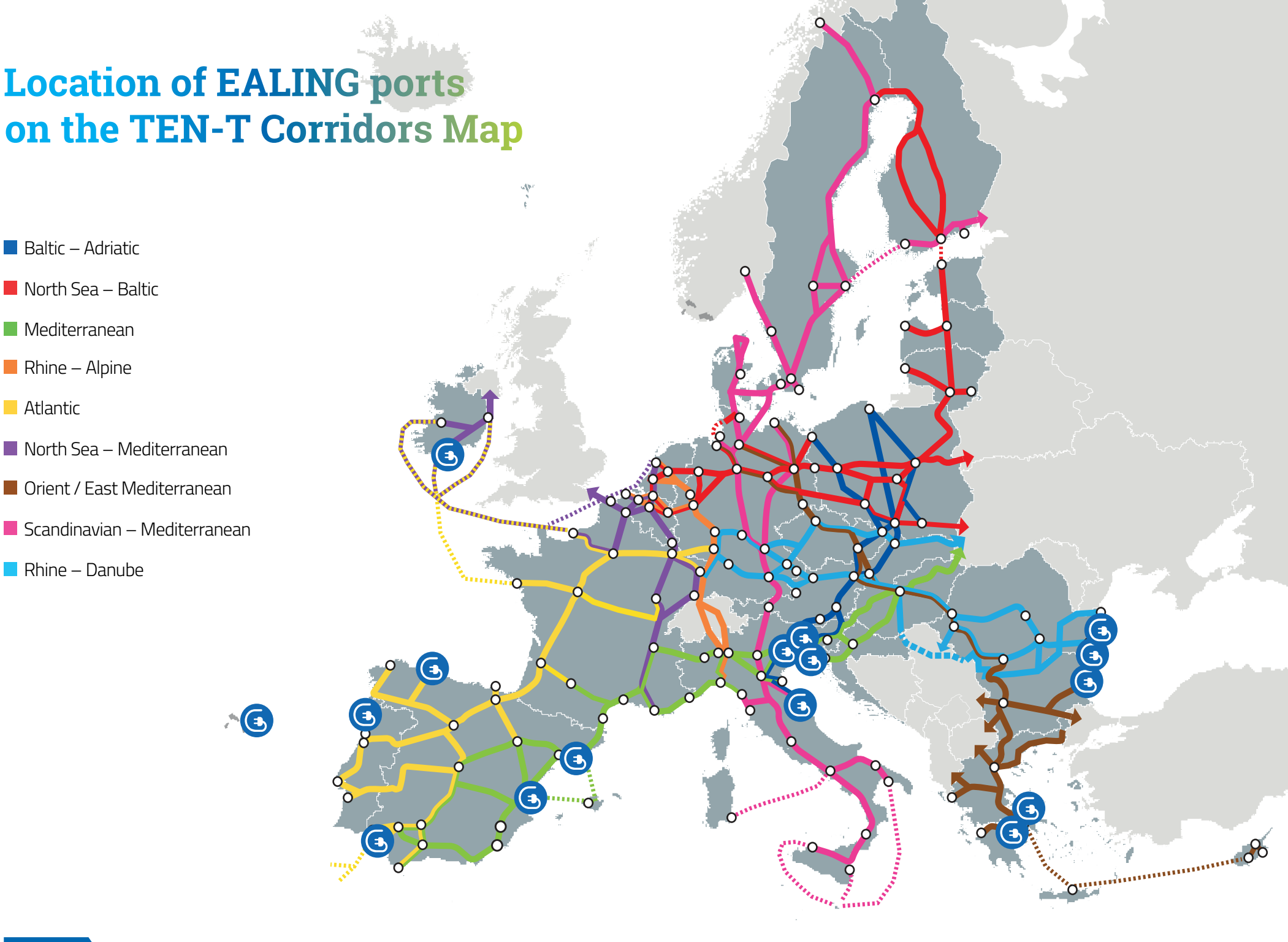
Clean power supply plans and tender documents

Clean energy supply plans (preparation or update) of the consortium's ports, based on the baseline identified for each port, in order to ensure the integration of OPS in the internal strategies of the Port Authorities; preparation of the tender documents for all proposed investments.

Cost-benefit analysis and Financial blending schemes

Cost-benefit analysis (CBA) for each OPS project of the maritime ports involved in the EALING Action and suitable investment schemes design, allowing the ports to proceed with Financial Investment Decisions.

Location of EALING ports on the TEN-T Corridors Map



Harmonised Framework for the electrification of the participating TEN-T maritime ports

The Harmonised Framework for the electrification of the participating TEN-T maritime ports activity aimed to analyse in detail the current technical, legal and regulatory framework affecting the implementation of Shore-Side Electricity (SSE, used in this document as equivalent to OPS) installations in the ports of the consortium, with the ultimate goal of proposing recommendations on how to overcome existing barriers and move towards a harmonised framework for their deployment.

To achieve this goal, the EALING consortium worked intensively with key stakeholders from the maritime and port sectors (shipping companies, ports, EU associations), the European Maritime Safety Agency (EMSA), SSE technology solution providers and energy suppliers (through literature review, workshops, conferences, interviews, and a specific questionnaire answered by 54 EU ports), to identify the main obstacles faced by ports and shipping companies when installing SSE systems.

Following this interaction, and inspired by the PESTLE methodology, recommendations were proposed, broken down by key external factors (political and legal, technical, economic, environmental and social).

On the political and legal side, recommendations included simplifying and harmonising administrative burdens at various levels, facilitating the involvement of port authorities in electricity distribution, clarifying responsibilities in EU legislation, intensifying public funding and advocating tax exemptions for electricity supplied to ships at berth.

At the technical level, there was consensus on the need to standardise and harmonise the SSE connection on ships. This included recommendations on the position of the SSE connection, necessary training, safety aspects and operational manuals. Tendering processes were addressed as well, with emphasis on flexibility, feasibility and innovation. The recommendations also called for further work on international shore connection standards and to broaden the scope to include shore battery charging and shore power banks.

In addition, recommendations focused on assessing energy demand, developing load forecasting models, defining appropriate energy demand values, creating a public repository of SSE-ready ships and applying energy allocation to specific ships.

On the economic side, recommendations were made to conduct detailed demand studies, carry out cost-benefit analyses (CBAs), create additional financing mechanisms and ensure full EU-wide tax exemption for the use of SSE in ports. Electricity tariffs, port tax rebates and the consideration of ports as energy communities were also discussed. The recommendations aimed to develop competitive and predictable tariffs, incentivise interactions between different stakeholders and encourage EU ports to join the ESI index.

The environmental recommendations proposed the creation of an environmental certificate for shipping companies and encouraged the registration of ships in the Clean Shipping Index. Technical specifications were also suggested for inclusion in the THETIS MRV system and the IMO Data Collection System (DCS).

Finally, recommendations in the social field focused on fostering interaction and collaboration between stakeholders through associations/working groups at port, national and European level. They also included the development of operational manuals and training guidelines, and close cooperation with educational institutions for training in SSE operations.

These recommendations aimed, as a whole, to streamline, harmonise and incentivise the implementation of the SSE in EU ports, addressing various aspects from policy and regulation to technical requirements and societal engagement.

Find out more about EALING Studies

Maritime Fleet Adaptation

The Maritime Fleet Adaptation activity was focused on facilitating the harmonisation between ports and vessels towards SSE adaptation, by addressing regulatory and technical considerations from the vessels' side, while taking into consideration the in-parallel developments of the Harmonised Framework for the electrification of the participating TEN-T maritime ports activity.
To achieve this goal, the consortium undertook the following steps:

- Identified and studied the relevant electrical standards and general regulatory framework for both ports and vessels.
- Chose appropriate vessel types for case studied and study their spatial and electrical arrangements towards recommending best practices for required vessel retrofit.
- Provided regulatory and operational recommendations for a harmonised technical, legal, and regulatory framework on fleet electrification adaptation.

Applying the same methodology as for the Harmonised Framework for the electrification of the participating TEN-T maritime ports activity, the information gathered through the EALING interactions with external SSE actors (workshops, conferences, interviews and two specific questionnaires to shipping lines, classification societies and flag administrations, answered by 25 stakeholders) combined with the literature / regulations review and the engineering execution work, led to the core outcomes of the activity: an analysis of the applicable standards and regulations and a set of final recommendations from technical, operational and regulatory points of view.

Following the methodology described above, five different ship types (cruise ships, container ships, Ro-Pax, bulk carriers and tankers) were selected as case studies, from which the following conclusions and recommendations were drawn:

- SSE is a viable solution for passenger and cargo vessels, both newbuilds and existing ones.
- EU Thetis MRV, and IMO DCS by extension, should be expanded to include the vessels' electrical consumption, characteristics and other information such as the time at berth.
- The development of an internet-based SSE information platform showing the ports' installed capacity and real-time operational conditions would facilitate fast adoption and operation.
- IEC/IEEE standard should be revised, especially for low voltage shore connection (LVSC) and limit the voltage provided options to decrease uncertainty on the required electrical equipment onboard.
- The study of actual implementation of the SSE and its effects on different vessel types will result in ship specific safety recommendations.
- The required SSE equipment and its position onboard are crucial parameters. The clear definition of the suggested areas for SSE infrastructure installation onboard per ship type is recommended.
- The standard installation of two receiving points onboard (one port and one starboard), the plug/socket similar power rating in both port and vessel sides at its maximum provided capacity, tension bars as standard safety equipment, and transformers with tap changer are among the main technical recommendations.
- To ensure safe operations, checklists provided by IMO are necessary. The blackout operation of the SSE should be discouraged to protect the vessels' electrical network.

Technical, financial, legal, and environmental studies performed at the 16 participating EU ports


Ports of Açores


Port of Ancona

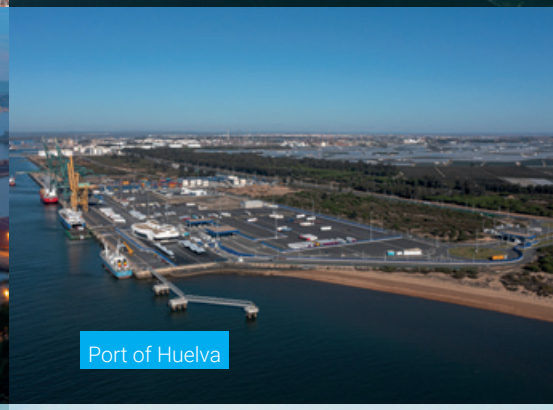

Port of Barcelona


Port of Burgas


Port of Constanta


Port of Cork

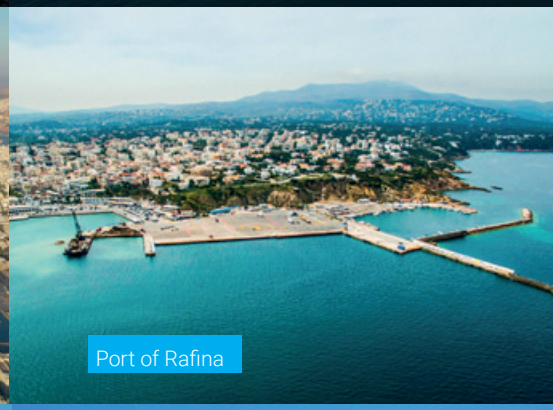

Port of Gijón


Port of Huelva


Port of Koper


Port of Leixoes


Port of Piraeus


Port of Rafina


Port of Trieste


Port of Valencia


Port of Varna


Port of Venice – Chioggia

Ports of Açores

Portos dos Açores, S.A. is engaged in the administration of the ports of:

- Vila do Porto (on the island of Santa Maria),
- Ponta Delgada (on the island of São Miguel),
- Praia da Vitória and Pipas - Angra do Heroísmo (on the island of Terceira),
- Praia da Graciosa (on the island of Graciosa),
- Calheta and Velas (on the island of São Jorge),
- Lajes do Pico, São Roque do Pico and Madalena (on the island of Pico),
- Horta (on the island of Faial),
- Lajes das Flores and Santa Cruz das Flores (on the island of Flores),
- Casa - Corvo (on the island of Corvo),

and others that come to it will be assigned, investing in its exploration, conservation and development and covering the exercise of the powers and prerogatives of "port authority" that belong to it or that may be assigned to it.

Technical studies

The objective of the study performed was to understand the challenges of adapting the current infrastructure to be able to provide shore connection to cargo ships in three diferent locations/islands, as well as the most suitable locations and budget estimation.

FEED studies have been carried out for the ports of Ponta Delgada, Praia da Vitória and Horta (TEN-T maritime ports).

Port	OPS Position	Location	Total Power (MVA)	Voltage (kV)	Vessel Type
Ponta Delgada	0PS 1	Berth 10	1.7	0.4	Cargo ships
	0PS 2	Berth 12	1.2	0.4	Cargo ships
Praia da Vitòria	OPS 1	Berth 10	1.2	0.4	Cargo ships
	OPS 2	Berth 12	1.7	0.4	Cargo ships
Horta	OPS1	Alpha/Bravo	1.7	0.4	Cargo ships

Ponta Delgada Port

The best berth places to make the shore connection were selected, in particular Berths 6, 10 and 12, which can handle the bigger ships.

The system should be divided into two OPS stations, one for Berths 6 and 10 with output power of up to 1.7 MVA and another for Berth 12 with an output power of up to 1.2 MVA.

Praia da Vitória Port

The best berth places to make the shore connection were selected, in particular Berths 10 and 12, which can handle the bigger ships.

The system should be divided into two OPS stations, one for Berth 12 with output power of up to 1.7 MVA and another for Berth 10 with an output power of up to 1.2 MVA.

Horta Port

Due to the small size of this port, Berth Alpha and Bravo for shore connection points were selected.

The system consists of only one OPS station, with an output power of up to 1.7 MVA.

Environmental studies

The study carried out assessed the environmental impact of the project's implementation. This evaluation took into account the current legislation, both the Environmental Impact Assessment (EIA) Directive and the specific legislation for each addressed topic.

After examining European, national, and regional regulations (Regional Legislative Decree (RLD) n.º 30/2010/A, dated November 15), it has been concluded that the project does not fall into any of the categories contemplated in Annex I (projects subject to Environmental Impact Assessment).

The study considered: climate, air quality, water quality, noise environment, ecology, and socioeconomics. The main conclusions are:

- The consequent limitation of ship engine use in the ports has a very significant local positive effect, due to the reduced concentration of pollutants in the air and the reduced noise level coming from ships auxiliary engines. This effect is of high importance given the surrounding cities and urban areas;
- The negative impacts identified may occur during the construction phase if there are inappropriate discharges that affect water quality. However, as these activities are controlled during implementation, significant impacts are unlikely to occur.

Overall, the installation and operation of the SSE installation in the three ports of the Açores will have a significant positive effect on local environmental conditions (air and noise), while also contributing to the global effort to reduce the pace at which climate change is occurring. Any negative impacts during the construction phase are negligible and of extremely short duration.

Although the identified impacts are not significant, the project implementation should ensure certain actions to minimise negative impacts and enhance positive ones. It is anticipated that the implementation of proposed mitigation measures will bring direct and indirect benefits across various environmental factors, either through impact mitigation or compensation.

Clean Power Supply Plan

Portos dos Açores, S.A. is committed to a significant operational transformation by electrifying its equipment, which includes ships, cranes, trucks, and other machinery. This initiative is driven by a clear objective: the complete elimination of direct emissions from the use of fossil fuels in the port's various operations.

To this end, Portos dos Açores, S.A., has already drawn up a strategic plan for carbon neutrality, in which the following topics have been analysed:

- Electrification of port equipment;
- Energy efficiency measures;
- Renewable energy infrastructure;
- Collaboration with energy providers.

This comprehensive plan aims to guide Portos dos Açores, S.A. towards a sustainable and resilient energy infrastructure, in line with environmental goals and reducing dependence on non-renewable energy sources.

Cost-Benefit Analysis and Blending Schemes

Main results	Praia da Vitória	Ponta Delgada	Horta
Total Investments (€)	4,240,000	4,245,000	2,460,000
Timeline (years)	25	25	25
Nº of calls requesting SSE for the full period studied	585	435	436
Financial Net Present Value (FNPV) (€)	- 8,636,314		
Total CO_2eq emissions saved (tonnes)	168,004		
Total NOx emissions saved (tonnes)	538		
Total SOx emissions saved (tonnes)	1,092		
Total PMx emissions saved (tonnes)	-		

It is planned that the future installations in the ports of Açores will be financed mainly through Next-GenerationEU, Connecting Europe Facility and regional funds.

Port of Ancona

The Port of Ancona, located in the central Adriatic Italian coast, in a strategic position in the Adriatic-Ionian Macro-Region, is a core node of the ScanMed and Baltic-Adriatic corridors of TEN-T network and a key hub in the Adriatic Motorways of the Sea.

Thanks to its priviledged position and favourable transit time with Greece and Balkan countries, the multipurpose Doric port stands up as main gateway for the connections between South-east Mediterranean regions and the Northern and Central Europe countries, both in terms of freight and passengers traffic.

The Port of Ancona is indeed one of the most relevant hubs in the Adriatic in terms of international passengers traffic with more than 1.1 million travelers annually, with about 100,000 cruise passengers. International lines connect the port of Ancona with the ports of Igoumenitsa and Patras in Greece, Durres in Albania, and Split and Zadar in Croatia, enabling the transit of some 4.6 million tonnes of cargo as well and ensuring the smooth connection of people and goods also in the East-West dimension.

Central Adriatic Ports Authority is committed to improve the environmental sustainability of all the ports under its competence (Falconara, Pesaro, San Benedetto del Tronto, Ortona, Pescara and Vasto) through a long-term investment plan financed also with Recovery and Resilience Funds.

Technical studies

FEED studies have been carried out for two installations, one at an offshore supply and research vessels quay and the other at a quay dedicated to the mooring of the technical-nautical ships.

Quay	Total Power (MVA)	Voltage (kV)	Vessel Type
Quay 17	87.5	0.4	Offshore supply vessels, research vessels
Quay 4/5	15	0.4	Technical-nautical services

The implementation of cold ironing of Quay No. 17 is based on obtaining a new split power supply in three separate electrical delivery points of 70 kW, three-phase at 400V, 50Hz, the relocation of an existing low-voltage supply and the availability of 400V, three-phase but 60 Hz low-voltage supply. The need is to ensure a power supply for the on-board equipment and facilities of the moored offshore supply vessels and research boats, thus avoiding the need to keep the auxiliary engines running.

For Quay No. 4-5, the intervention consists of the implementation of new electricity supplies at three separate electrical delivery points each 4 kW, three-phase at 400V, 50Hz, to ensure a power supply for ships for technical-nautical services.

Environmental studies

Despite the limited dimension of the two interventions, an analysis of the environmental and climate effects caused by the project has been carried out for the purpose of EALING initiative.

environmental

- Due to their nature and limited scope, the two OPS technical studies implemented under EALING Project are excluded from EIA procedure and screening, according to the current national legislation and not involving protected natural areas or Natura 2000 Network areas. They therefore fulfill with the European and national environmental obligations;
- The impacts that may emerge during the construction phase, as a consequence of the limited works, on the environmental components of soil and subsoil, atmosphere, climate, water, biodiversity and ecosystem, can be classified as scarce or not significant;
- During the operation phase, the two cold ironing interventions will have a positive impact on the environmental component of atmosphere, climate and biodiversity: by allowing the ships to turn off the engines during the mooring phase they contribute to reduce some of the negative impacts on air pollution, noise and GHG emissions and to positively affect factors as population, biodiversity and material assets.

climate

- Climate impacts have been assessed according to the Guidelines for the preparation of Documents of Environmental Energy Planning of Port Systems (DEASP) drafted at national level;
- The climate impacts of the two interventions were calculated in terms of reduction of air pollution and contribution of climate change, and were estimated in 40.7 tonnes of CO_2 emissions avoided and 535 GJ of energy saved per year.

Clean Power Supply Plan

With the mission to pursue and adopt the environmental and social sustainability principle in any field of the ports operations, Central Adriatic Ports Authority approved its DEASP (Energy and Environmental Planning Document), following common national guidelines, which aims to develop a current and prospective assessment of energy needs, determine the carbon footprint and provide the tools to ensure over the time a concrete environmental sustainability of the Port System.
This energy-environmental planning document also sets as objectives the reduction of anthropogenic emissions of so-called climate-altering gases with particular attention to those of carbon dioxide (CO_2).
To promote the reduction of energy consumption to meet the future energy needs, the DEASP defines strategic guidelines for the implementation of specific actions aimed at improving energy efficiency and promoting the use of renewable energies in the port area. The solutions identified cover three types of intervention:

- Interventions promoted both by public and private subjects, which involve works, facilities, structures, as a result of investments made with the aim of improving energy efficiency and producing energy from renewable sources;
- Green Ports interventions, comprising project proposals of the Port Authority under the National Recovery and Resilience Plan (PNRR);
- PNIC interventions, including project proposals of the Port Authority within the framework of the National Plan for Complementary Investments (PNIC).

Cost-Benefit Analysis and Blending Schemes

Main results	Quay 17	Quay 4-5
Total investments (€)	300,000	70,000
Timeline (years)	2023 - 2047	2023 - 2047
N° of calls requesting SSE for the full period studied	900	1,095
Total CO_2eq emissions saved (tonnes)	7,482	
Total NOx emissions saved (tonnes)	22	
Total SOx emissions saved (tonnes)	57	
Total PMx emissions saved (tonnes)	3	

The two interventions are being carried out with internal resources of Central Adriatic Ports Authority.

Port of Barcelona

The Port of Barcelona is Spain's leading port in terms of the value of goods passing through it. It is also one of the largest container ports and one of the most important cruise ports in Europe, attracting numerous cruise lines and tourists.

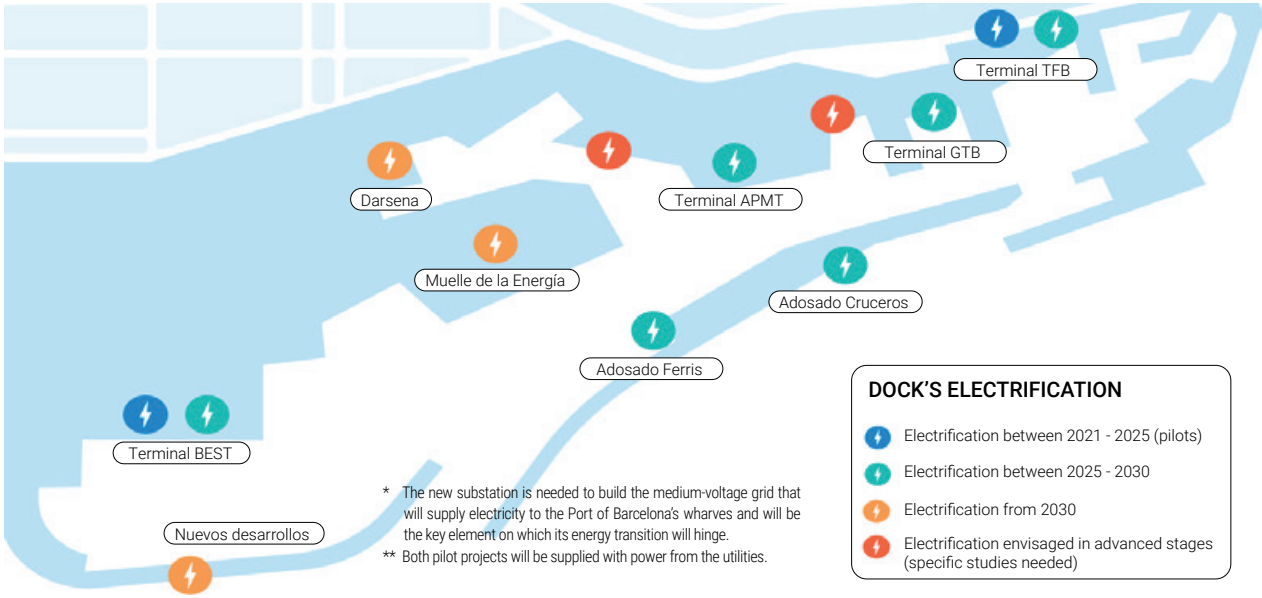
The Port of Barcelona assumes its role as a leader and agent of change in the decarbonisation of maritime transport and port activity. Its Fourth Strategic Plan (2021-2025) is fully oriented towards the objectives set by the Paris Agreements of the European Union and the International Maritime Organisation (IMO), which envisage approaching decarbonisation by 2050.

Technical studies

The development of the electrification project, planned to be implemented progressively, required a preliminary phase to prepare various technical studies. EALING facilitated the preparation of the front-end engineering design studies (FEED) as well as the tender technical specifications for the first three crucial actions:

1. OPS pilot at BEST container terminal **
2. OPS pilot at TFB ferry terminal **
3. Construction of the port electrical substation (SS Port)*

FEED studies	Total Power (MVA)	Characteristics
Basic preliminary design for the OPS pilot at BEST container terminal	9	• Three OPS connection points will be installed for container ships, with a maximum power of 7.5 MVA for a single container ship, and with the possibility of simultaneous supply to two smaller ships, with a maximum power of 4 MVA each. • High Voltage Shore Connection (6.6 kV). • 50 or 60 Hz available. • Although the OPS installation of this project will be sized to supply a maximum power of 7.5 MVA (6 MW) in an initial phase, the Port Authority of Barcelona has opted to make a power reserve of up to 9 MW from the current electricity distributor of this terminal.
Basic preliminary design for the OPS pilot at TFB ferry terminal	4	• Two OPS connection points will be installed with the capacity to supply one single ferry, and a maximum power of 4 MVA. In order to carry out the pilot tests of this terminal, it has been decided to request 2.5 MW from the electricity distributor in the area. • High Voltage Shore Connection (6.6 kV). • 50 or 60 Hz available.
Basic preliminary design for the construction of a new power substation (SS Port)	80	• Construction of the port electrical primary substation of 220/25 kV, connected by a new 220 kV high voltage line to a position in the transmission grid requested to the Spanish TSO Red Eléctrica de España (REE)



* The new substation is needed to build the medium-voltage grid that will supply electricity to the Port of Barcelona's wharves and will be the key element on which its energy transition will hinge.

** Both pilot projects will be supplied with power from the utilities.

Environmental studies

Electrical power installations shall be subject to an environmental impact assessment where required by applicable legislation (Spanish Law 21/2013, 9th of December, which completes the legal framework of the European legislation on environmental assessment - Directive 2014/52/EU). Accordingly, each of the before-mentioned future installations - has been subject to an environmental analysis to determine whether or not it is necessary an environmental impact assessment.

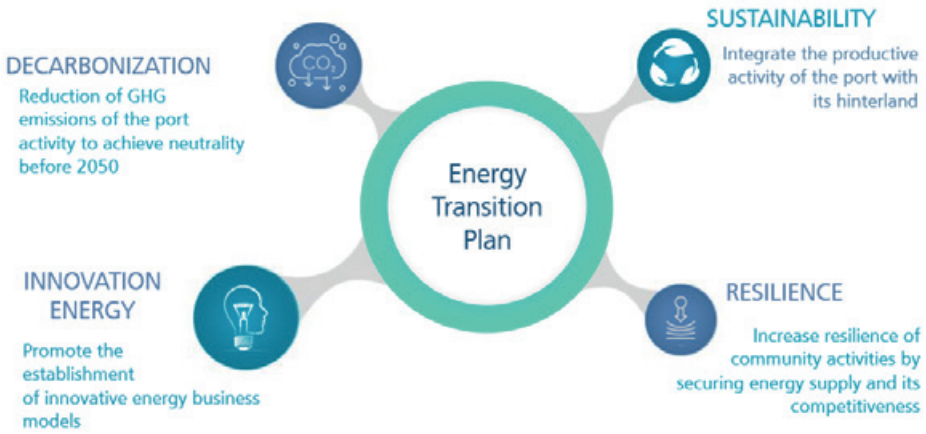
As a result of consultations with national and regional environmental impact regulations, it has been concluded that an ordinary or simplified environmental impact assessment will not be required for any of infrastructures developed by the Port of Barcelona.

During the period 2023-2047, as a result of implementing the pilots described, it is estimated total savings of 440,721 tonnes of CO_2eq emissions, 276 tonnes of SOx, 7,647 tonnes of NOx and 191 tonnes of PM will be avoided, which will also improve air quality and noise pollution in the areas of action.

Clean Power Supply Plan

The Port of Barcelona has begun the process of energy transition to achieve an energy model based on three axes: the electrification of wharves, the generation of renewable energies and the commitment to clean fuels when these will be an operationally, financially and commercially viable alternative to fossil fuels. The deepening of multimodality is also a high priority.

The Energy Transition Plan will set out an energy-focused mission and vision centred on sustainability (environmental, economic and social), from which the following objectives will be derived:



NEXIGEN, the Wharf Electrification Plan, is one of the major projects driven by the Port of Barcelona to achieve the reduction in GHG emissions from port operations and become a climate-neutral port by 2050.

nexigen
Electrification by Port de Barcelona

NEXIGEN aims to improve the air quality in the port and the city of Barcelona by implementing OPS technology to provide electrical power to ships operating in the port, especially cruise ships, container ships, ferries, car carriers and liquid bulk carriers. This allows them to shut down their auxiliary engines while docked, using clean energy certified as 100% renewable in origin.

NEXIGEN sets the goal of electrifying 50% of container and ferry wharves by 2025. To that end, in 2022, the two pilot projects included in EALING were launched.

Cost-Benefit Analysis and Blending Schemes

Main results	BEST container terminal	TFB ferry terminal
APB own resources (€)	3,405,201	2,422,429
National Grant received –NextGeneration funds (€)	2,270,134	1,614,953
Total investments (€)	5,675,336	4,037,382
Timeline (years)	2023 - 2047	2023 - 2047
Nº of calls requesting SSE for the full period studied	10,912	10,990
Financial Net Present Value (FNPV) (€)	-11,501	-703,971
Total CO_2eq emissions saved (tonnes)	355,209	85,512
Total NOx emissions saved (tonnes)	6,150	1,497
Total SOx emissions saved (tonnes)	221	55
Total PMx emissions saved (tonnes)	154	37.10
Total noise emissions saved (€)	48,134	45,518

This CBA considered the grant received through NextGenerationEU managed by the Spanish Ministry of Transport and Sustainable Mobility.

Port of Burgas

The Port of Burgas is located on the eastern coast of Bulgaria, on the shores of the Black Sea.

The Port of Burgas was established by virtue of the Decree for Construction, signed by Prince Ferdinand I on 20 December 1894. The opening ceremony was held on 18 May 1903 and since this moment the port is considered as open for commercial shipping. The Port has a total of 34 berths with a maximum permissible depth of 12.3 m.

The types of vessels regularly calling at Burgas are General Cargo (47%), Oil/Chemical Tanker (11%), Bulk Carrier (10%), Container Ship (7%) and Oil Products Tanker (4%).

The implementation of alternative fuel technologies will improve the sustainability of the port and, at the same time, reduce its environmental footprint in order to meet the European Climate Action principles and, in particular, the 55% net reduction target.

Technical studies

The Port of Burgas makes the next steps towards the implementation of SSE technology via the EALING project.
In the framework of the EALING project, the Port of Burgas has performed the FEED study for 11 High Voltage SSE positions at the Burgas East and Burgas West locations. These will be the first SSE systems deployed in the port.

SSE berthing position	Location	Total Power (MVA)	Voltage (kV)	Vessel Type
SCP 1.1	Berth 22 (West)	2.5	6.6	Container/General Cargo
SCP 1.2	Berth 23 (West)	2.5	6.6	Container/General Cargo
SCP 1.3	Berth 24 (West)	2.5	6.6	General Cargo
SCP 1.4	Berth 24 (West)	7.5	6.6	General Cargo
SCP 2.1	Berth 30 (East)	2.5	6.6	Crude Oil/General Cargo
SCP 2.2	Berth 31 (East)	2.5	6.6	General Cargo
SCP 2.3	Berth 32 (East)	2.5	6.6	Crude Oil/General Cargo
SCP 2.4	Berth 31 (East)	7.5	6.6	General Cargo
SCP PAS	PAS (East)	16	11	Cruise
SCP 3.1	Berth 11	4	11	Passenger
SCP 3.2	Berth 12	2	6.6	General Cargo

Environmental studies

Bulgarian national legislation states that Environmental Impact Assessment (EIA) is aimed at the integration of the predictions with regard to the environment in the process of development as a whole and the introduction of the principle of sustainable development.
The conclusions of the environmental and climate studies for the implementation of the SSE in the Port of Burgas have been:

- The land use, soil, and biodiversity will not be affected by the construction and operation phase of the Project.
- During the various stages of implementation of the Project construction and operation of the SSE system, there is no release of harmful emissions into the adjacent hydrographic network and groundwater, due to the characteristic of the activity.
- The operation of the SSE system is not related to the emission of harmful substances into the atmospheric air. During operation, there will be no organised and/or unorganised sources of atmospheric air pollution.
- The soil will not be affected by the Project as it will take place at the existing terminal where no soil layer is available.
- During the operation, the equipment and the operation of the SSE system is not a source of noise and it is not possible to have a negative impact on the workers and the population in the area.
- There are no sources of heating and radiation during the construction and operation.
- During the operation only in case of repairing some waste can be generated.

The measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis) will be developed as part of the EIA Report and in accordance with the relevant legal requirements.

Clean Power Supply Plan

Bulgarian Ports Infrastructure Company outsourced the development of a Clean Power Plan for the Port of Burgas. The Plan contains both an analysis of the port's spatial organisation and main sources of consumption, as well as future energy needs.
The document also includes planned activities for the use of the port's energy, including the SSE system, as well as activities to meet future energy needs. The possibilities for renewable energy installations at the Port of Burgas are also analysed. The developed Clean Power Plan is essential for the transformation of the Port of Burgas into a green port.

Cost-Benefit Analysis and Blending Schemes

Main results	
Total investments (€)	23,800,000
Timeline (years)	2023 - 2047
No of calls requesting SSE for the full period studied	46,676
Financial Net Present Value (FNPV) (€)	107,334
Total CO_2eq emissions saved (tonnes)	56,654
Total NOx emissions saved (tonnes)	157
Total SOx emissions saved (tonnes)	383
Total PMx emissions saved (tonnes)	7

It is planned that the future installations in the port of Burgas will be financed through Transport Connectivity Programme 2021 - 2027.

Port of Constanta

The Port of Constanta is the main Romanian port on the Black Sea, located at the crossroads of the trade routes linking the markets of the landlocked countries from Central and Eastern Europe with the Trans-Caucasus, Central Asia and the Far East.

Maritime port

- A hub for the container traffic in the Black Sea
- A hub for cereals in Central and South-East Europe
- Good connections with all means of transport: railway, road, river, airway and pipelines
- Land availability for future expansion

River port

The connection of the port with Danube is made through the Danube-Black Sea Canal. Due to low costs and important cargo volumes that can be carried, the Danube is one of the most advantageous modes of transport, an efficient alternative to the European rail and road congested transport.

Technical studies

In the framework of the EALING project, for the port of Constanta, the FEED studies have been performed for a total of ten LV and HV SSE berthing positions.

SSE berthing position	Location	Supply S/S	Total Power (MVA)	Voltage (kV)	Vessel Type
SSE 1	PAS	Port Station 6	5	11	Ro-Pax
SSE 2	Berth 35/36	PT 22A	1	0.44/0.4	Bulk
SSE 3	Berth 44	PT21B	1	0.44/0.4	Bulk
SSE 4	Berth CL	Port Station 3	5	6.6	LNG carriers
SSE 5	Berth PL6	PT47	1	0.44/0.4	Ro-Ro
SSE 6	Berth 114	PT49	1	0.44/0.4	Bulk
SSE 7	Berth 119	PT6 ZL	1	0.44/0.4	Bulk
SSE 8	Berth 120	PT6 ZL	1	0.44/0.4	Car carriers
SSE 9	Berth 121	PTC-1	5	6.6	Container
SSE 10	Berth 123	PTC-1	5	6.6	Container

A containerised SSE substation will be built to supply each vessel, which in turn will be supplied by the existing substations in the port.
For the final definition of the SSE berthing positions an estimation of the power needs per berth positions was considered, based on the following criteria:

- Vessel type
- Berthing positions
- Energy demands of each vessel

Environmental studies

Environmental study performed: Assuring the electrical conditions for the berth connection of the vessels in the port of Constanta (cold ironing regime) in order to interconnect to the trans-European transport network for the implementation of EALING project

The Environmental Protection Agency of Constanta declared that the project is not subject to the environmental impact assessment procedure. It will also have no significant effects on the NATURA 2000 network.

Clean Power Supply Plan

Maritime Ports Administration Constanta adopted different plans and a development strategy on short, medium and long term included in the Master Plan of Constanta Port 2014-2040 or subject in projects financed by EU programmes.

Dimension	Measures	Name of the plan/strategy/project
Decarbonisation - GHG emissions and removals	Development of alternative fuels infrastructure	Ealing Project
		E-Cold Project- Providing shoreside electrical power to ships at berthing in the Port of Constanta (Cold ironing)
		LNG Bunkering Station at Berth no. 99
	Upgrading railways projects	Development of Railway Capacity in the River-Maritime Area
		Development of Rail Access to the Island (railway bridge in parallel with road bridge)
	Waste management	Separate collection of: plastic, paper, metal and glass
		Closing down the landfill inside port area
		Upgrade of Infrastructure and Environmental Protection in the Port of Constanta – PROTECT
	Water quality	New construction and Expansion of Water Supply, Sewage and Drainage Networks
	Air protection and noise reduction	Noise maps inside port area and action plans for noise reduction
	Renewing the vehicle stock	Acquisition of electric cars for company fleet
	Deployment of recharging stations for electric vehicles	Deploying recharging stations for electric cars inside port area
Decarbonisation -renewable energy	Promoting the use of renewable energy	Photovoltaic Farm in the Port of Constanta
Energy efficiency	Reduction of energy consumption	Modernisation of the electricity distribution infrastructure in the Port of Constanța
	Encouraging the use of LED/smart lights instead of the conventional ones	Modernisation of outdoor street lighting networks
Research, innovation and competitiveness	Accessing Horizon Europe projects under the research, innovation and dissemination axes in order to implement pilot demonstration BAT projects	Pioneers Project – Portable Innovation Open Network for Efficiency and Emissions Reduction Solutions

PLANNED ACTIONS TO COVER THE FUTURE ENERGY NEEDS

Projects related to the improvement of (classic) electric network:

- Modernisation of the electricity distribution infrastructure in the Port of Constanta (to be finalised in 2024);
- Modernisation of the electricity distribution infrastructure in Constanta Port - Stage II (2024 – 2026)

Green energy projects:

- Providing shoreside electrical power to ships at berthing in the Port of Constanta (Cold ironing) – E-COLD (2023 – 2026);
- Photovoltaic Farm in the Port of Constanta (under preparation);
- PIONEERS project (H2020) (2021-2026);
- Future hydrogen projects. Once the national hydrogen strategy will be finalised, the plans of Constanta Port Administration are to develop itself as a hydrogen hub at the Black Sea will be completed.

Cost-Benefit Analysis and Blending Schemes

Main results	
Total investments (€)	23,154,500
Timeline (years)	2023 - 2047
No of calls requesting SSE for the full period studied	29,733
Financial Net Present Value (FNPV) (€)	62,281
Total CO_2eq emissions saved (tonnes)	343,690
Total NOx emissions saved (tonnes)	968
Total SOx emissions saved (tonnes)	2,409
Total PMx emissions saves (tonnes)	104

Port of Cork

The Port of Cork (POC) is the key deep-water seaport in the south of Ireland, located in one of the largest natural deep-water harbours in the world and is one of only two Irish ports that accommodates all shipping modes.

The Port of Cork is designated as a "Core Port" in the Trans-European Transport Network (TEN-T) and is located on both the Mediterranean (NSMED) and Atlantic Core Network Corridors. The Port of Cork Company (PoCC) is a commercial semi-state company and identified by the Irish Government's national port's policy as a 'Tier 1 Port of National Significance' in recognition of its strategic importance to the island of Ireland, where over 90% of all trade is imported and exported by sea. Some 10 million tonnes of trade passed through the POC in 2022 reflecting Ireland's strong economic growth.

The PoCC is progressing with ambition as it embarks on a historic period of change and development. In May 2023, PoCC launched the "Port Masterplan 2050", which outlines the port's plans and ambitions over the next three decades and provides an integrated framework for the port to strategically plan and adapt to meet the needs of Ireland's future social, economic and environmental development. The key pillars of the Masterplan include the Port's 'River to Sea' journey - consolidating all port activities in the lower harbour by 2040, supporting the growth of the green energy and ORE sectors, and achieving a "Net Zero Emissions Port" by 2050.

Technical studies

A technical study was completed for the main terminal in Ringaskiddy & Cobh under the EALING project . The OPS study identifies the key terminals where OPS will need to be provided to cater for container ships, Ro-Pax, Ro-Ro and cruise ships as outlined in the table below:

Location	Number of OPS Points	Total Power (MVA)	Vessel Type
Cork Container Terminal (CCT)	3	6.5	Container vessels up to 6 MVA
Ferry terminal	1	6.5	Ro-Pax up to 6.5 MVA Ro-Ro up to 4 MVA
Deepwater Berth (DWB)	1	4 (Incl. upgrade to 20kV system)	Ro-Ro up to 4 MVA
Cobh Cruise Terminal	1	20	Cruise ships up to 20 MVA

The main findings from the study are summarised as follows

- In total, the PoC will be required to provide six supply points at four terminals to meet the EU requirements by 2030;
- An increase in the power supply from the National Grid is required for all terminals;
- Significant upgrade works are required to the electrical infrastructure at all terminals;
- Significant civil works are necessary to accommodate the above electrical works;
- Significant upgrade works are needed on the marine infrastructure at Cobh Cruise Terminal to facilitate mobile OPS connection units;
- Planning permission & other statutory consents are necessary to be in place to progress some elements of the works;
- Works will be required to be undertaken from 2025 to 2030;
- The estimated cost of investment will be about 30M€.

Environmental studies

Information on environmental studies is not included, as they were not carried out under the EALING project, but under a previous project, also financed with CEF Funds, "Port of Cork Ringaskiddy Project" (CEF Action 2014-IE-TM-0091-W), whose objective was to improve the handling of cargo from container and ferry traffic in the Port of Cork.

Clean Power Supply Plan

The PoCC's ambitious and well-documented greenhouse gas (GHG) emission reduction and energy efficiency targets are detailed in the company's Port Climate Action Roadmap 2023 (not carried out within the framework of the EALING project).

The PoCC aims to achieve a 51% reduction in its overall greenhouse gas emissions by 2030, with a view to reaching net-zero emissions by 2050, in accordance with the Government of Ireland Climate Action Plan and the EU Green Deal and EU 'Fit for 55' legislation.

The roadmap outlines the Port's ambition, which will be achieved through projects that will generate renewable energy on Port lands, reduce emissions through the use of alternative fuels, and seek energy efficiency in port operations. It also includes the provision of SSE infrastructure in the port by 2030 to support the decarbonisation of the shipping industry by reducing shipping emissions while at berth in the port as required by the EU Green Deal, the FuelEU maritime initiative and the Alternative Fuels Infrastructure Regulation (AFIR).

Cost-Benefit Analysis and Blending Schemes

Main results	Ringaskiddy Ferry Terminal	Ringaskiddy Container Terminal
Total investments (€)	5,857,728	10,488,642
Timeline (years)	2024 - 2048	
Nº of calls requesting SSE for the full period studied	6,422	
Financial Net Present Value (FNPV) (€)	0	
Total CO_2eq emissions saved (tonnes)	59,411	
Total NOx emissions saved (tonnes)	158	
Total SOx emissions saved (tonnes)	393	
Total PMx emissions saved (tonnes)	30	

Port of Gijón

The Port of Gijón, also known as Puerto de El Musel, is an important seaport located in the city of Gijón, in the region of Asturias.
It is one of the most important ports in northern Spain and plays a key role in the region's trade and industry. The Port of Gijón is presented to Europe as the best way of connection with the western north of the Iberian Peninsula.
With an annual movement of more than 20 million tonnes, the Port of Gijón has infrastructures adapted to the new needs of customers and users in terms of specialised terminals, draughts for large ships and storage areas, providing services with the best quality references and respect for the environment.

Since 2007, an Environmental Management System in accordance with the ISO 14001 international standard has been in place year after year. This system involves the precise identification of environmental aspects and a periodic analysis aimed at continuous improvement.

In 2019, the Port Authority of Gijón achieved certification for the reduction of greenhouse gas emissions, highlighting the commitment of the Port Authority of Gijón in reducing the carbon footprint associated with its operations.

Technical studies

FEED studies have been carried out for two facilities, one at the container terminal (7th alignment of the OSA quay) and the other for ferries and cruise ships (8th alignment of the OSA quay and Moliner quay).

FEED studies	Total Power (MVA)	Vessel Type	Characteristics
7th alignment of the OSA quay	2	Container vessels	High Voltage Shore Connection (6.6 kV). 2 MVA available for a single connection of a large vessel or two connections for a medium and a small vessel. 50 or 60 Hz available.
8th alignment of the OSA quay and Moliner quay	4	Cruise and ferries	High Voltage Shore Connection (6.6 or 11 kV). The service could be provided as follows: • Ferries only up to 2 MVA • One ferry (2 MVA) and one cruise ship (up to 2 MVA), one at each pier. • Only one cruise up to 4 MVA (coupling the two stages in parallel). 50 or 60 Hz available.

Environmental studies

After examining European, national and regional regulations, it has been concluded that the project does not fall into any of the categories contemplated in Annex I (projects subject to Ordinary Environmental Impact Assessment) or Annex II (projects subject to Simplified Environmental Impact Assessment).
The project offers notable positive environmental impacts by supplying electricity to the ships, resulting in a decrease in greenhouse gas emissions. This approach not only improves air quality, but also reduces ambient noise. Together, these positive impacts contribute to mitigating climate change, protecting local health and marine wildlife, and encouraging the adoption of environmentally responsible solutions.

Clean Power Supply Plan

The Port Authority of Gijon has started the energy transition process to achieve an energy model based on 5 axes, including OPS as one of the key strategic measures to decrease emissions in the port area:

1. ELECTRIFICATION

- OPS at container, ferry and cruise docks.
- Replacement of combustion vehicles by 100% electric units.
- Electrification of the container terminals machinery.

2. NEUTRAL PORT

- Replacement of old luminaires with new LED projectors and intelligent control system.
- Installation of a new, more efficient air conditioning for the multi-services building, as well as renovation of part of the lighting and installation of photovoltaic panels.
- Installation of renewable energy for self-consumption.
- Annual calculation of the carbon footprint.

3. RENEWABLE ENERGIES

- Energy Communities
- Hydrogen for ships and land fleet.

4. SUSTAINABLE MOBILITY

- Car fleet electrification.
- Installation of charging point for electric vehicles.
- Construction of bike lane for access to the commercial area of the port.

5.CIRCULAR ECONOMY

- Green purchasing "0 waste".
- Ship recycled materials.
- Green and Eco-Labels.

The Port Authority has implemented specific measures to promote electricity savings and the use of renewable sources. As part of these initiatives, it has established as a requirement that all energy purchased by the company for supply to the Port Authority comes exclusively from renewable sources or high-performance cogeneration, with a guarantee of origin accredited by the National Commission for Markets and Competition (CNMC), as defined in Directives 2009/28/EC and 2004/8/EC.

Thanks to these actions, in recent years, all electrical energy consumption in the public areas of the port has become 100% renewable.
Finally, the Port Authority periodically establishes environmental objectives aimed at achieving compliance with the commitments acquired in its environmental policy and aimed at protecting the environment and improving the organisation's environmental performance.

Cost-Benefit Analysis and Blending Schemes

Main results	7th alignment of the OSA quay	8th alignment of the OSA quay and Moliner quay
Total Investments (€)	5,103,753	4,378,318
Timeline (years)	2024 - 2045	2024 - 2045
Nº of calls requesting SSE for the full period studied	4,810	4,652
Financial Net Present Value (FNPV) (€)	-1,948,350	-2,218,915
Total CO_2eq emissions saved (tonnes)	33,159	35,984
Total NOx emissions saved (tonnes)	658	714
Total SOx emissions saved (tonnes)	22	24
Total PMx emissions saved (tonnes)	30	32
Total noise emissions saved (€)	34,680	95,880

This CBA has considered the grant received through NextGenerationEU, managed by the Spanish Ministry of Transport and Sustainable Mobility

Port of Huelva

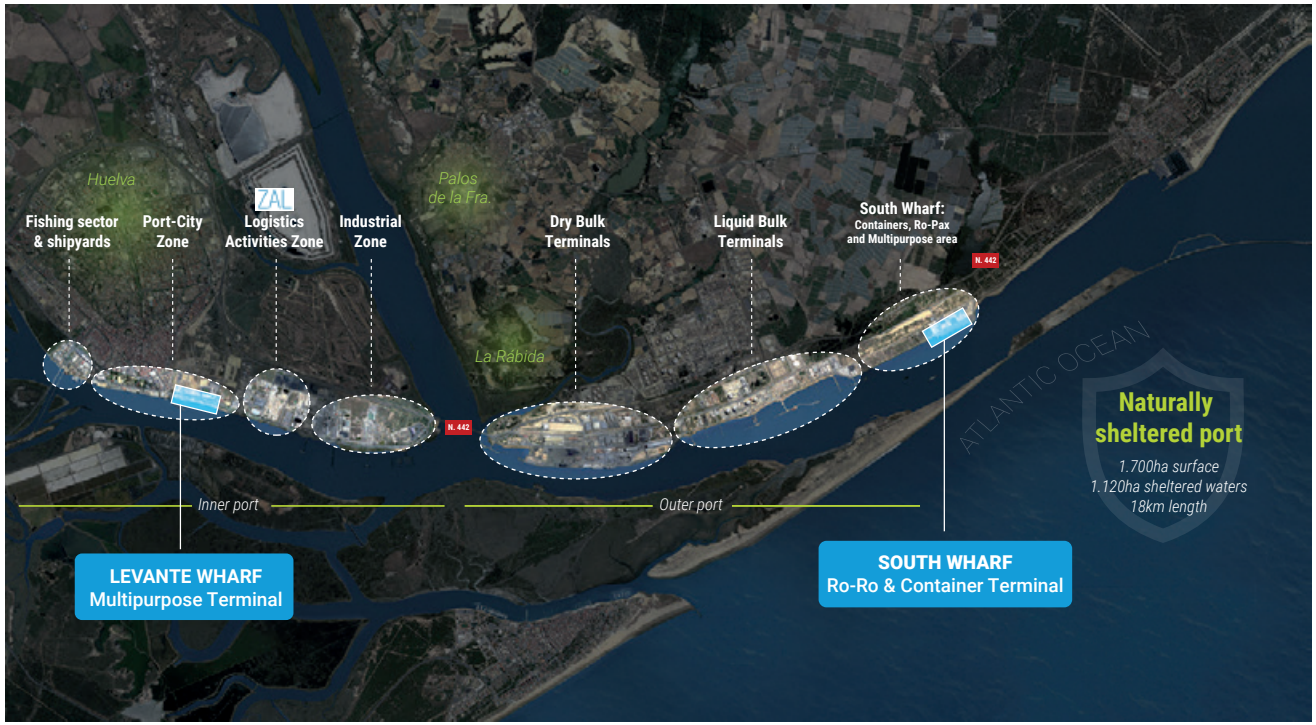
The Port of Huelva is located in Southern Europe, near the Strait of Gibraltar, at the crossroads of the most important maritime routes, in an area of important geostrategic value. The port surface area is 1,700 ha and its hinterland covers the Iberian Peninsula through the Atlantic Corridor. The Port of Huelva is the official node of the Atlantic Corridor to the Canary Islands.

The Port of Huelva is one of the main gateways to southern Europe, playing a crucial role for multimodal transport and modal shift, being an entry and exit point of the land-based TEN-T network and transport flows, with more than 32 million tonnes in 2022. Although its main traffic has a clearly industrial and mining orientation, in recent years the biggest growth has been observed in general cargo, due to the development of the Intermodal Platform of the Port of Huelva.

The Port of Huelva has developed a Strategic Energy Plan, which analyses the needs of energy in the port and the actions necessary to be carried out to meet the decarbonisation objectives. The Port of Huelva is particularly committed to the European decarbonisation strategy, implementing decarbonisation projects, being SSE one of the key initiatives under development, together with renewable energy sources projects.

Technical studies

FEED studies have been carried out for three installations, one at Levante Wharf, located a city centre of Huelva, and the other two in the outer port, specifically on the South Wharf, where the Ro-Ro and container terminals are located.



Location	Total Power (MVA)	Vessel Type	Characteristics
Levante Wharf	630	Multipurpose vessels	Low-Voltage Shore Connection (400 V). 250 kVA available in case of a single connection. Possibility of simultaneous supply points with up to 0.6 MVA in total. 50 Hz available.
South Wharf	7	Ro-Ro & Ro-Pax vessels	High Voltage Shore Connection (11 kV). 3 OPS supply for Ro-Ro and Ro-Pax with a maximum power each of 2.5 MVA. 50 or 60 Hz available.
South Wharf	18.75	Container vessels	High Voltage Shore Connection (6.6 kV). 2 OPS supply for containers with a maximum power each of 7.5 MVA. 50 or 60 Hz available.

In addition to the FEED studies, the maximum power available from the current grid has been analysed. It has been concluded that it is necessary to request an increase in capacity from the local Distribution System Operator (DSO) or electricity distribution operator company.

Environmental studies

In line with the InvestEU Regulation, the Port Authority of Huelva outsourced a sustainability proofing, which included the climate, environmental and social dimensions.

The conclusions of the environmental and climate studies have been:

environmental

- The projects comply with the regulations, are not subject to the procedure of an Environmental Impact Assessment, nor do they represent a significant impact on the Natura 2000 Network and do not have a negative impact on the framework directives on the atmosphere or the international environmental conventions listed in Annex X of Directive 2014/24/EU of the European Parliament and of the Council.
- Noise reduction is an aspect to be taken into account, to a greater extent in the Levante Wharf (inner port) than in the South Wharf (outer port, far from the city).
- In the construction phase, the negative impacts identified are mainly due to emissions and any impact that may occur on the quality of water and soil due to spills, spillages, or faults in the execution of the trenches for the channelling of the power line. These risks are manageable, and it is the responsibility of the Port Authority of Huelva to carry out appropriate monitoring and controls to help keep the level of risk low.
- Similarly, in the operating phase, the negative impacts are scarce, and none are significant.

climate

- The Port of Huelva has carried out a study on its carbon footprint, which includes indirect emissions from transport, scope 3, with those from maritime transport being important. To reduce these emissions, OPS infrastructures are presented as an effective alternative.
- The Port of Huelva is a resilient port, so the infrastructures will be developed in compliance with the criteria of resilience to possible climatic adversities, such as floods or heat waves.

Clean Power Supply Plan

The Port Authority of Huelva has drawn up its new Strategic Plan 2023-2030, with vision 2050, which is aligned with the Strategic Framework of the Spanish General Interest Port System.

The main objective of the Strategic Framework is to define what kind of ports of general interest are desired for the near future in a context of profound transformation with signs of being disruptive, while contributing to the Sustainable Development Goals (SDGs):

- Designing and implementing the port's energy strategy.
- Drawing up and developing the port's environmental strategy.

In relation with its new Strategic Plan, the Port of Huelva has developed a Strategic Energy Plan which analyses the energy transition necessary to meet the decarbonisation objectives at national and international level, which will require a major transformation in the use of primary and final energy in highly industrialised ports such as the Port of Huelva. The proposed path towards decarbonisation is based on the development of several areas, each of which will have lines of action and objectives in the short, medium and long term, with the installation of SSE being a key element for the reduction of emissions in the port.

Cost-Benefit Analysis and Blending Schemes

Main results	Levante Wharf	Ro-Ro Terminal	Container Terminal
Total investments (€)	1,365,710	9,407,226	8,878,615
Timeline (years)	2025 - 2049		
Nº of calls requesting SSE for the full period studied	3,461	7,011	4,601
Financial Net Present Value (FNPV) (€)	-5,704,114		
Total CO_2eq emissions saved (tonnes)	153,116		
Total NOx emissions saved (tonnes)	420		
Total SOx emissions saved (tonnes)	1,048		
Total PMx emissions saved (tonnes)	74		

It is planned that the future installations in the port of Huelva will be financed mainly through Connecting Europe Facility and own resources.

Port of Koper

The Port of Koper, the only Slovenian multi-purpose seaport, is located in an integrated sea-coastal area, where port activities related to cargo and passenger transport services take place. With its operations, the Port of Koper influences the appearance of Koper, as well as the development of the region, the Slovenian economy, and logistics in this part of Europe.

In 2008, Luka Koper, d. d. concluded with the Republic of Slovenia the Concession Agreement for the performance of port activity, management, development, and regular maintenance of the port infrastructure in the area of the Koper cargo port. Company Luka Koper, d. d. provides core port services in the Port of Koper and a range of complementary services on goods and other services, providing customers with comprehensive logistics support.

Traffic and warehousing are carried out at twelve specialised port terminals, which are organised according to the cargo they receive. All terminals are operated by Luka Koper, d. d.

Two public utility services are performed by Luka Koper, d. d., i.e., the public utility service of regular maintenance of the port infrastructure intended for public transport and the public utility service of collecting waste from vessels in the Koper port area. The company also manages the economic zone and ensures the development and maintenance of port infrastructure.

Technical studies

As part of the EALING project, the project documentation, including the technical maritime study, conceptual design study and construction study are elaborated, which are necessary for the projected works and administrative permits.

The construction plan includes the implementation of three SSE supply points for Ro-Ro traffic in Basin III, a new transformer station and the related power infrastructure installations. One SSE supply point is planned at the existing Ro-Ro berth at the Car and Ro-Ro terminal, and two supply points at the future berths in Basin III.

SSE berthing position	Total Power (MVA)	Voltage (kV)	Frequency (Hz)	Vessel Type
SSE 1	4	12	50/60	Ro-Ro
SSE 2	3	12	50/60	Ro-Ro
SSE 3	3	12	50/60	Ro-Ro

Environmental studies

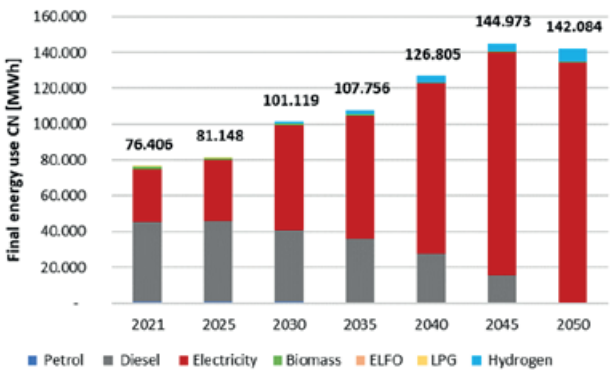
The Environmental Study was prepared as an input for the Energy Climate Plan of the company Luka Koper d.d. and addresses the impacts of implementing the Plan (which includes the implementation of SSE installations) on various environmental areas, such as air quality, climate change, soil, water, noise, vibrations, radiation, waste, accident risk, light and heat pollution, material goods, biodiversity, cultural heritage, and landscape. The study encompasses measures outlined in the Energy Climate Plan, implemented within the scope of the Spatial Plan for the Port of Koper. Public data from various sources were used to describe the environmental condition in the vicinity of the Port of Koper, including cadastral records, other public databases, and scientific research.

When assessing the environmental impacts of the intervention, environmental baseline criteria, as defined by environmental protection legislation, international agreements, national and operational environmental protection programmes, and other relevant legal frameworks were considered. The impact assessment was based on various criteria such as the nature and type of impact, probability, and duration, as well as the intensity of environmental changes. Changes in environmental loads were evaluated across different classes, ranging from positive impacts to destructive impacts. The negative impacts identified are few, and none are significant. On the contrary, a very positive impact is expected by reducing noise and emissions in the port area.

Clean Power Supply Plan

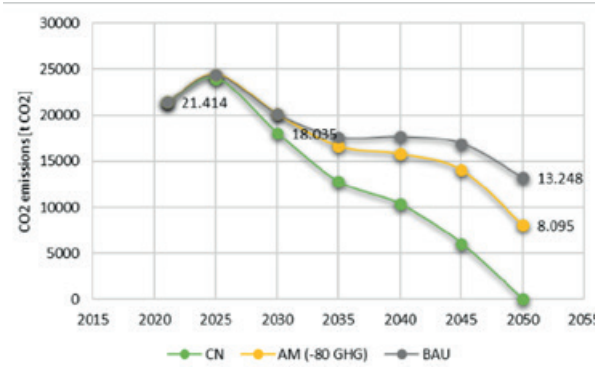
In the Energy Climate Plan Luka Koper examined the possibilities for the green energy transition of Luka Koper by 2030, with a perspective to 2050.

The resulting projection of the final energy source use until 2050 is shown in the graph on the right.



The proposed energy transition for Luka Koper encompasses several measures to enhance energy efficiency and sustainability, including SSE installations and the upgrade of the electrical grid, as crucial actions to be undertaken. The deployment of renewable energy sources such as solar panels is also foreseen, some of which are already installed.

In the Energy Climate Plan, measures are organised into three different scenarios based on their level of ambition: Business as Usual scenario (BAU), Additional Measures (AM) scenario, and, the most ambitious, Climate Neutrality (CN) scenario. The types of measures are the same in all scenarios, with the difference lying in the intensity and timeline of implementation.



Comparison of CO_2 emissions projections by scenarios

In terms of impacts on climate change mitigation, it was found that only the CN scenario is acceptable, as it is the only one that achieves the set climate goals (climate neutrality by 2050).

Cost-Benefit Analysis and Blending Schemes

Main results	Supply point Berth 1	Supply point Berth 2	Supply point Berth 3
Total investments (€)	2,120,640	1,749,528	1,431,432
Timeline (years)	2023-2047	2023-2047	2023-2047
Nº of calls requesting SSE for the full period studied	2,992	1,646	1,347
Financial Net Present Value (FNPV) (€)	- 1,699,847	- 1,402,374	- 1,147,397
Total CO_2eq emissions saved (tonnes)	72,517		
Total NOx emissions saved (tonnes)	221		
Total SOx emissions saved (tonnes)	436		
Total PMx emissions saved (tonnes)	-		

It is planned that the future installations in the Port of Koper will be financed mainly through European and own funds.

Port of Leixões

The Port of Leixões is the second biggest port in Portugal in terms of cargo throughput per year, representing about 21% of Portuguese foreign trade by sea, having received during 2022, around 2,434 ships, of which the container ships represent 50% of the global movement.

The Port of Leixões is an urban port located between Matosinhos and Leça da Palmeira, so its decarbonisation and climate neutrality is extremely important for the quality of life of the inhabitants of these populations centres. The concern regarding urban integration of the port grew and today this issue is a strategic perspective within the future development of the port.

Intending to become a reference port in southern Europe, the Port of Leixões initiated the implementation of its Roadmap for energy transition and decarbonisation of its activities, which will result in the achievement of carbon neutrality and energy self-sufficiency by 2035, 15 years earlier than foreseen in the European Green Deal.

The roadmap of the Port of Leixões includes seven major areas of action: decarbonisation of activities, electrification of terminals (including OPS), alternative fuels, renewable energy production, digitalisation, upgrade of the electrical grid and improvement of the air quality monitoring.

Technical studies

FEED studies were conducted at four berths, for container, passenger and Ro-Ro traffic. These studies allowed the definition of the necessary requirements and specifications for the design and construction process of the OPS system in the future.

The image displays all the anticipated connections, with the initial ones corresponding to those mentioned in the table.

Location	Total Power (MVA)	Vessel type	Characteristics
T. Cruzeiros	16	Cruise	CRUISE Nr. connections: 1 (+1) point of 16 MVA | Max. Simultaneity: 1 (+1) vessel | Level of service: 99.0% (1 point); 99.0% (2 points) | Voltage: 6.6/11 kV | Frequency: 50/60 Hz
TC Norte	7.5	Container	CONTAINER Nr. connections: 2 points of 7.5 MVA each | Max. Simultaneity: 2 vessels | Level of service: 97.6% | Voltage: 6.6 kV | Frequency: 50/60 Hz
Doca 1 Norte *	6.5	Ro-Ro, cruise	CRUISES/PASSENGER Nr. connections: 1 (+1) point of 6.5 MVA | Max. Simultaneity: 1 vessel | Level of service: 63.9% (1 point); 71.0% (2 points) | Voltage: 6.6/11 Kv | Frequency: 50/60 Hz Ro-Ro Nr. connections: 1 point of 1.7 MVA | Max. Simultaneity: 1 vessel | Level of service: To be defined in the pilot | Voltage: 6.6/11 kV | Frequency: 50/60 Hz
T. C. Sul	10	Container	CONTAINER Nr. connections: 2 (+1) points of 7.5 MVA each | Max. Simultaneity: 2 (+1) vessels | Level of service: 78.3% (2 points); 95.8% (3 points) | Voltage: 6.6 kV | Frequency: 50/60 Hz

***** The APDL plans to carry out works on this quay, in which the berthing line of the two terminals (Ro-Ro and passenger) will be aligned. It is also planned to carry out a pilot for the electricity supply for Ro-Ro traffic. This installation will have 1.5 MW.

Environmental studies

The Port Authority (APDL) prepared the related environmental studies that aim to analyse the environmental impacts resulting from the implementation and operation of the SSE systems in the Port of Leixões and suggest measures that allow the mitigation of these environmental impacts.

During the construction phase, the most significant environmental impacts are related to atmospheric and noise emissions due to activities such as the transport of materials, demolition activities and the operation of machinery. Although there are other environmental impacts, such as water or soil pollution due to the risk of substance spills, measures can be implemented to reduce the likelihood and significance of these impacts. During the exploration phase, positive impacts are expected in terms of noise pollution at a local level, as well as an improvement in air quality at a regional level. The significance of these positive impacts depends on the number and type of ships calling, the length of stay in port, and the energy sources used during the stay in port (electricity, methanol, hydrogen, liquefied natural gas,...), the capacity of ships to connect to the available grid, the cost of electrical energy compared to other fuels and the existence.

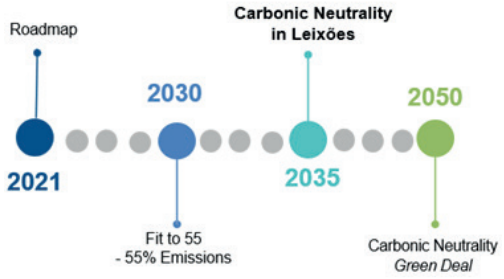
Clean Power Supply Plan

Environmental sustainability is a priority in the APDL's port cluster, with significant focus being placed on improving the environmental conditions of the areas managed by APDL. In accordance with its commitment to society and the environment, and in line with the European Green Deal, APDL, as a socially and environmentally responsible company, aims to be an active part of the energy transition and climate emergency. Proof of its commitment is that the Port of Leixoes has decided to anticipate the objectives proposed in European Green Deal, and aims to achieve climate and energy neutrality by 2035.

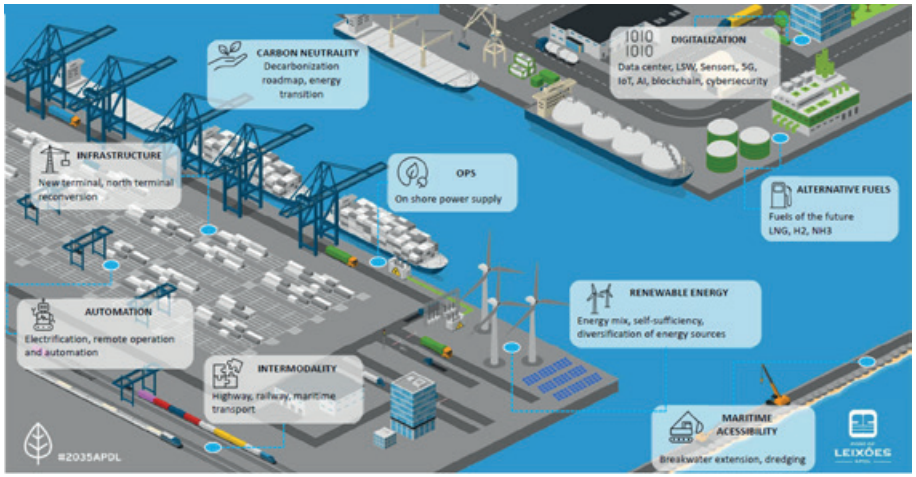
With the ambition of pursuing these objectives and holding on to its vision for the Port of Leixões, APDL decided to develop its own Roadmap for an energy transition towards carbon neutrality in the Port of Leixões, to define the path to follow in order to achieve the objective of the decarbonisation of the port. The APDL's Roadmap, already concluded in 2021, identified the challenges and opportunities for the full development of the energy transition in the port of Leixões, in line with the 2021 Annual Sustainable Growth Strategy published by the European Commission, and taking advantage of the European consensus on the importance of decarbonisation in the context of green recovery.

The roadmap for the energy transition and decarbonisation plan developed has two main sections: diagnosis and action plan. The diagnosis makes a global analysis of all the emissions and energy consumption, including the port infrastructure, the equipment, the operations and the road traffic and maritime activities.

This diagnosis has been made as a joint effort, involving all the stakeholders of APDL.
The second part was the action plan, including concrete measures, and the respective schedule to achieve carbon neutrality by 2035..



The APDL is aware this is a very ambitious goal since it implies anticipating carbon neutrality for 15 years compared to other timelines.



Cost-Benefit Analysis and Blending Schemes

Main results	
Total investments (€)	1,305,000
Timeline (years)	2023-2047
No of calls requesting SSE for the full period studied	2,056
Financial Net Present Value (FNPV) (€)	148
Total CO_2eq emissions saved (tonnes)	51,605
Total NOx emissions saved (tonnes)	145
Total SOx emissions saved (tonnes)	368
Total PMx emissions saves (tonnes)	24

It is planned that the future installations in the Port of Leixões will be financed mainly through NextGenerationEU, Connecting Europe Facility and own resources.

Port of Piraeus

The Port of Piraeus,located strategically in the southeast Mediterranean, has a significant geostrategic position. Not only it is one the largest and busiest ports in Europe and the Mediterranean, serving a large hinterland (stretching all the way to the Balkan peninsula), but it is also located at the gateway to the routes that connect Europe to the Near and Middle East, to Africa, and through the Suez Canal to the Far East. In this sense, the strategic importance is very high.

In terms of traffic only in 2023, the Port of Piraeushandled more than 16 million passengers, 2.9 million vehicles, 1.5 million cruise tourists, 762 cruise ships, more than 5.1 million TEU of containers, and 317 thousand merchandise vehicles. Furthermore, it has a big ship repair base for small, medium and big ships. During 2023, 270 ships used the ship repair bays while 160 ships used the floating docks.

Today, the port is particularly dedicated to greening, its activities and seeking sustainable solutions to address transformation for resilient infrastructure and energy-efficient operations, while respecting the local community and the needs of the stakeholders.

Technical studies

FEED studies have been carried out for five installations, all located at the Passenger Terminal of Piraeus Port. These systems will be the first SSE systems deployed in the port.

SSE berthing position	Location	Total Power (MVA)	Voltage (kV)	Vessel Type
SSE 1	Poseidonos Coast	0.5	0.44/0.4	Ro-Pax
SSE 2	Ag. Dionisiou Coast	1	11	Ro-Pax
SSE 3		4	11	Ro-Pax
SSE 4	Ietionia Coast	4	11	Ro-Pax
SSE 5	Perikleous Coast	4	11	Ro-Pax

For the final definition of the SSE berthing positions, an estimation of the power needs per berth positions was considered, based on the vessel type, berthing positions and energy demands of each vessel. Each shore side installation will include one shore connection substation, the underground MV and LV cables between the substation and the shore connection points, with all the necessary civil work and one (1) Cable Management System (CMS). For the supply of each vessel, a containerized SSE substation will be constructed, which will be supplied by the existing substations of the port.

Environmental studies

The environmental dimension is the project's primary objective, addressing the requirements to transform the Port of Piraeus into a zero-emission port through the quantity of infrastructure, quality of services and adoption of modern technologies and practices focusing on energy efficiency of harbour activities. In this respect, the project will allow the improvement of the environmental performance of the port transforming it into a greener, technologically advanced pillar of the maritime industry and will upgrade the future energy profile of the port, providing also the shipping industry with access to more sustainable and greener sources of energy.

In accordance to Article 6/Par.1a of National Law 4014/2011 on the environmental licensing of works and activities and other provisions falling under the competence of the Ministry of Environment as applied at present, an Environmental Compliance Report was prepared and submitted to the competent authority, General Directorate of Environmental Policy / Ministry of Environment and Energy. The Report assessed the impacts of the work interventions to the environment and to the climate with the following conclusions:

- The interventions comply with the European and National environmental regulations and do not require an Environmental Impact Assessment;
- The interventions concern small-scale construction of an environmentally approved project;
- The shore-side electricity supply system will be placed in a substation minimising negative visual impact and volume;
- The interventions are expected to reduce NOx, SOx, PMx and CO_2 emissions and improve the overall environment footprint;
- The interventions are expected to reduce the emitted sound level and vibrations/vibrations caused by ships in the port zone and surrounding area.

Clean Power Supply Plan

Over the last years, the Port Authority of Piraeus has been working to pave the sustainability roadmap towards complete carbon neutrality via a set of energy transformation short and mid-term measures comprising implementation of shore-side electricity in all its terminals (Ro-Pax ferries, fast passenger ferries, cruise ships, containerships), smart energy saving (building management systems, LED lighting), installation of alternative fuel infrastructure, deployment of electric vehicle chargers, smart traffic management systems within the port, etc.

The successful materialization of this target will relief the surrounding urban area of Piraeus from the atmospheric pollution and improve the life quality of its citizens as suggested by the European Green Deal.

Cost-Benefit Analysis and Blending Schemes

Main results	5 SSE positions at Piraeus Passenger Terminal
Total investments (€)	14,102,767
Timeline (years)	2023-2047
Nº of calls requesting SSE for the full period studied	1,076,133
Financial Net Present Value (FNPV) (€)	11,835,319
Total CO_2eq emissions saved (tonnes)	85,175
Total NOx emissions saved (tonnes)	246
Total SOx emissions saved (tonnes)	625
Total PMx emissions saved (tonnes)	37

The future installations in the Port of Piraeus are planned to be financed through a combination of EU funds and own resources.

Port of Rafina

The Port of Rafina, located in the suburban town of Rafina, on the north-eastern cost of Attica in Greece, has been particularly active in recent years in greening its activities and is seeking sustainable solutions for the green development of the port, while respecting the local biodiversity, the local community and the needs of the stakeholders.

The Port of Rafina belongs to the Trans-European Transport Network (TEN-T network) and connects north-eastern Attica with the Cyclades islands (Tinos, Andros, Mykonos etc) and with Marmari of Evoia island via both Ro-Pax and high-speed vessels, serving both passenger/tourist and commercial traffic for all the above-mentioned destinations.

The implementation of alternative fuel facilities, such as OPS installations, will improve the sustainability of the port and at the same time reduce its environmental footprint aiming at fulfilling the European Green Deal principles and particularly the climate plan's 55% net reduction target.

Technical studies

The Port of Rafina makes the next steps towards the implementation of shore-side electricity technology via the EALING project. In this framework, the port of Rafina has performed the FEED study for four berthing positions at the Passenger Terminal:

SSE berthing position	Total Power (MVA)	Voltage (kV)	Vessel Type
1	1.5	11	Ro-Ro
2	1.5	11	Ro-Ro
3	1.5	11	Ro-Ro
4	1.5	11	Ro-Ro

The installations for the Rafina SSE system include:

- One shore connection substation
- The Underground MV and LV cables between the substation and the shore connection points, with all the necessary civil works
- Four Cable Management Systems (CMSs)

Environmental studies

The cold ironing facility is in alignment with the envisaged land uses of the approved Master Plan of the Port of Rafina while it fully complies with the approved environmental terms of the port. The operation of the future SSE facility has an important positive effect on the environment through its positive contribution to the reduction of the rate at which climate change is taking place.

The resulted limitation in the use of the ships' engines while in the port has a very important positive local effect, due to the reduced concentration of pollutants in the air and the reduced noise level coming from ships auxiliary engines. This effect is of high importance given the vicinity of the city of Rafina to the port.

Furthermore, the negative impacts on the environment from the installation/construction works of the facility, they will be of negligible importance. The construction works, due to the short duration scale of the excavations required, will not have an important impact on the natural environment, human health, and landscape. In addition, due to the geomorphology in the area of the works, these will not be close to residences or other city activities. Also crucial to minimizing impacts is the fact that the required input power is medium voltage.

In conclusion, overall, the installation and operation of the SSE facility in the Port of Rafina will have an important positive effect on the local environmental conditions (air and noise), while it will also contribute to the global effort to reduce the rate at which climate change is taking place. Any negative impacts during construction phase are negligible and of extremely short duration.

Clean Power Supply Plan

Regarding the supply of clean power, the Port of Rafina plans to cover the energy demand through green energy sources either locally (within or nearby the port) or at distant sites and injected in the main National Grid of Greece.

In addition to the SSE plans, the Port of Rafina has conducted extensive research on the installation of renewable energy sources in place within its jurisdiction, with the focus being primarily on photovoltaics (PV). Due to significant space limits, it has been concluded that for the time being the installation of PV panels is feasible only in the roof of buildings that belong to the Port. In addition, some energy savings can be attained by implementing actions like installing, programming and adjusting Building Management Systems in the buildings, or Energy Management systems for the entire electric network of the Port.

Cost-Benefit Analysis and Blending Schemes

Main results	
Total investments (€)	6,065,989
Timeline (years)	2023 - 2047
Nº of calls requesting SSE for the full period studied	35,139
Financial Net Present Value (FNPV) (€)	- 4,845,600
Total CO_2eq emissions saved (tonnes)	48,794
Total NOx emissions saved (tonnes)	140
Total SOx emissions saved (tonnes)	361
Total PMx emissions saved (tonnes)	22

Port of Trieste

The Port Network Authority of the Eastern Adriatic Sea is a public body having as its primary task to direct, plan, coordinate, promote and control port operations and commercial and industrial activities in the ports of Trieste and Monfalcone, being respectively core and comprehensive nodes in the TEN-T network.

Located at the intersection between the Baltic-Adriatic and Mediterranean TEN-T core network corridors, the Port of Trieste is an international hub for overland and sea trade with the dynamic markets of Central and Eastern Europe, and it is the top-ranking Italian port for total throughout, with more than 57 million tonnes (2022) as well as for intermodal trains – almost 10,000 trains.

Technical studies

Through EALING, the Port Network Authority of the Eastern Adriatic Sea realised the final designs of SSE systems for 3 docks to provide ships with the electricity needed to power their on-board systems directly from the quay while keeping the on-board generators switched off to limit port emissions Pier no. 5/Riva Traiana (Trieste), Logistic Platform/Scalo Legnami (Trieste), and Portorosega (Monfalcone).

An analysis of the type of vessels calling at these docks was performed in order to define the voltage, frequency and power levels output of each SSE connection.

Location	Shore Output Power (single connecting point maximum power) (MVA)	Shore Output Power (system maximum power) (MVA)	Shore output Voltage (kV)	Vessel Type
Pier no. 5 / Riva Traiana - Trieste	2.25	3.5	6.6 or 11 kV at 50 or 60 Hz	Ro-Ro vessels
Logistic Platform / Scalo Legnami - Trieste	2	4	6.6 or 11 kV at 50 or 60 Hz	Container carriers
Portorosega – Monfalcone (berths 4, 5, 6, 7, 8 ,9)	2	5	11 kV at 50 or 60 Hz (6.6 kV available with specific cable dispensers equipped with converters)	Pure Car Carriers, Bulk, Cruises carriers, General dry cargo ships
Portorosega – Monfalcone (berths 1, 2, 3 second phase)	20	20	6.6 or 11 kV at 50 or 60 Hz	Cruises

The systems are designed in accordance with the standard IEC 80005-1 to ensure interoperability between shore and on-board systems. The HV shore connection provides 6.6 or 11 kV at 50 or 60 Hz, with an output of maximum 2.25 MVA for the 3 connecting point of Pier no. 5/Riva Traiana, 2 MVA for the 4 connecting point of the Logistic Platform/Scalo Legnami berths and 2 MVA for the electrification system of the Portorosega dock berths 4, 5, 6, 7, 8, 9, while the berths 1, 2, 3 - to be implemented in a second phase - will be dedicated to cruises and will operate at 20 MVA maximum, thanks to a direct high voltage connection to the energy distributor.

Environmental studies

In order to define the possible impacts induced by the project actions, environmental studies were carried out to:

- Provide a description of the status and trends of environmental factors against which significant effects can be comparted and evaluated;
- Form the basis on which ex-post monitoring can be used to measure change once the Project has been initiated;
- Evaluate and estimate potential impacts, both at the construction and operating phases.

The results assured that:

- The impact of the interventions on the environmental matrices of the area, both in the contruction and operating phases are globally sustainable, as they do not significantly alter appreciably the context of the moorings, nor do they produce harmful effects on the environment and the human presence;
- The interventions do not require the activation of an Environmental Impact Assessment procedure.

Clean Power Supply Plan

The adoption of shore-side electricity is a key part of the complex environmental strategies that the Port Authority of the Eastern Adriatic Sea has set out in their Port System Energy and Environmental Planning Document (DEASP).
Starting from the analysis of the actual state of emissions, referred to year 2019, the document represents a strategic guideline for the implementation of interventions to improve energy efficiency and the use of renewable energy in ports:

- Implementation of shore side electricity systems;
- Implementation of a smart grid aimed at an efficient use of green energy within the port system;
- Use of available surfaces (building roofs) for the construction of photovoltaic systems for the production of electricity to be fed into the port smart grid;
- Use of electricity produced through the implementation of a wind turbine to feed the port smart grid;
- Implementation of LED technology lighting systems to replace standard lighting systems;
- Implementation of systems to increase the thermal insulation of buildings;
- Implementation of more efficient heat generators;
- Implementation of the use of light and heavy-duty vehicles powered by electricity to replace fossil fuels;
- Implementation of the use of vehicles fuelled by green hydrogen.

When the action plan will be fully implemented, the total emissions should be 48.1% of the 2019 situation.

Cost-Benefit Analysis and Blending Schemes

Main results	Pier no. 5 / Riva Traiana – Port of Trieste	Logistic Platform/ Scalo Legnami - Port of Trieste	Portorosega - Port of Monfalcone
Total investments (€)	3,984,304	3,707,873	7,137,585
Timeline (years)	2026 - 2045	2026 - 2045	2026 - 2045
N° of calls requesting SSE for the full period studied	6,840	5,660	3,360
Financial Net Present Value (FNPV)	-3,134,650	-3,445,442	-7,638,896
Total CO_2 emissions saved (tonnes)	74,795	55,552	64,034
Total NOx emissions saved (tonnes)	1,081	1,337	1,542
Total SOx emissions saved (tonnes)	71	53	61
Total PMx emissions saved (tonnes)	59	44	50

In line with the adopted assumptions and expectations related to SSE investments, the project is particularly beneficial in terms of CO_2 reductions. According to the main CBA economic performance indicators, the 3 SSE investments in the ports of Trieste and Monfalcone generate over € 11.5 million of net benefits.

The funds for the realisation of the 3 SSE installations are secured by a combination of the following financial resources:

Sources of financing	Total estimated amount
Total investments (€)	16,293,870
National Recovery and Resilience Plan (€)	15,000,000
National Public funds (€)	178,546
EU funds (€)	279,352
Own resources (€)	835,970

Port of Valencia

The Port of Valencia is the fourth most important port in Europe in terms of container traffic[1], handling the movement of five million TEUs in 2022. To this must be added the importance of Ro-Ro traffic, where more than 420,000 Intermodal Transport Unit (ITU) were handled in 2022. In recent years, the Port of Valencia has consolidated its status as a mixed hub, maintaining the balance between import and export traffic at the service of foreign trade and maritime transit, providing connectivity for companies. It is not in vain that the Port of Valencia is the port with the best connectivity in Spain according to the UNCTAD Liner Shipping Connectivity Index (LSCI), channelling 40% of Spanish import and export containers. Likewise, the Port of Valencia is a benchmark for passenger connectivity with the Balearic Islands and at the service of tourism via cruise traffic.

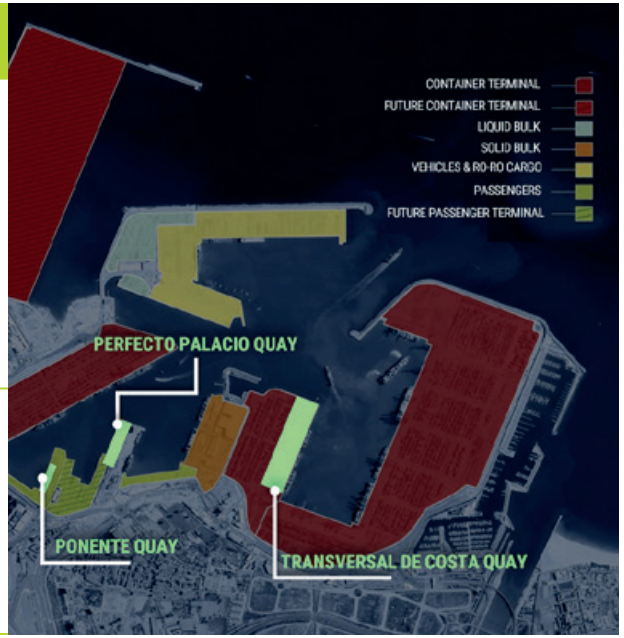
The Port of Valencia is particularly committed to the 2030 Agenda and has long been a leader in the promotion of sustainable projects to reduce the environmental footprint and achieve a net-zero emissions port in 2030.

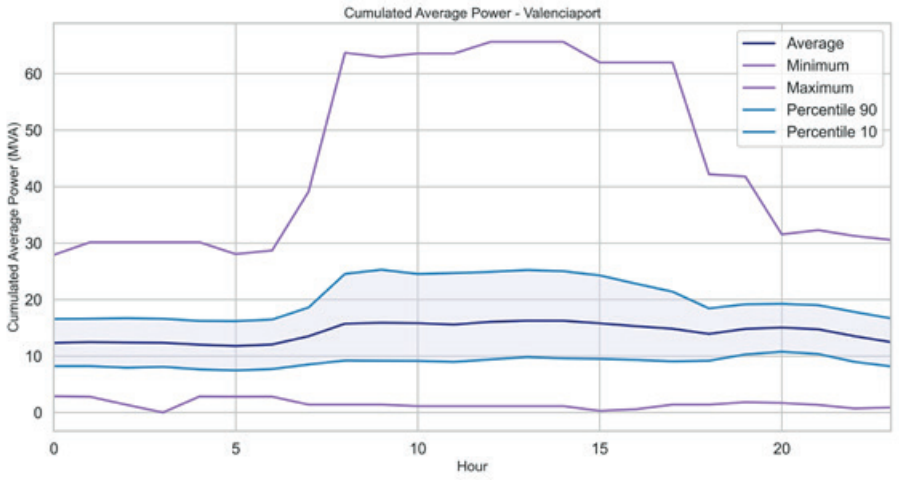
[1] Top-15 container ports in European Union in 2022 – PortEconomics

Technical studies

FEED studies have been carried out for three installations, one at a container terminal, one at a passenger and ferry terminal and the last one at a future passenger and ferry terminal. These systems will be the first SSE systems deployed in the port.

Location	Total Power (MVA)	Vessel Type	Characteristics
Transversal de Costa quay	10	Container vessels	High Voltage Shore Connection (6.6 kV). 7.5 MVA available in case of a single connection. Possibility of two simultaneous supply points with up to 5 MVA each. 50 or 60 Hz available.
Poniente quay	16	Cruise ships up to 16 MVA and ferries up to 4 MVA	High Voltage Shore Connection (6.6 or 11 kV). 1 OPS supply line for cruise ships and 1 OPS supply line for ferries. 50 or 60 Hz available.
Perfecto Palacio quay	20	Cruise ships up to 20 MVA and ferries up to 4 MVA	





In addition to the FEED studies, an analysis of the estimated SSE demand for the entire port has been carried out. The result is that, if 100% coverage of calls is to be achieved, the port of Valencia will have to be prepared to supply an average of around 20-70 MVA throughout the day in shore power, which could rise to more than 90 MVA in the highly unlikely event that all ships at berth would demand peak power at the same time. The main factor in this huge variation is the number of cruise ships calling at the port on a daily basis.

Environmental studies

In line with the InvestEU Regulation[2], the Port Authority of Valencia outsourced a sustainability proofing, which included the climate, environmental and social dimensions.

The conclusions of the environmental and climate studies have been:

environmental

- The projects comply with the regulations, are not subject to the procedure of an Environmental Impact Assessment, nor do they represent a significant impact on the Natura 2000 Network, nor are they located in any Site of Community Interest (SCI) in the Valencian Community and do not have a negative impact on the framework directives on the atmosphere or the international environmental conventions listed in Annex X of Directive 2014/24/EU of the European Parliament and of the Council. They are also subject to compliance with the Environmental Impact Statement of the Port of Valencia of 30 July 2007.
- In the construction phase, the negative impacts identified are mainly due to emissions and any impact that may occur on the quality of water and soil due to spills, spillages, or faults in the execution of the trenches for the channelling of the power line. These risks are manageable, and it is the responsibility of the Port Authority to carry out appropriate monitoring and controls to help keep the level of risk low.
- Similarly, in the operating phase, the negative impacts are scarce, and none are significant.

climate

- Based on the calculation of the carbon footprint, it is concluded that the implementation of the SSE installations would have a positive impact as GHG emissions would be significantly reduced.
- In relation to the impact of climate change on the infrastructure, the installation areas will be impacted by the phenomenon of heat waves and sea flooding, the latter of which may affect the operation of the substations with a decrease in the power supplied. Nevertheless, measures have been taken in this respect in the choice of components to ensure the correct operation of the installations in compliance with the common monitoring and surveillance requirements.

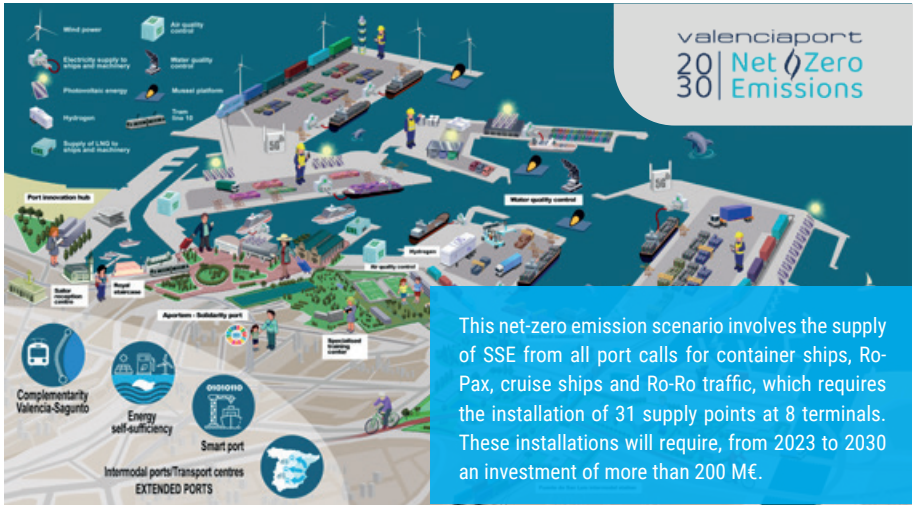
+ 35M
TOTAL INVESTMENTS

+890,000 tonnes
CO_2eq EMISSIONS SAVED

[2] https://eur-lex.europa.eu/eli/reg/2021/523/oj

Clean Power Supply Plan

With the mission to be a net-zero emission port by 2030, the Port Authority and Fundación Valenciaport have worked since 2021 in the development of the "Net-Zero Emissions Plan 2030", which defines the actions to be carried out in the short, medium and long term to drive the adoption of more sustainable options by the different sub-sectors (i.e. port authority, terminals, ships, nautical services, other services) in the port of Valencia, so as to make significant progress towards the net-zero emissions target in 2030 and minimise the necessary investment in offsetting projects.



This net-zero emission scenario involves the supply of SSE from all port calls for container ships, Ro-Pax, cruise ships and Ro-Ro traffic, which requires the installation of 31 supply points at 8 terminals. These installations will require, from 2023 to 2030 an investment of more than 200 M€.

Cost-Benefit Analysis and Blending Schemes

Main results	Transversal de Costa Quay	Poniente Quay	Perfecto Palacio Quay
Total investments (€)	10,164,650	12,318,187	12,528,034
Timeline (years)	2023 - 2047	2023 - 2047	2023 -2047
Nº of calls requesting SSE for the full period studied	12,233	13,084	16,741
Financial Net Present Value (FNPV) (€)	- 20,559,551	- 13,272,780	- 13,455,292
Total CO_2eq emissions saved (tonnes)	662,349	75,918	156,113
Total NOx emissions saved (tonnes)	10,635	1,266	2,536
Total SOx emissions saved (tonnes)	294	40	73
Total PMx emissions saved (tonnes)	666	52	141
Total noise emissions saved (€)	84,642	308,719	460,858

It is planned that the future installations in the port of Valencia will be financed mainly through NextGenerationEU, Connecting Europe Facility and own resources.

Port of Varna

The Port of Varna is the largest seaport complex in Bulgaria. It is located on the Black Sea's west coast on Varna Bay, along Lake Varna and Lake Beloslav. The Port of Varna offers full service: loading, discharging, stevedoring, freight forwarding, storage and various intermodal services. For its approximately 40 berths, it operates 65 electric cranes and about 400 other pieces of ship, landside and warehouse port facilities.

The Port of Varna is particularly active in recent years in greening its activities and seeking sustainable solutions for the green development while respecting the local community and the needs of the stakeholders.

The implementation of alternative fuel technologies will improve the sustainability of the port and, at the same time, reduce its environmental footprint in order to meet the European Climate Action principles and, in particular, the 55% net reduction target.

Technical studies

In the framework of the EALING project, the port of Varna has performed the FEED study for eight berthing positions.

SSE berthing position	Location	Total Power (MVA)	Voltage (kV)	Vessel Type
2	Berth 2/Varna West	3	6.6	Chemical Tanker/Tanker
5	Berth 5/Varna West	1	6.6	Bulk Carrier Dry
10	Berth 10/Varna West	1	6.6	Bulk Carrier Dry/ General Cargo
10a	Berth 10a/Varna West	1	6.6	Bulk Carrier Dry/ General Cargo
17	Berth 17/Varna West	3	6.6	General Cargo Ship/Container
1	Berth 1/Varna East	2	11	Passenger
7	Berth 7 Varna East	2	6.6	General Cargo Ship
9	Berth 9 Varna East	1.5	6.6	Bulk Carrier Dry/ Chemical Tanker

Environmental studies

Bulgarian national legislation states that Environmental Impact Assessment (EIA) is aimed at the integration of the predictions with regard to the environment in the process of development as a whole and the introduction of the principle of sustainable development.
The conclusions of the environmental and climate studies for the implementation of the SSE Project in the Port of Varna have been:

- The land use, soil, and biodiversity will not be affected by the construction and operation phase of the Project.
- During the various stages of implementation of the Project construction and operation of the SSE system, there is no release of harmful emissions into the adjacent hydrographic network and groundwater, due to the characteristic of the activity.
- The operation of the SSE system is not related to the emission of harmful substances into the atmospheric air. During operation, there will be no organised and/or unorganised sources of atmospheric air pollution.
- The soil will not be affected by the Project as it will take place at the existing terminal where no soil layer is available.
- During the operational phase, the equipment and the operation of the SSE system are not a source of noise and it is not possible to have a negative impact on the workers and the population in the area.
- There are no sources of heating and radiation during the construction and operation.
- During the operation only in case of repairing some waste can be generated.

The measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis) will be developed as part of the EIA Report and in accordance with the relevant legal requirements.

Clean Power Supply Plan

Bulgarian Ports Infrastructure Company outsourced the development of a Clean Power Supply Plan for the Port of Varna. The Plan contains both an analysis of the port's spatial organisation and main sources of consumption, as well as future energy needs.
The document also includes planned activities for the use of the port's energy, including the SSE system, as well as activities to meet future energy needs. The possibilities for renewable energy installations at the Port of Varna are also analysed. The developed Clean Power Plan is essential for the transformation of the Port of Varna into a green port.

Cost-Benefit Analysis and Blending Schemes

Main results	
Total investments (€)	11,050,000
Timeline (years)	2023 - 2047
No of calls requesting SSE for the full period studied	6,350
Financial Net Present Value (FNPV) (€)	28,984
Total CO_2eq emissions saved (tonnes)	57,338
Total NOx emissions saved (tonnes)	162
Total SOx emissions saved (tonnes)	386
Total PMx emissions saves (tonnes)	-

It is planned that the future installations in the port of Varna will be financed through Transport Connectivity Programme 2021-2027.

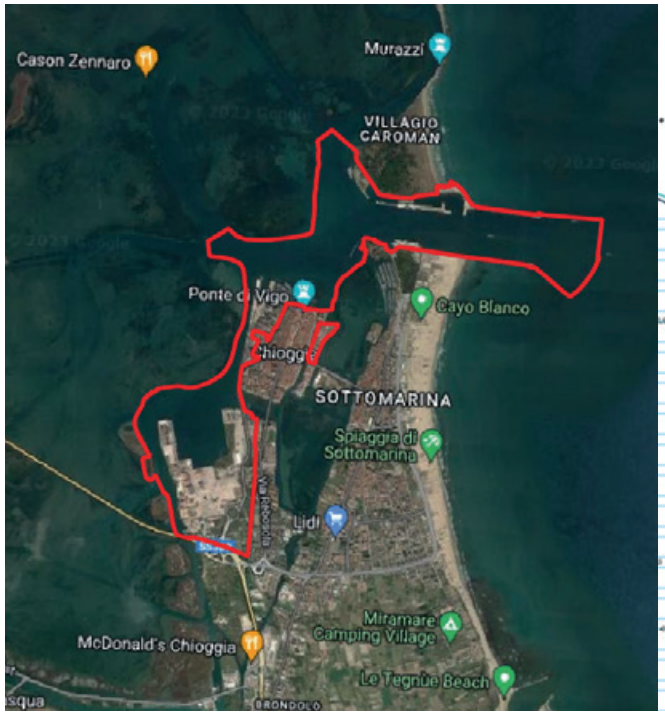
Port of Venice-Chioggia

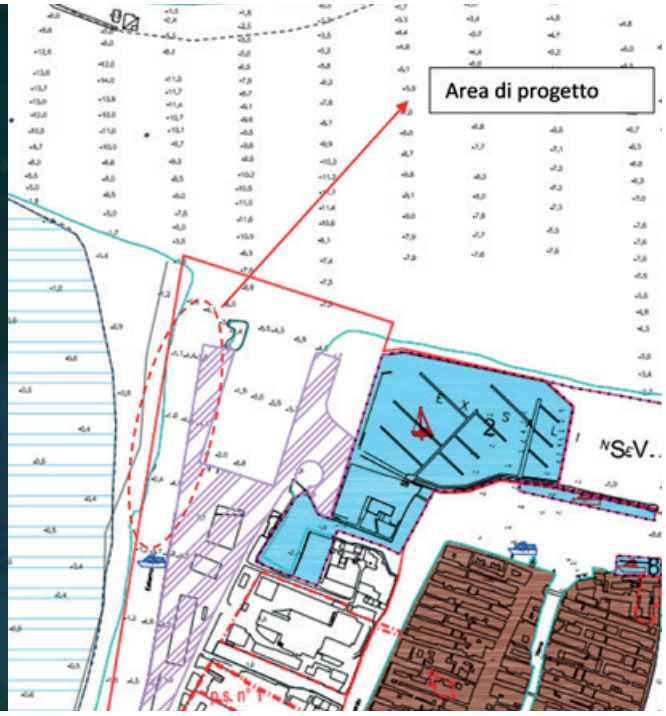
The North Adriatic Sea Port Authority (NASPA) is a strategic player for the economy and the well-being of the North-East of Italy.
1,260 is the number of enterprises based in the port of Venice, while 322 enterprises are in the port of Chioggia and more than 21,000 is the number of direct employees.
In the last years, NASPA re-allocated resources to find the right balance for the sustainability of port operations, even facing current difficult climate challenges, learning from past experiences, and applying 21st century's technologies.

In line with the philosophy of the UN 2030 Agenda, NASPA aims at enhancing and coordinating all future sustainability efforts in the ports of Venice and Chioggia. Pursuing this goal requires cooperation with all supply chain partners, working together on new technologies to make economic activities and operations not only sustainable, but also financially and economically more efficient and viable.

Technical studies

FEED studies have been dedicated to "Porto Saloni" dock in the port of Chioggia for small cruises and river barges.





Medium voltage shore connection (7 MW)

1 OPS supply for cruise ships and 1 OPS supply for river barges

Total estimated costs around €6 million

Evaluation of different solutions for energy supply system
(grid/fuel cell/photovoltaic plant)

Based on the Environmental Assessment carried out, the project complies with current regulations; it is not subject to the procedure of an Environmental Impact Assessment, nor does it represent a significant impact on Natura 2000 Network.

Potential negative impacts, identified through the Environmental Assessment, in relation to the construction phase and mainly related to dust and emissions, can be managed with the appropriate mitigation measures, monitoring and controls; any other risks are considered under control.

Environmental studies

- The Port Environment and Energy Plan (DEASP) was carried out.
- Carbon footprint was calculated for every port activity, providing proposals of mitigation measures and interventions for the different emission's sub-sectors (direct and indirect: Port Authority, terminal, services, tugs, vessel during maneuvering and mooring phases).
- OPS project development can contribute to reduce almost 25% of CO_2 emissions related to vessel mooring phase within a year.

Thanks to all the analyses implemented and listed in the Port Environment and Energy Plan (DEASP) and Clean Power Supply Plan, solutions toward developing a Net-Zero Emissions Port Plan were identified along with the relative specific actions to be carried out in the the short, medium and long term for each emission sub-sectors.

Clean Power Supply Plan

Photovoltaic plants for Sorima and Impreport

Apart from the implementation of SSE installations, one of the main actions that will be carried out in relation to the clean energy plans of the port is the installation of two 100 kW photovoltaic plants at SO.RI.MA and IMPREPORT commercial terminals, producing 250,000 kWh/year., thus covering the total energy needs and generating surpluses.

The expected benefits will be as follows:

- Use of clean electricity from solar sources, thus reducing the use of fossil energy sources;
- Reduced dependence on grid and purchase of non-renewable energy;
- Increased lighting system efficiency;
- Reduction of CO_2 emissions.

1,079,750 € → estimated investment

63,000 € → economic benefits/year
(energy saving and avoided negative externalities)

64 tCO_2 → CO_2 saved/year

Photovoltaic plans in Chioggia

Cost-Benefit Analysis and Blending Schemes

Main results	Port of Chioggia OPS installation
Total investments (€)	5,863,461
Timeline (years)	2025 - 2049
N° of calls requesting SSE for the full period studied	3,075
Financial Net Present Value (FNPV) (€)	-5,537,218
Total CO_2eq emissions saved (tonnes)	59,731
Total NOx emissions saved (tonnes)	1,085
Total SOx emissions saved (tonnes)	38
Total PMx emissions saved (tonnes)	73
Total noise emissions saved - Sum (25 years) (€)	1,519,214
Total noise emissions saved - NPV (25 years) (€)	856,469

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