Ports leading a sustainable and just transition

Guidelines on systems innovation for ports

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ATHENA SUSTAINABLE DEVELOPMENT UNIT

Contents

Executive Summary

Ports are operating in an international, competitive environment, in which volatility, uncertainty, complexity, and ambiguity (VUCA) are predominant. Current global challenges, like the climate crisis, food insecurity, energy crisis, growing inequalities, conflicts and a rapid biodiversity collapse are interlinked and require immediate action. In this complex environment, sustainability at all levels (economic, environmental, social) is placed at the forefront, with ports called to respond to various regulatory, investment and societal requirements from the global to the national and local levels.

The Growthfund, the National Fund of Greece, is the sole shareholder of several Port Authorities in Greece, also acting as a Ports Planning Authority aiming to develop the country's port infrastructure and promote investments with a positive footprint for local communities – has partnered with Climate KIC and ATHENA RC on a new approach to innovation. The aim of the programme is to manage the systemic interconnected risks, support decarbonisation targets and open up prospects for exploring new business models and relationships with citizens in the cities and regions ports operate in service of.

These Guidelines have been developed in the first phase of the systems innovation programme 'Green Port Lavrio Deep Demonstration' (2023), where the first steps of a systems innovation approach have been designed and implemented at the Port of Lavrio area. The aim of these Guidelines is to share the process followed with other ports in Greece and beyond, in the form of a practical step-by-step guide for sustainability transitions.

Introduction

Ports have historically played a crucial role in trade, economic development and cultural exchange, with many large cities being port-cities. Operating in an international, competitive environment, ports are influenced by global challenges and trends. Challenges like the climate crisis caused by human-induced greenhouse gas (GHG) emissions, food insecurity, the energy crisis, growing inequalities, conflicts and a rapid biodiversity collapse, while trends like urbanisation, (de)globalization, digitalisation, artificial intelligence, aging population, sustainable finance, increasing citizen engagement and participation are radically changing the global economic and social landscape.

At present, the vast majority (90%) of raw materials and goods are transported by sea, signifying the importance of the sector in our globalised economy[1] and for human well-being, but also making the maritime sector currently responsible for 2.9% of global anthropogenic GHG emissions[2] – a figure projected to increase threefold by 2050, as demand for global freight increases[3]. In July 2023, the International Maritime Organisation (IMO) adopted the 2023 IMO Strategy on Reduction of GHG Emissions from Ships[4]. This strategy builds on the 2018 IMO Initial GHG Strategy and envisages a reduction of total annual GHG emissions from international shipping by at least 20% by 2030, at least 70% by 2040 and to reach net-zero by or around 2050 (the % targets are set in relation to 2008). Additional global challenges are addressed by national and international institutions, which send strong signals on various fronts: the UN 'High Seas Treaty'[5] (agreed in March 2023) supports marine biodiversity protection, while the European Union sets a clear direction towards a digital, green, democratic, just and prosperous future[6], striving - as stated in the European Green Deal - to become the first climate-neutral continent by 2050, leaving no-one behind[7]. All EU Member States have pledged to reduce greenhouse gas (GHG) emissions by at least 55% by 2030 (compared to 1990 levels)[8], and the shipping sector has now been included in the EU Emissions Trading Scheme (EU ETS). Furthermore, in March 2023, EU co-legislators provisionally agreed on the world's first green shipping fuel mandate: the FuelEU Maritime is an initiative aiming to reduce the greenhouse gas intensity of fuels used by the shipping sector from 2% in 2025 to up to 80% by 2050. Alongside other initiatives, it is a substantial part of the EU's "Fit for 55" package, which constitutes a set of proposals to revise and update EU legislation, ensuring that a 55% reduction in carbon emissions can be reached by 2030. At the same time, sustainability and ESG reporting requirements are become more stringent at legislative level (for example the Corporate Sustainability Reporting Directive - CSRD) and discussed by an ever-growing number of investors, businesses and initiatives (eg Task Force on Climate-Relevant Financial Disclosures - TCFD)

[1] https://www.oecd.org/ocean/topics/ocean-shipping/

[2] https://www.imo.org/en/OurWork/Environment/Pages/Fourth-IMO-Greenhouse-Gas-Study-2020.aspx

[3] https://www.oecd.org/ocean/topics/ocean-shipping/

[4] https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/annex/MEPC%2080/Annex%2015.pdf

[5] https://www.un.org/bbnj/sites/www.un.org.bbnj/files/draft_agreement_advanced_unedited_for_posting_v1.pdf

[6] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024_en

[7] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

[8] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en

These changes are affecting ports, businesses, communities and investors alike, who are called to respond and adapt to this multi-level, complex landscape. Several port authorities are transforming from being landlords and logistic hubs operators to becoming innovation hubs, business partners and mobilisers of their local communities and beyond, while shareholders and investors are also adapting their strategies (see Chapter 8 'Innovation Examples'). Considering the current global landscape, emerging trends and the upcoming legislative requirements, a unique opportunity arises for the Port Authorities to reduce their risk but also enhance positive societal impact: the possibility of adopting a systems innovation approach that extends beyond compliance, into reimagining ports into agents capable of transforming their wider geographical areas by supporting and enabling multi-stakeholder innovation to flourish and providing inspiration for others.

In Greece, the country with the most extensive coastline throughout the EU and the world's largest ship-owning nation, there is a well-developed port network, with Greek ports adding significant value and contributing materially to the Greek economy and society. Furthermore, Greece is strongly committed to sustainable development and supports the long-term strategic vision by 2050 of a European economy with minimal climate impact. In this context, the Growthfund - who is the sole shareholder of several Port Authorities in the country and also acts as the Planning Authority for Greek ports other than those included in its portfolio – has deeply embodied the principles of sustainable growth and started integrating the ESG criteria[9] in its core operations. Growthfund envisages the development of a network of Greek ports that implement sustainable business strategies which meet their own but also their stakeholders´ current and future needs, with future-proof, innovative port infrastructure that protects human and natural resources, and serving as best practice examples for the sustainability transition of the EU maritime industry.

In this respect, Growthfund has partnered with Climate KIC and ATHENA RC (see Appendix for more details) on a new approach to innovation, that responds to complex challenges and breaks through traditional innovation siloes: a 'systems innovation' approach, able to bring together relevant stakeholders and multiple ports for an impactful, long-lasting change, by co-designing and delivering portfolios of interconnected innovations, which tackle multiple port challenges simultaneously, support ports to learn from each other to innovate quicker (saving time, effort and costs), while delivering benefits across the 3 pillars of sustainability (economic, social, environmental).

The first steps of a 'systems innovation' approach were implemented at the start of 2023 at the Port of Lavrio, aiming to a holistic transformation of the area ("Green Port Lavrio Deep Demonstration" process).

[9] Lambiris, R.; Christantoni, M. The Greek Privatization Program as a lever for Sustainable Development in Greece. In Proceedings of the International Conference on Sustainable Development (ICSD), Virtual, 21 September 2020; Available online: **https://ic-sd.org/wp-content/uploads/2021/02/Riccardo-Lambiris.pdf** (accessed on 29 July 2021).

1. Systems innovation on the ground: Deep Demonstrations

The Synthesis Report issued in March 2023 by the Intergovernmental Panel on Climate Change[10] outlines the **urgency of acting together, and fast, in order to be able to secure a liveable and sustainable future for all**. As the United Nations Secretary General António Guterres put it, *"in short our world needs climate action on all fronts – everything, everywhere, all at once"*.

However, mainstream innovation approaches seem to:

- prioritise siloed, short-term interventions
- implement innovation in a fragmented way, delivering solutions that might solve a problem temporarily in a particular place ("quick fix"), but over time, or for some parts of the local/global population the situation worsens.
- focus extensively on technological innovation in comparison to innovation in other areas of the economy & society (e.g. policy / finance / skills / social innovation)
- key societal actors are often disconnected, missing out on opportunities to build on each other's skills and knowledge, co-create and learn from the successes and failures of their various innovation efforts.

A new frame of innovation in the port environment is crucial, to manage the systemic interconnected risks, support climate adaptation and decarbonisation targets and create the conditions to flourish in an unknown climate-impacted future. A frame of innovation which is able to:

- tackle complex challenges
- build on the various interfaces of the port with its surrounding city and region
- bring various stakeholders together to examine complex problems from different angles and co-design a course of action
- support the development of new business models for ports
- accelerate learnings
- connect innovation across sectors and lift up from individual solutions to scale transformational impact

We call this a "Systems innovation" approach. Instead of focusing on the delivery of short-term results, a systems innovation approach aims for an impactful, lost-lasting change, transforming whole value chains and geographical areas into a more sustainable paradigm.

In systems innovation:

[10] IPCC is the scientific body advising the UN on the climate crisis

- **participatory processes for collaboration and co-creation among stakeholders are at the centre**, allowing all voices to be heard and building on each other's viewpoint, skills and expertise.
- **innovation takes a holistic view**, considering how it affects other parts of the system, **tackling multiple challenges** simultaneously and taking place on **several fronts** (policy, technology, finance, citizen engagement innovation etc)
- **Innovations and innovators are connected** under one umbrella ('systems innovation portfolio')) and 'speak' to each other, allowing space for knowledge exchange on **what works and what doesn't.** This increases efficiency, value-for-money and speed.

The ultimate objective of the portfolio/s of innovation being built is to provide insight and intelligence for the multi-port system to form actionable decisions, and to provide the means to do so through considered acquisitions, implementations, joint ventures, scale-ups that are investable and of interest to those who want to accelerate and create new and emerging maritime market economies that rethink global standards and the data corridors of the maritime industry.

How can a Systems Innovation approach be implemented in practice?

Climate KIC, Europe's leading climate innovation initiative and community, has developed a systems innovation approach, aiming to support the transformation of places (and sectors) into prosperous, inclusive, climate-resilient societies with circular, net-zero emission economies by 2050. The high-level architecture is implemented through on-the-ground systems innovation programmes, called "Deep Demonstrations". These are large-scale, multi-year programmes that use 'systems innovation' to enable change at the level of whole countries, regions, cities, landscapes and sectors.

Deep Demonstrations employ a step-by-step approach for unlocking collective potential and enabling co-creation among stakeholders affected by and interested in the sustainable transformation of a value chain or geographical area.

The process comprises of the 4 phases below, that often take place interchangeably (as part of an iterative process):

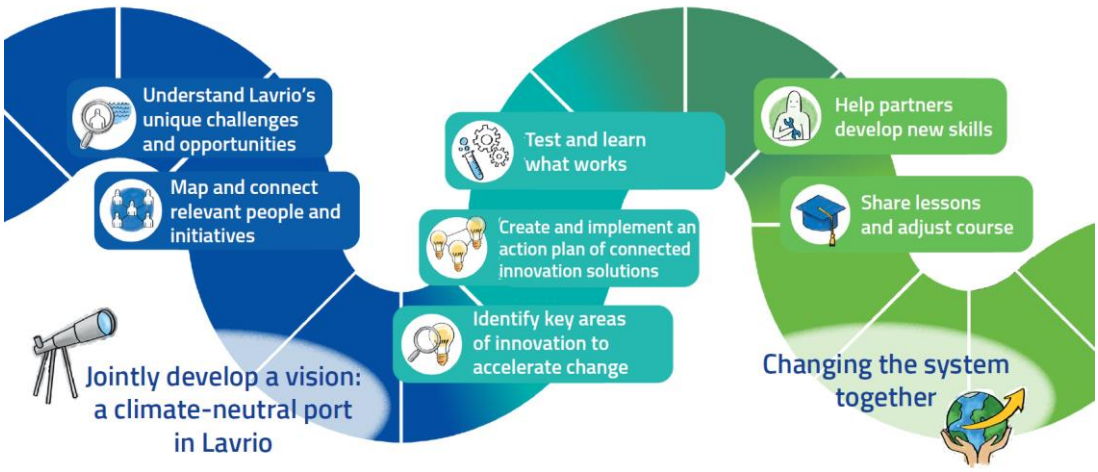
PHASE 1: INTENT It supports stakeholders to have a **collective understanding**, from various perspectives, **of the system to be transformed**, the challenges faced and develop together a vision for the future.	This phase brings relevant stakeholders around the table, from all aspects of life, to collectively understand the current situation and set together the 'Intent' for change. It is mainly comprised of: - developing and aligning behind a **'shared vision' for the area/value chain** to be transformed

	- **collective mapping exercises** (mapping stakeholders, mapping challenges and opportunities, mapping existing on-the-ground projects and future plans, mapping funding sources to support innovation)
PHASE 2: FRAME It supports **stakeholders to co-develop a 'systems innovation strategy'** for their value chain / geographical area and identify the role each one can play in the transformation.	Building on the stakeholder input from Phase 1, this phase culminates with a 'systems innovation strategy', indicating the areas where innovation can catalyse positive change and new opportunities. It is mainly comprised of: - analysis of system maps developed in Phase 1 and identifying **'sweet spots' for innovation** - gathering and reviewing **inspirational innovation examples** from across the world - developing a **systems innovation strategy**, based on solid principles
PHASE 3: PORTFOLIO It **co-develops a 'systems portfolio': a set of interconnected innovations** ('interventions') that stakeholders can learn from and which help stakeholders bring their 'shared vision to life.	This phase enables stakeholders to co-develop and deploy a portfolio of interconnected innovation in economic and social systems, according to the principles and direction set in the 'systems innovation strategy' (phase 2) and in service of the 'shared vision' (phase 1). It Is mainly comprised of: - **mobilising funding** for innovation - **co-designing and delivering innovation** activities across the whole spectrum (policy, technology, behaviour change, finance etc) - **active identification of synergies and complementarities** between innovations / initiatives
PHASE 4: INTELLIGENCE It creates **regular feedback loops enabling stakeholders to learn from their innovation**	This phase takes place on a continuous basis, in parallel with phases 1-3. It supports stakeholders to revisit and evaluate their innovation efforts, understand the impact

efforts and iterate their course, if needed. This phase takes place in parallel with the other 3 phases and builds over time.	they are making and whether they need to iterate or change course, for greater transformation potential. It Is mainly comprised of: - **structured activities for active, actionable learning** among diverse stakeholders

These 4 phases are intended to support long-term transformation of a geographical area or a value chain; they spread into time and build on each other. An indicative spread of the various workstreams and activities is provided below – however, activities are always tailored according to the relevant local / national / value chain environment, the needs of the stakeholders involved, the structures and projects already in place.

In a port environment, the below multi-year process would gradually connect and integrate existing initiatives and core stakeholders under a shared intent for transformational change and design and implement new innovations for bringing the port-city system into a net zero future that makes a positive environmental, economic and social impact. At the core would be a dynamic innovation portfolio/s developed in a participatory way among stakeholders, made up of multiple innovation actions, each providing experience in alternative business models that help manage and mitigate climate risks and understand its changing context. A key objective of the portfolio/s of innovation we build is to provide insight and intelligence for decision-making, so that the port-city system can exercise various options for scaling-up action (eg projects, public-private partnerships, joint ventures, scale-ups, acquisitions).



Deep Demonstration process.

YEAR 1 WORK ON LOCAL PORT SCALE	YEAR 2 CONNECT TO PORTS AT NATIONAL SCALE	YEARS 3-5 CONNECT TO PORTS AT NATIONAL / INTERNATIONAL SCALE	YEARS 6-10 BECOME INSPIRATIONAL EXAMPLE GLOBALLY
INTENT phase **Map & mobilise** - Map relevant stakeholders related to the port - establish Stakeholder discussion spaces - Map and mobilise funding sources for innovation delivery	**FRAME, PORTFOLIO & INTELLIGENCE phases** **Prioritise & Implement Innovation** *** include other Greek ports in the process* - Identify key innovation areas - Workshops with Stakeholders to develop a 'Systems Innovation Strategy' (action plan of connected innovation solutions) - Implementation of first on-the-ground pilots of various	**PORTFOLIO & INTELLIGENCE phases** **Implement innovation & learn** *** include other Greek ports in the process* - Implementation of connected of on-the-ground pilots of various innovation types (tech, social etc) – test and learn what works - Dynamic Portfolio Management: Workshops with Stakeholders & use of IT tools to:	**PORTFOLIO & INTELLIGENCE phases** **Implement innovation & learn** *** include other Greek ports in the process* - Implementation of connected of on-the-ground pilots of various innovation types (tech, social etc) – test and learn what works - Dynamic Portfolio Management: Workshops with Stakeholders & use of IT tools to:

Understand & align *** include other Greek ports in the process* - Workshops with Stakeholders to: a) Map priorities, opportunities, challenges b) Map and connect existing on-the-ground activities	innovation types (tech, social etc) - Mobilise stakeholders and funding sources for innovation delivery **Develop new innovation skills, business models and investment opportunities.** *** include other Greek ports in the process* - Trainings: Equip key stakeholders (e.g. SMEs, startups, policy makers) with relevant skills for systemic innovation delivery and/or uptake **Measure**	a) connect pilots / innovations-on-the-ground b) exchange knowledge among innovators and adapt plan c) exchange knowledge with other Greek ports **Continue developing new innovation skills, business models and investment opportunities.** *** include other Greek ports in the process* - Trainings: Equip key stakeholders (e.g. SMEs, start-ups, policy makers) with relevant skills for systemic innovation delivery and/or uptake **Measure** - Monitor performance and adapt activities in relation	a) connect pilots / innovations-on-the-ground b) exchange knowledge among innovators and adapt plan c) exchange knowledge with other Greek and global ports **Continue developing new innovation skills, business models and investment opportunities.** *** include other Greek ports in the process* - Trainings: Equip key stakeholders (e.g. SMEs, start-ups, policy makers) with relevant skills for systemic innovation delivery and/or uptake **Measure**

c) Develop a Shared Vision **Measure** - Develop Theory of Change - Measure current Performance (baseline)	- Monitor performance and adapt activities in relation to Theory of Change and baseline, drawing on diverse perspectives.	to Theory of Change and baseline, drawing on diverse perspectives.	- Monitor performance and adapt activities in relation to Theory of Change and baseline, drawing on diverse perspectives.

Measuring Aspects of the System

"If you can't measure it, you can't improve it."

It is advisable to start a transformation process with a basic understanding and measurement of the current state-of-things to enable a smooth comparison through time.

Some of the metrics currently used across-the-board on a global level, are linked to the ESG framework (Environmental, Social, Governance) and the UN Sustainable Development Goals (SDGs). These metrics allow stakeholders to review progress towards their transformation goals and their impact to society and the environment, enabling them to assess risks and where more effort might be needed. They are also linked to rigorous sustainability reporting requirements (for example the Corporate Sustainability Reporting Directive - CSRD). Integrating SDGs further into the CSRD framework, requires the valuation of the economic impacts and benefits related to achieving a higher level of SDG implementation. In other words, natural and social capital valuation needs to be integrated in long term investment decisions.

In the long-term systems transformation processes, additional parameters are considered, which focus on early and intermediate – as well as unforeseen - changes that point us in the long-term direction we want the system to move towards (our 'shared vision'). A 'Theory of Change' is often used as a basis which describes the view of the stakeholders on how positive change happens in their area of work, drawing out assumptions on how this will look, which changes influence each other and how their own work will impact what is happening. These assumptions need to be a part of regular monitoring and tracking; and when they turn out as inaccurate, these assumptions - as well as plans that built on these assumptions - need to be adapted during programme implementation.

In such systems transformation processes, measurement includes 'non-traditional' elements, such as changes in organisational structures, behaviours, and visions. The focus is also redirected towards qualitative ways of thinking about change that are used alongside quantitative KPIs. The reason for this, is that KPIs can deliver signals on 'how much' performance or change has occurred but not a robust understanding of the why and how that is necessary to make improvements. Along with 'traditional' metrics, in systems innovation processes, we are using enquiries like the below to measure impact and adjust course within our portfolios of interconnected innovations:

- **Overview / health check**: What is happening on the ground? Which areas need more attention?
- **Sum of the parts**: What is the cumulative effect of multiple projects?
- **Synergies and spillovers**: How do projects and actors interact?
- **Hypothesis testing**: Which approach works better? What should be scaled up, down or discontinued?

- **Transferability**: What can projects learn from each other? What promising practices could be adopted elsewhere?
- **Context responsiveness:** What do all projects need to consider or change in response to shifts in the context? (eg new policies, demographics, conflicts etc)
- **Balancing / hedging:** How can the portfolio maintain a pipeline of outcomes over different time frames, also balancing out diverse risk levels?
- **Comparative advantage/future positioning:** In the next five years, how can we maximise the value of our investment and unique contribution? What should we move out of and expand into? How should future resources be allocated?
- **Room for emergent change:** What other changes are we observing that were not foreseen? What does it mean for portfolio decisions / projects in the portfolio?

Mapping the System - Stakeholder Map

"Deep Demonstration Stakeholders" are organisations and individuals who are interested, have a key role to play, can contribute and / or are affected at the different stages of the Deep Demonstration process.

An integrated and holistic approach to stakeholder engagement is needed to first establish a cohesive sense of direction (Shared Vision - INTENT) but also to enable implementation of such stakeholder engagement mechanisms that inherently accelerate systems innovation efforts on the ground (PORTFOLIO) and overall operational efficiency of the program. Stakeholder engagement should be systemic, coherent, and practical and it requires strategic planning, aligned with the Deep Demonstration methodology.

Stakeholder mapping and prioritisation are the initial steps towards Stakeholder Engagement, as they allow to systematically identify stakeholders, understand their role in the system and the relationships they have with one another, and evaluate their influence and interest within the Deep Demonstration process.

During the Stakeholder Mapping process, it is recommended to:

- **include a variety of stakeholders that work across the system** (eg public authorities, private companies, NGOs, citizen representatives, academia and research, financiers, media etc). Systems transformation requires engagement of a wide spectrum of stakeholders, beyond any single group.
- **start building upon existing networks and relationships** - instead of starting from scratch. During the Deep Demonstration process and as stakeholders are getting increasingly involved, new stakeholders will appear and become part of the stakeholder community.

- **identify and prioritize stakeholders with vested interest in Deep Demonstration ways of working ('champions')** who can accelerate uptake of the systems innovation approach.

In order to develop and implement a holistic transformation in line with local / national / EU aspirations which incorporates economic, environmental, social and cultural elements, we need to engage stakeholders active in all these fields in order to have their perspective integrated. Therefore, it is important to map stakeholders of various types, levels and focus. Some guidance on elements that can be mapped for stakeholders related to port environments can be seen below:

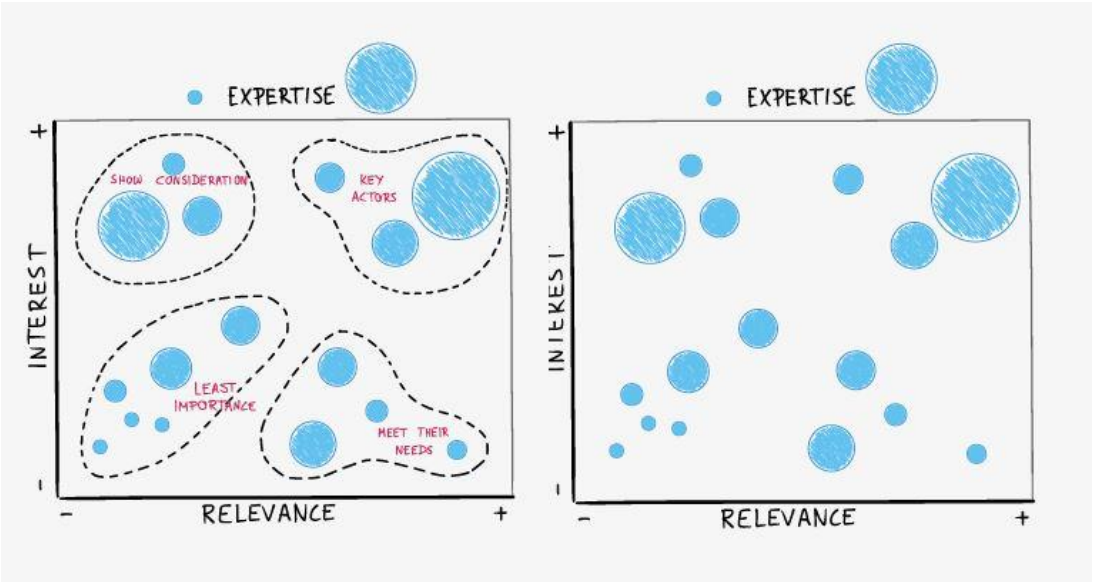
ORGANISATION DESCRIPTION	Organisation Name, Organisation website, organisation main business location (country)
CONTACT DESCRIPTION	Name, Surname, Job Title of our Contact within the Organisation and if / how we are connected
TYPE	Business (corporate / SME), City / Regional Administrations, National / EU Institutions, NGO / non-profits, Associations (citizen associations, industry associations, shipowner associations etc), Research / Academia, Labour Unions, Financial & Cultural Institutions, Media
LEVEL	Local, Regional, National, Territorial, EU, Global
FOCUS	Environmental, Social, Economic, Cultural

At a second level – and possibly after having interacted with (some of) the stakeholders mapped – you will be in a position to also record their attributes, which will help in prioritisation for engagement at the next stages.

Some suggestions for attributes to map can be seen below (as described in the "Visual Toolbox for System Innovation", 2016, EIT Climate-KIC). If you need to prioritise your mapping, the must-have attributes would be 'Level of Power / Influence', 'Necessity / Urgency' and 'Interest'.

- **Level of Power / Influence**: ability of the actors to influence, modify or drive your initiative or other stakeholders
- **Necessity / Urgency:** Is this actor someone who could derail or delegitimise the process if they were not included in the engagement – regardless of their stance or interest in the project?

- **Relevance:** Combination of Influence and Necessity – it can give you a first approximation of those stakeholders to engage with
- **Interest**: How willing is the stakeholder to engage?
- **Attitude:** regardless of the stakeholder's willingness to engage, their stance towards the transition process may be in favour, against or indifferent
- **Adaptation or Resistance to Change:** How adaptable or resistant is the stakeholder to the changes?
- **Expertise:** Does the stakeholder have information, councel or expertise on the issue that could be helpful to the process?



Graph: "Stakeholder Mapping Tool" (from the Visual Toolbox on Systems Innovation)

TIP: Stakeholder mapping is a dynamic process and needs to constantly be updated as you progress through the Deep Demonstration process and engage the local ecosystem and beyond. Remember to regularly update the Stakeholder Map, both with new information on the existing stakeholders and by adding new stakeholders.

An indicative Stakeholder Mapping tool is provided in the Appendix.

Mobilising the System – Developing a Shared Vision

Organisations are operating based on a vision, reflecting their aspirations for the future.

It is often the case that:

1. **Stakeholder Visions are not holistic:** an organisation's vision normally takes the perspective of the organisation itself, with the perspective of other stakeholders / societal actors (including nature) often missed out

2. **Stakeholder Visions are not aligned,** or even contradictive

The reasons for the above is often the lack of meaningful interaction, collaboration and joint planning between the various stakeholders operating in the same value chain / geographical area. Non-holistic and/or non-aligned visions could lead to single-sided, siloed approaches, while spreading the effort in various – often conflicting – directions, wasting precious resources and time.

A Shared Vision, however, enables for the perspectives, wishes and aspirations of various stakeholders to be considered, leading to shared actions towards a common goal. Achieving transformative change, requires for the vision to include both technical and social elements.

When kick-starting a systems innovation process, it is important to engage key stakeholders from various fields and backgrounds that are directly related to the value chain on geographical area to be transformed, so they can discuss their various perspectives and set the transformation Intent, together.

This process can be performed in several ways, the most common ones being:

1. **Stakeholder workshops**: stakeholders are brought together in a workshop format, to co-create a feasible and desirable future, in which current problems are solved. Storytelling-based techniques are becoming more and more common for shared visioning activities. There are various workshop formats for shared visioning, some designs can be visited in the "Visual Toolbox for System Innovation", 2016, EIT Climate-KIC).

2. **Stakeholder interviews:** the facilitator of the shared visioning process invites key stakeholders to an on-to-one structured interview, to discuss their key aspirations. After the interviews take place, the facilitator collates key information into a vision that is shared with and validated by the interviewees. This process is useful to kick-start a systems innovation process, at a very initial stage in which all key stakeholders might have not been identified yet or a new collaboration structure needs to be gradually built. In the case of a Port, interviews could take place with eg the adjacent Municipality, key shareholders, relevant regional authorities or Ministries. This vision is to be employed only as a starting point, to be further complemented as additional stakeholders are engaged in the course of the process.

In line with systems innovation philosophy, the visioning process should not be perceived as definite and static, but rather as the departure point of an evolving and reflexive process, that captures not only the present aspirations and needs but also the future ones. With the Shared Vision acting as a 'North Star', essentially guiding stakeholders, it is recommended to revisit it at regular intervals, to ensure it still resonates with new stakeholders entering the process or if it needs to be updated due to changing global / national / local circumstances.

Nurturing the System - Ensuring Continuity

A systems innovation approach aims at a portfolio of interventions co-designed with relevant stakeholders and delivered at various levels: from technological innovation to social innovation, policy innovation, as well as novel skills, business models and innovative finance. It is a long-term transformation process, with the stakeholder engagement, co-creation and innovation activities sitting at the core and spreading into time.

To ensure continuity, it is advisable to consider from the very start various possibilities for financing the upcoming work, so that a mix of public and private funding streams can be mobilised and allocated at every step of the process, according to needs.

While funding comes in many different shapes and forms, it can be broken down into two general categories: (i) grants and (ii) investment capital. For both types of capital, there are two main challenges: (a) mobilising it, and (b) allocating it as effectively as possible in support of a particular systems transformation agenda. Timeframes can also pose significant challenges, as capital needs may occur at a time when the capital is not yet available. These are the reasons that planning well in advance is of high importance.

As soon as the process starts, it is crucial to develop a 'Funding Registry', i.e. a mapping of diverse funding public and private funding sources that could support activities under the Deep Demonstration phases: INTENT, FRAME, PORTFOLIO, INTELLIGENCE. Activities under these stages could, for example, include costs for programme orchestration (relevant for all phases), development of roundtables for mapping the system and developing a shared vision (INTENT phase), developing a Systems Innovation Strategy (FRAME phase), individual innovation projects within a wider portfolio of interventions (PORTFOLIO stage), knowledge exchange (Sensemaking) workshops among innovation actors (INTELLIGENCE phase).

The mapping of funding sources is mostly performed through:

- **desktop research**: by visiting the website of key public funding programmes or private funders
- **active engagement and word-of-mouth**: it is often the case that different ecosystem stakeholders are aware / work with different funding sources. It is important to regularly interact with the ecosystem on this topic, to exchange knowledge and evaluate different options and possibilities. Cooperation with, and the involvement of experts at national ministries and sub-national public bodies will be important to identify domestic and commercial sources.

The public stream could include:

A. EU public funding calls for proposals

Some indicative programmes which are opening public funding calls on a regular basis are the below:

- **Horizon Europe** Framework Programme

- **LIFE**: The LIFE programme is the EU's funding instrument for the environment and climate action created in 1992
- **Connecting Europe Facility (CEF)**: EU funding instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at a European level
- **Creative Europe** framework programme
- **ERA-NET Co-Fund** programme
- **European Innovation and Technology Institute (EIT) – Knowledge & Innovation Communities (KICs)**
- **BlueInvest:** boosting innovation and investment in sustainable technologies for the blue economy (for early-stage businesses, SMEs, scale-ups)

B. Structural and Recovery and Resilience Funds

- **INTERREG**: this EU programme supports cross-border cooperation via project funding to jointly tackle common challenges and find shared solutions. Supports foci on specific regions, eg Interreg Euro-MED, INTERREG Sudoe
- **The European Maritime, Fisheries and Aquaculture Fund (EMFAF):** one of the 5 European Structural and Investment Funds under shared management that supports the EU common fisheries policy (CFP), the EU maritime policy and the EU agenda for international ocean governance

C. National Level

- **NSRF (ΕΣΠΑ) programme (Partnership Agreement for the Development Framework):** this programme has several pillars aiming to enhance growth and competitiveness. Relevant funding streams could be found under the 'Competitiveness-Entrepreneurship-Innovation' programme, the 'Environment – Energy – Climate Change' programme, the 'Transport Infrastructure' programme
- **Blue Economy Fund:** to support innovation and entrepreneurship under the areas of blue economy and blue growth, as well as maritime technology and equipment, use of digital technologies

It must be noted here that public funding often requires a significant amount of private co-funding, depending on the programme selected.

The private stream includes:

A. Companies and Banks

- banks
- private companies
- venture capital firms

- commercial companies impacted by the same risks

B. Philanthropic funds

Philanthropic institutions are mostly non-profit private initiatives, whose assets are provided by donors and managed by the employees of the foundation. Foundations and charities are often focusing their efforts on socially useful purposes, aiming to improve the quality of life on various levels.

Climate change and environmental pollution is a key topic for several foundations acting at national and international level.

FUNDING REGISTRY DEVELOPMENT PROCESS

When you initiate the mapping process it is useful to map the below elements for each funding stream, which will later help in the decision-making process. It is important to already map at this stage to which stages / activities of the Deep Demonstration process each funding stream can support – this will help with prioritisation and allocating efforts into time, as we progress form one Deep Demonstration stage another.

FUNDING STREAM IDENTIFICATION	Funding Stream Source, Name, Link, other funding stream identifiers
FUNDING STREAM DESCRIPTION & REQUIREMENTS	Scope, Eligibility criteria, Co-funding required
FUNDING SPECIFICATIONS	Funding provided, Frequency, Timeframe when funding is expected to begin
RELEVANCE FOR EACH DEEP DEMONSTRATION STAGE	Intent, Frame, Portfolio, Intelligence
APPLICATION DEADLINE	Frequency / Closing date for applications

TIP: The 'Funding Registry' is a dynamic tool and needs to be constantly updated by the innovation ecosystem stakeholders, as they progress through the Deep Demonstration process and decide which innovation activities they would like to further develop. Remember to regularly update the Stakeholder Map, both with the funding streams the ecosystem is pursuing as well as new funding streams that are becoming available.

An indicative Stakeholder Mapping tool is provided in the Appendix.

3. Innovation examples

In recent years considerable efforts have been made at world-level to introduce sustainable innovation in the port environment.

In Greece, activities range from innovative practices in the areas of energy (LED lighting, cold ironing, energy efficiency for office spaces, introduction of RES into the ports' power systems, vessel fuel quality inspection), pollution measurement and prevention (water and air quality monitoring), community engagement, waste and circular economy ("eco-zones" for waste management) – leading to compliance with national and international legislation, but also saving costs in the long-term and improving the performance of the ports in relation to ESG targets (as measured on a year-on-year basis with Growthfund's digital ESG Rating Tool).

Several of these activities are performed with the support of European funded programmes – an outline of such projects from the Greek Port sector are provided in the table below. The table also provides examples of 'systems innovation' from the global stage, including examples from non-port sectors, to enhance cross-fertilisation and provide inspiration of possibilities that can be opened via systems innovation. Additional examples can be found in the Appendix.

In support of innovative practices and knowledge exchange to increase efficiency, Growthfund has been creating spaces to bring together managing authorities of maritime infrastructure across Greece to discuss and exchange on the challenges they face and best practices they have followed related to green transition.

PROJECT NAME & AREA OF WORK	PROJECT DESCRIPTION
SYSTEMS INNOVATION **Slovenia Deep Demonstration**	Slovenia, along with other EU Member States, needs to significantly step up its efforts to meet the goals of reaching net-zero emissions by mid-century. In response to this urgent need, the Slovenian government has started working with EIT Climate-KIC on the Deep Demonstration of a Circular, Regenerative and Low-Carbon Economy in Slovenia to develop pathways for a more radical transition to climate neutrality through a circular economy, using a systems innovation approach.

(link)	This partnership aims to catalyse rapid decarbonisation and drive climate action and resilience through circular economy approaches while having a prosperous society. The Deep Demonstration methodology was deliberately chosen due to the complexity associated with transforming whole systems (not only technical but also social systems) and at the pace, the transformation needs to happen. This pace stems from the fact that achieving net-zero greenhouse gas emissions by 2050 requires rapid critical structural and exponential changes on multiple fronts simultaneously. The Deep Demonstration mechanism aims to generate actionable intelligence for local policy and decision makers on how to manage system change in the current context of urgency, diversity and uncertainty.
COMMUNITY ENGAGEMENT **Port of Helsinki – The Port as a Functioning part of the City** (link)	The Port of Helsinki (PoH) has been long working on integrating the port and its operations with the surrounding community, of which the port is an integral part. To be able to operate efficiently, the port needs to have a proactive, ongoing and inclusive dialogue with its neighbours, as the port's activities pose challenges for locals: traffic, emissions etc. These demand that the port listens and acts on the feedback received by the many people of its shared neighbourhood. The PoH commitment to societal integration is demonstrated though the following actions and initiatives: a) representatives of PoH attend town hall forums regarding the development of the city, to be able to share development visions b) PoH sets up multiple events annually for the port neighbours (parties, fishing days, 'Visit-the-Harbor' day) c) "The Port as a Functioning Part of the City" is one of PoH six spearhead projects in the new port strategy. d) PoH environmental incentive program for vessels reduces emissions & noise
PORT AS INNOVATION ECOSYSTEM	Winner of the European Sea Ports Organisation (ESPO) 2020 Award.

Port of Algeciras "The Journey of Innovation – Travesía de la Innovación" (link 1, link 2)	A strategic programme for fostering innovative culture at the Algeciras Port Authority. It supports implementation of digital transformation and innovation strategy, improving competitiveness and leading the port into reaching the label of next generation port. Elements: - Consolidating innovation culture among the port's employees and the port community through the organisation of workshops, symposiums, demonstration days, talks and awards - Consolidating the "Algeciras Port Living Lab" by collaborating with start-ups and universities in the co-creation of innovative solutions in a real and operational environment. The port is available for testing and developing pilots and proof-of-concepts by sharing data and facilitating the use of some operation areas.
START-UP INNOVATION **MENA Maritime Accelerator** (link)	The MENA Maritime Accelerator (previously named 'Maritime ClimAccelerator'), through its vast network of collaborators, offers participating start-ups funding, training, peer to peer coaching and theme-specific mentoring (both virtually and in-person). Up to 5 startups are accepted per year and are asked to provide innovative solutions for the transition to sustainability of the maritime industry, both locally and globally, and are given the opportunity to present their ideas in front of investors, port authorities and shipping companies. The MENA Maritime Accelerator provides start-ups with a unique opportunity to test, demonstrate and validate their solution.
ADAPTATION **ARSINOE** (link)	ARSINOE aims at climate resilient regions through systemic solutions and innovations. ARSINOE shapes the pathways to resilience by bringing together the Systems Innovation Approach (SIA) and the Climate Innovation Window (CIW), to build an ecosystem for climate change adaptation solutions. Within the ARSINOE ecosystem, pathways to solutions are co-created and co-designed by stakeholders, who can then select innovative technologies to be implemented at their region (thus providing an example with environments with similar characteristics)

	This approach is showcased in nine demonstrators - one of them being the Mediterranean ports of Piraeus (Greece), Limassol (Cyprus) and Valencia (Spain) - as a proof-of-concept with regards to its applicability, replicability, potential and efficiency. Project Duration: Oct 2021 – Sept 2025 Budget: EUR 15.5 million (financed under the EU H2020 programme)
INFORMATION FLOWS **Green C Ports** (link)	The Green C Ports action piloted the use of sensors big data platforms, business intelligence tools and artificial intelligence modelling at the ports of Valencia, Venice, Piraeus, Wilhelmshaven and Bremerhaven, contributing this way to the future roll out of these technologies in the market. Objectives: - upgrade existing sensor networks with new sensors at the pilot ports - implement a Port Environmental Performance (PEP) IT platform that will receive real time data from the sensor networks and from existing port systems (i.e. PCS, PMIS and TOS) - reduce the impact of port operations in their cities - monitor emissions from ports and vessels - increase the efficiency of port operations and optimize handling of cargo in core ports - facilitate access and areas of cargo in and out of core ports - communicate effectively the case studies results and the main benefits of the technologies piloted in this Action Project Duration: Apr 2019 – Mar 2023

	Budget: EUR 7.1 million (50% of which is financed by the Connecting Europe Facility of the European Union – CEF)
ENERGY **HUPPINESS** (link)	The HUPPINES project at the Port of Heraklion contributes to the increase of safe maritime access by improving basic port infrastructure, and to the increase of environmental benefits by deploying wave energy generation on the windward breakwater. The project addresses studies for the upgrade and extension of the existing windward breakwater, and for the installation of a wave energy generation system at the port of Heraklion. Budget: EUR 1,35 million (85% of which is financed by the Connecting Europe Facility of the European Union – CEF)
ENERGY **CENTAVROS** (link)	The project aims to provide the necessary studies and financial engineering designs for the port of Volos: - For the development of the infrastructure and facilities that will enable shore-side electricity (SSE) for vessels berthed at the port - For the installation of a wave-energy generation system that will contribute to the increased power SSE needs - For the safety upgrade of the port's windward breakwater to safeguard vessels from extreme wave and wind conditions in the basin and facilitate access to the port Project Duration: Nov 2022 – Dec 2024 Budget: EUR 1.9 million (85% of which is financed by the Connecting Europe Facility of the European Union – CEF)

ENERGY CIRCULAR ECONOMY – INDUSTRIAL SYMBIOSIS **CIRCULAR STEAM ROTTERDAM** (link)	The Circular Steam Project is situated at the Maasvlakte platform of the Port of Rotterdam. The project is converting water-based waste collected from chemical company LyondellBasell and polymer manufacturer Covestro (joint venture) into energy. LyondellBasell and Covestro built a new bio plant and incinerator on their site, in which the production's waste is treated and transformed into steam. The steam is used as an energy source in the existing on-site production plant, thus making it a circular process.

4. Next steps

Greece, the country with the most extensive coastline throughout the EU and the world's largest ship-owning nation, hosts a well-developed port network which is undertaking significant efforts towards a sustainable, just and prosperous transition.

In this context, Growthfund has partnered with Climate KIC and ATHENA RC on a new approach to innovation, that responds to complex challenges and breaks through traditional innovation siloes: a 'systems innovation' approach.

Commencing with pilots in the Port of Lavrio in 2023, HRADF envisages bringing together several Greek ports for an impactful, long-lasting change, by co-designing and delivering portfolios of interconnected innovations, which tackle multiple port challenges simultaneously, supporting ports to learn from each other to innovate quicker (saving time, effort and costs), while delivering benefits across the 3 pillars of sustainability (economic, social, environmental).

The activities below are innovating on multiple fronts and preparing the ground for a systems innovation approach, which will culminate in a dynamic portfolio of interconnected innovation in the Greek port sector.

Energy innovation: a) In March 2023, Growthfund partnered with the Port of Lavrio, local innovation research institutes, businesses and other nearby ports towards the development of an energy community, having secured direct technical assistance by the EU Energy Communities Repository. The project 'Green Tech Port' is exploring the possibility of reducing greenhouse gas emissions through the production of renewable energy and plans to explore mechanisms for energy poverty alleviation to spread benefits to the local communities. Lessons learnt and best practices will be shared with other Greek ports and the Ministry of Maritime Affairs and Insular Policy. b) Growthfund partnered with – among others - four of its portfolio ports (Lavrio, Rafina, Kavala and Kerkyra) for the submission of a joint proposal to the Connecting Europe Facility (CEF) EU funding instrument regarding the deployment of Shore-Side Electricity (SSE) supply infrastructure in four Greek ports located on the comprehensive network. The project is in line with the TEN-T Regulation objectives and contributes to the European Green Deal objectives, as it strives to enhance low-emission shipping and improve the availability of alternatives fuels for maritime traffic by enabling the SSE. The proposal is scheduled to be submitted in January 2024.

Appendix

Green Port Lavrio Deep Demonstration Programme Partners

Growthfund

Growthfund is a holding company established in 2016 with the Greek State as its Sole Shareholder, represented by the Minister of National Economy & Finance. As the National Investment Fund of Greece, its mission is to actively contribute to the modernization of State-Owned Enterprises, maximize the value of public assets, ensure the delivery of enhanced services to citizens/consumers, and its contribution to the support of the national economy.

Following the recent integration of HRADF and HFSF, Growthfund has transformed into an organization with deep expertise and a broadening scope.

- The total nominal value of its portfolio amounts to €12 billion across 10 key sectors of the economy: Energy, Water Resources, Maritime Infrastructure (Ports & Marinas), Airports, Transportation & Logistics, Banks, Real Estate, Postal Services, Food Markets & Exhibitions (MICE).
- It manages and oversees more than 20 subsidiaries.
- It serves as a reliable partner for investors choosing Greece, acting as a one-stop shop.

Growthfund has already left a significant development footprint in the Greek economy, while introducing high standards of corporate governance in the public sector.

Through the professional management of public assets, our mission is to improve the quality of life for the fellow citizens by creating sustainable economic and social value for future generations.

A key priority of Growthfund's ESG Strategy is the promotion of sustainable blue growth in Greece through dedicated efforts to enhance the transition of ports to climate neutrality, given the fact that the Fund:

- Is the sole shareholder of several ports in Greece
- Also acting as a Ports' Planning Authority aiming to develop the country's port infrastructure and promote investments with a positive footprint for local communities.
- Through PPF, matures Strategic Projects in Greece, mainly funded by the Recovery and Resilience Fund (RRF), including projects to upgrade the country's port infrastructure

The ESG Department of the Fund works closely with several Port Authorities in Greece focusing on:

- monitoring Ports' ESG performance since 2021 - on an annual basis – using the Growthfund's digital ESG RATING TOOL,
- promoting their participation in initiatives to enhance their sustainable development and inform them of relevant funding opportunities,
- enhancing their interconnection with start-ups, intending to promote green and innovative solutions,

- conducting workshops and seminars on thematic areas related to sustainable development/ESG criteria

Climate KIC

Climate KIC is Europe's leading climate innovation agency and community, creating climate-resilient communities and fighting climate breakdown by mobilising systems change in countries, regions, cities, and businesses. Together with partners across the globe, Climate KIC orchestrates solutions and facilitates learning to bridge the gap between climate commitments and current reality, driving faster and more ambitious action.

Founded in 2010 upon the initiative of the European Institute of Innovation and Technology (EIT) (a body of the European Union), Climate KIC received funding and strategic guidance for over 15 years as an EIT Knowledge and Innovation Community (KIC). Today, as an independent foundation, Climate KIC continues to collaborate with EIT and other EU institutions, as well as intergovernmental organisations, UN agencies, national and regional governments, cities, civil society, academia and the private sector to boost climate innovation across Europe and beyond.

SDU.AE4RIA at Athena Research Center

The Sustainable Development Unit (SDU.AE4RIA) at the Athena Research Center is a leading interdisciplinary research and innovation unit dedicated to accelerating the green and digital transition toward a sustainable, resilient, inclusive, and climate-neutral future. Scientifically directed by Professor Phoebe Koundouri, the Unit brings together science, policy, innovation, finance, technology, and society to design evidence-based pathways for addressing complex global challenges. A core component of SDU.AE4RIA's work is the integration of software engineering, artificial intelligence, machine learning, data science, and digital decision-support systems into sustainability research and policy design.

Its work focuses on key thematic areas, including climate neutrality and resilience, sustainable seas and oceans, water-food-energy-biodiversity nexus and land use, sustainable economics and finance, innovation acceleration and education and capacity building. Across these fields, SDU.AE4RIA supports practical solutions that connect research excellence with policy action, innovation, investment, and social transformation.

As a core pillar of the Alliance of Excellence for Research and Innovation on Aeiphoria, SDU.AE4RIA is part of an international ecosystem that turns sustainability knowledge into measurable societal value. AE4RIA brings together more than **200 multidisciplinary researchers**, a global network of over **20,000 members**, more than **100 international projects**, activities in over **120 countries**, 70+ Living Labs, and support for more than **250 spinoffs and startups every five years**.

Through this broad ecosystem, the Unit contributes to the co-creation, testing, demonstration, and scaling of transformative solutions across regions, sectors, and policy levels. Its work strengthens evidence-based decision-making, supports sustainable entrepreneurship, builds resilient communities, and advances science-driven pathways for a fair and future-ready economy.

Stakeholder Mapping Tool - example

Date the record was created	Stakeholder (Organisation) Name	First name	Last name	Job Title	Website	Country	Geographical scope	Core business area	Stakeholder type	Main focus area (ESG-related)	Comments/ Additional info

** additional columns can be included, depending on the information that we want to map, eg "Is the stakeholder in the Port User Council?", "Is the stakeholder in the Port Board of Directors?", "Interest", Influence" etc

Funding Registry - example

Funding stream source (i.e. name of funding programme + ID)	Amount of funding + year expected to begin	Eligibiliy criteria	Scope & Expected outcomes	Submission deadline	Link	Ideas: which activities in our systems innovation portfolio can this funding support? How / with whom can we work on it?

Innovation Examples

PROJECT NAME & AREA OF WORK	PROJECT DESCRIPTION
ENERGY **ELECTRIPORT** (link)	The Port of Heraklion aims to become the first Greek Port to apply fully integrated electrification services for any ship approaching alongside ("cold ironing"). The project 'ELECTRIPORT' provides detailed studies (technical, economic, financial aspects) required for "cold ironing" to become eligible for funding timely and effectively. The expected outcomes contribute to the

	development of know-how, implementation of environmental policies, reduction of CO2 emissions in the port and consequently in the neighbouring Port-city of Heraklion. Project Duration: Dec 2021 – March 2023 Budget: EUR 1.5 million (85% of which is financed by the Connecting Europe Facility of the European Union – CEF)
ENERGY **EALING** (link)	The project EALING aims at implementing the following specific objectives: - Defining a common harmonised and interoperable Legal and Regulatory framework in order to facilitate the implementation phase of OPS infrastructure in the 16 ports of the consortium - Ensuring the port-to-vessel compatibility in the TEN-T Maritime Network, for vessels calling at the ports of the consortium - Leading all the necessary technical, financial, legal and environmental studies to prepare and accelerate the effective launch of cold ironing and electric bunkering equipment for ports Project Duration: June 2020 – Dec 2022 Budget: EUR 6.9 million (50% of which is financed by the Connecting Europe Facility of the European Union – CEF)
ENERGY **ALFION** (link)	The main scope of ALFION is to transform Igoumenitsa port into an energy hub of the Adriatic-Ionian Sea, providing sustainable solutions based on the requirements of the port's marine and vehicle traffic. It provides the final studies and engineering designs for the development of: - on-shore power supply technology to the port of Igoumenitsa - the introduction of renewable energy sources to the power system of the port - creation of a central power management system that will regulate the energy network of the port, maximising the environmental and financial profits for the port and the entire area

	Project Duration: Aug 2020 – Nov 2022 Budget: EUR 1.1 million (50% of which is financed by the Connecting Europe Facility of the European Union – CEF)
ENERGY **CIPORT** (link)	CIPORT aims to provide the final studies and engineering designs for the development of onshore power supply (OPS) technology for four cruise vessels positions at the Themistoklis coast in the core maritime Port of Piraeus. The Action includes the elaboration of the following main studies: - technical studies for the installation of OPS for the four identified cruise vessels positions, including the infrastructure that will allow the connection of the Port's grid to the city's local grid - Technical requirements and operational procedures for the electric connection and power provision to cruise vessels by the Port - Environmental studies required for the installation and operation of the OPS system - A Cost-Benefit Analysis - A study for the appropriate commercial model for the electricity supply to cruise vessels as well as a calculation of the appropriate pricing methodology - Tender documents for the subsequent works (the tender will be launched at the end of the project) Project Duration: Aug 2021 – Nov 2023 Budget: EUR 1.4 million (50% of which is financed by the Connecting Europe Facility of the European Union – CEF)
ENERGY **Heliorec – Floating Solar** (link)	An industrial start-up focused on generating green electricity from a cutting-edge floating solar technology, transforming unused water space into a home for clean energy generation. This customizable floating solar system can be tailored to various sizes, colours and shapes ranging from 10kW systems up to 100MW installations. It provides solutions to multiple challenges: - reduces dependence on diesel electricity generation and subsequently costs

	- can be combined with aquaculture, wind energy, meteorological stations etc into hybrid systems - saves space: electrical boat parking and charging in the same place

climate-kic.org

growthfund.gr

athenarc.gr

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