

FINAL PUBBLICATION

Energy efficiency planning and sustainable mobility
services across Adriatic marinas:
the DEEP-SEA project

Project Partners



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DEEP-SEA Development of Energy Efficiency Planning and Services for the mobility of Adriatic marinas

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Abstract

The challenge to decrease the environmental impacts of mobility activities gravitating around small ports and nautical marinas can be effectively faced with more systemic, integrated and multimodal mobility services put in place.

In this framework, the DEEP-SEA project aims to tackle the problems of predominant single-modality land transport (cars), highly polluting maritime transport (motor boats with endothermic engines) and limited integration of mobility services offered in the sector described above. The project, through the development of a model based on a strong scientific knowledge and tested on field, supports Marinas Operators and Public Authorities in planning and implementing sustainable mobility options in their territories. This publication recalls key project milestones, providing an overview of the analyses, documents and tools developed by DEEP-SEA partnership.

Keywords: electric mobility; e-mobility; sustainable mobility; nautical marinas; Adriatic Sea.

Introduction

DEEP-SEA mission

Nautical marinas along the Adriatic Sea are the main tourism hubs for inward and outward mobility flows. The marinas spread along the Adriatic seacoast generate a considerable number of different types of mobility and transport flows, both inside and outside marinas, with huge negative environmental externalities, like CO₂ emissions, noise pollution and traffic congestion. Road and maritime transport are the most polluting and the most used ones, while the other types, even if less harmful to the environment, are less commonly present. In the latest years, Public Administrations and Mobility Operators have been making great steps forward in the mobility sector, developing, promoting and implementing different set of mobility services with low or zero negative impacts, such as electric vehicles (e-vehicles) and boats (e-boats), electric charging stations for cars and boats, e-vehicles rental and sharing. However, these services are rarely offered in nautical marinas, most of which usually offer highly polluting services, i.e. endothermic engines cars and motorbikes, and very few offer some kind of sustainable services, such as bike and car rental and sharing. Furthermore, solutions provided are little integrated in a unique offer.

The challenge to decrease the environmental impacts of mobility activities gravitating around marinas could be effectively faced with more systemic, integrated and multimodal mobility services put in place.

In this framework, the DEEP-SEA project aimed to tackle the problems of predominant single-modality land transport (cars), highly polluting maritime transport (motor boats with endothermic engines) and limited integration of mobility services offered in the sector described above. The project, through the development of a model, based on a strong scientific knowledge and tested on field, supported Marinas Operators and Public Authorities in planning and implementing sustainable mobility. Effective planning increased the offer of energy efficient mobility services, mainly e-mobility and shared mobility, and will lead marinas to tackle the increasing demand of e-charging stations for e-boats. To achieve this, DEEP-SEA established a partnership with important stakeholders such as Mobility Operators, Chambers of Commerce, Public Authorities and three of the best Universities in this sector in the Adriatic area. Project partners selected five pilot sites for the tailor-made investment plans to test the start-up of new services and installations. DEEP-SEA developed an ICT application to enable end-users to map, access, book and pay the service. The application represents a unique web-portal for the promotion of sustainable mobility offers through which services will be spread to further Adriatic locations. DEEP-SEA defined a Guidelines for the elaboration of intervention and investment plans related to mobility services and activated a cross-border network in order to replicate the positive effects of sustainable mobility services established within the project.



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Territorial challenges addressed by the DEEP-SEA project

At global level, mobility is one of the major sources of CO₂ emissions (25% of total) and energy consumption (20%). Often Public Authorities and Mobility Operators do not have the necessary skills and knowledge to integrate energy efficiency into mobility planning and investments budgeting, therefore leave the energy efficiency improvement in terms of CO₂ emission reductions out of the strategies and services offered. In particular, the planning process does not foresee direct involvement of major stakeholders (e.g. service and energy providers, transport operators, SMEs) and end-users. Although the Sustainable Energy Action Plans (SEAPs) and the Sustainable Mobility Plans (SUMPs) seek to overcome these criticalities, they do not find application and integration into implementation processes. This contributes to the inadequate promotion and implementation of sustainable mobility models and limits the use of related services. This is particularly critical in cross-border areas characterized by poor cooperation, lack of synergistic transport planning and sustainable mobility services and segmentation of the transport system. There is a need to decrease environmental impacts of mobility activities gravitating around nautical marinas through more systemic, integrated and efficient mobility services along the Adriatic seacoast. Currently marinas are mainly characterized by highly polluting mobility options, adding up to the general CO₂ emissions and energy consumption of transport. Marinas are characterized by extensive areas that could be efficiently used for the infrastructures dedicated to production of energy from renewable sources, which could be used for implementation of sustainable services. Few marinas already have electric charging columns located along the docks for the power charging to yachts and diesel engine moored boats. The nautical sector is increasingly looking at new models of electro-propulsion power-driven boats that require faster charging solutions (over 22kW), columns not yet widespread in nautical marinas. Moreover this sector should look at already available sustainable solutions for mobility and implement them in order to decrease the negative impacts and profile them as innovative sector for green mobility. The current situation limits the spread of vehicles and services for the sustainable mobility to/from and within marinas and the development of electric boats.

DEEP-SEA objective

The overall project objective is to **improve current marinas mobility services and turn them into low-carbon or zero emission, environmentally friendly and energy efficient systems.** DEEP-SEA has developed and implemented, through pilot actions, innovative mobility services with introduction of innovative technologies in support to marinas mobility enhancement and greening. Furthermore, it has integrated Adriatic marinas in a unique cross-border cooperation where management capacity and networking among relevant bodies were the main focus. Innovative and transferable tools and methods provided by the project improved mobility services available, boosting the quality of passenger's transport, reducing CO₂ emissions, lowering noise pollution and cutting energy consumption. The main DEEP-SEA results are **(i) improved sustainable passengers mobility services in or connected to nautical marinas across the Adriatic Sea** and **(ii) increased competences of decision makers and operators involved in marina mobility management.** DEEP-SEA tested **innovative technologies (e-cars, e-bikes, e-boats) and applied mobility solutions integrated with renewable energy (micro-grid).** **(iii) Integrated management, cooperation and networking between Mobility Operators, Universities and Public Authorities on both sides of the Adriatic Sea will be another project result.**

Specific objective 1: Enhance Mobility Operators & Public Authorities' competences to plan and implement energy efficient mobility services

DEEP-SEA has increased the competences of Mobility Operators responsible for mobility services and Public Authorities in charge of public transport, and enable them to plan the mobility service and to develop investments in new services, equipment and infrastructures for e-mobility and shared mobility for passengers and tourists in nautical marinas in the Adriatic Sea area. To boost competences, DEEP-SEA activated an intense cross-border exchange between marinas capitalizing on the most up to date experiences at Adriatic and European levels.

Specific objective 2: Increase marinas' innovative and sustainable mobility service offer for passengers

DEEP-SEA has shaped and implemented replicable energy efficient mobility services in and connected to marinas and developed tailor-made investment plans. The current mobility services offer has been increased with innovative and green services and investment plans strictly related to mobility and based on each marina's characteristics and needs. Innovative services, both mobility and charging ones developed by DEEP-SEA, have been first mapped and then made available to be booked by a single ICT window with the DEEP-SEA app and card, that enable users to register, find and use the charging stations or shared mobility services.

Specific objective 3: Enlarge cooperation on sustainable energy efficient mobility among marinas in Adriatic Sea area



The project partnership has enlarged the cooperation between nautical marinas through a cross-border community. Through the enhancement of competences in planning, implementing and further developing energy efficient mobility services, DEEP-SEA has reinforced joint actions and activities in a network of Public Authorities, Mobility Operators and other related stakeholders directly involved in nautical sector and passengers' mobility. The community compared and exchanged knowledge and experience, cooperated on common issues and problems, exploited opportunities and capitalized public-private initiatives.

Overview of the DEEP-SEA approach

As summarized in the previous sections, DEEP-SEA contributed to enhance the framework for the development of energy efficient mobility services inside and around nautical marinas with special focus on electric and shared mobility. It triggered sustainable, environmentally-friendly, low or zero carbon mobility high quality systems with a special focus on energy efficient services offered in the nautical sector.

The project is structured across three technical work packages, each of them addressing one specific objective (Work Packages number 3, 4 and 5). Work Package no. 3 started from the analysis of the best available technological and organizational solutions on energy efficiency and sustainable mobility for coastal and nautical mobility; it described the current situation of mobility services inside the marinas and calculated the energy consumption related to them. It defined an intervention and an investment plan related to mobility services (energy and environmental impacts and economic analysis) to support the development of harmonized services for passengers to be put in place along the marinas in the Adriatic Sea. Starting from the current baseline of energy consumption, the plan drafted the objectives and defined the actions in order to increase the energy efficiency of the marinas mobility. Guided by the plan, in Work Package no. 4 DEEP-SEA followed the deployment of specific small scale investment for e-mobility infrastructure (micro-grids, e-charging station, e-vehicle rental stations, e-vehicle, etc.) and started up new sustainable mobility services (e-boats, e-bike and e-car sharing, Adriatic Marina e-mobility cards) at partners' pilot sites. This activity was followed in Work Package no. 5 by the development of a model, based on the investment action plan and tested by the pilots, and was standardized in the Guidelines for the energy efficient mobility of Adriatic marinas. DEEP-SEA contributed to define a larger network, including stakeholders of the nautical sector, marinas, shipyards, Municipalities and other Public Authorities responsible for mobility planning, outside the partnership. With the support of the network, the guidelines were spread to other sites of the Adriatic Sea and acknowledged through the signature of a Memorandum of Understanding. To better illustrate project milestones and achievements, the following sections present a brief overview of each work package and the core activities conducted within the DEEP-SEA project.

Work package no. 3 - Nautical marinas framework analysis and investment plans

DEEP-SEA Project Partners worked on the definition of the overall framework and planning actions for the implementation of pilot actions in the short run, and for the long-term development and implementation of energy efficient sustainable mobility services in the Adriatic marinas. This activity was the basis for the definition of the Guidelines, which have included also the results of pilots' actions and their transferability.

The third Work Package focused on four core activities, which led to the definition of the following outcomes:

1. A complete picture of the best available technological and organizational solutions on energy efficiency and sustainable mobility for coastal and nautical mobility based on national and international perspective and future development outlook, including a specific focus on the need of the Adriatic marinas' territorial context and ready-to-use tools for the pilot sites.
2. A financial and investment model with focus on the features and services to improve marinas accessibility from/to Inland (land side) and from/to sea side (nautical side).
3. **An updated overview of the current mobility services and passengers flows in marinas pilot sites**, with analysis of energy consumption, baseline for the definition of future accessibility (cost and time) and energy consumption and emissions reduction.
4. **An innovative investments planning model for the marinas** to achieve improved coastal, inland and maritime transport and mobility services.

Analysis of best solutions integrating energy efficiency in sustainable coastal and nautical *mobility*

Scope of the activity

DEEP-SEA Partners kicked off the project starting from an analysis of the best available technological and organizational solutions for the energy efficiency and sustainable mobility services in coastal and nautical sector. The research started from the cases and services available in the Adriatic Sea area and were then enlarged to other significant European areas. The selection is based on literature analysis and business cases and includes the outcomes of direct interviews conducted with relevant stakeholders and experts from the international networks on mobility, planning, e-mobility technology and nautical industries. The activity was finalized with the elaboration of a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis, which gives evidence of the most prominent trends and opportunities while anticipating technological and organizational solutions with adequate investments. The analysis also includes a description of model for the definition of the passengers and tourists flows and scenario elaboration on transport volume in the coastal zones.

Key results

Based on the results of the analysis, recommendations for the DEEP-SEA marina pilot sites were established, which proved to be useful for the development of the Investment Plans for each site. These recommendations can help support the diffusion of e-mobility and in general energy sustainable solutions in the marinas of the Adriatic Sea.

Table 1: Key recommendations from DEEP SEA partners on e-mobility

e-mobility	Key Recommendations
<p>Business: adoption of services and technology related to e-mobility</p>	<ul style="list-style-type: none"> - In order to spread electric mobility, a charging infrastructure needs to be developed in order to have, using electric vehicles, a comfortable and easy experience. Priority objective is to build a high-power charging network for electric vehicles along the major marinas in Europe. - Start by offering free of charge charging bicycles and scooters and offer them to business for testing; - Promotion of the marina as a modern, ecological, and e-friendly destination; - Further education of human resources on the benefits of e-mobility is needed; - Installation of a charging station with the latest technology and OCPI protocol for e-vehicles - Purchase of e-vehicles and e-bicycles for renting and carpool service.
<p>Governance: request of policy from the decision makers to support e-mobility diffusion</p>	<ul style="list-style-type: none"> - Continue enforcing existing climate/energy strategies, (such as “Krk 0% CO₂ emissions” strategy) and push for better implementation among businesses by incentivising them to use smart mobility solutions. - Advocating for: <ul style="list-style-type: none"> • The promotion of e-mobility between residents with the local authorities. • The development of local policies on e-infrastructure. • The development of a local strategy on sustainable tourism. • Definition of clean and more sustainable forms of transport through new laws and developments. • The reducing ferry fees for e-vehicles with the port authorities. • The construction of charging stations with the local and regional authorities. • The implementation of a universal e-roaming system in the EU with the national authorities. • The procurement of e-vehicle for carpooling services on the island. - Public authorities should facilitate business-to-supplier relations with economic aids, to develop a more effective service. - Activation of communication campaigns for the dissemination and knowledge of the e-mobility service using social media and multimedia. - Developing models and example of good practice from the EU and using EU funds.
<p>R&I: cooperation and alliance to support knowledge transfer and strategy</p>	<ul style="list-style-type: none"> - Advocating for the implementation of e-infrastructure across other marinas beyond DEEP SEA. - Forming alliances for promotion purposes with other marinas in the area that have charging stations. - Cooperation with universities, local authorities, port authorities, and tourist communities. - Promotion of the marinas as touristic destinations with the possibility of personal privacy (guests spend most of their time on boats). - Cooperation on advocating the construction of charging stations in and outside marinas. - Cooperation on establishment of a universal e-roaming system in the EU. - Focus on the concept of interoperability, through agreements between operators and sustainable service providers. - Activation of communication campaigns for the dissemination and knowledge of the e-mobility service using social media, multimedia and newsletter.

Table 2: Key recommendations from DEEP SEA partners on renewables and smart grids.

Renewable energy and Smart Grid	Key Recommendations
<p>Business: adoption of services and technology related to removable energy and microgrid</p>	<ul style="list-style-type: none"> - Encourage business to use renewables in their daily operations providing them actual figures and incentives to incorporate energy index. - Further education of human resources on the benefits from renewable energy sources and the microgrid concept. - Construction of a plant for obtaining electricity from renewable energy sources and implementing the microgrid system. - Promotion of marinas as a sustainable and eco-friendly destination. - Implementation of a sustainable tourism concept. - Identification of best practices, innovation-based project action plans, know-how and transfer of knowledge acquired in the project.
<p>Governance: request of policy from the decision makers to support e-alternative energy solutions</p>	<ul style="list-style-type: none"> - Establish a body in charge of promoting and encouraging the switch to renewable energy. - Incentivise switch to clean energy. - Advocating for: <ul style="list-style-type: none"> • the development of a local energy strategy. • the education of residents on the benefits of renewable energy resources with the local authorities. • the implementation of microgrid systems. • the education of residents on the necessity of environmental protection and advantages of electrification. - Public authorities must develop action plans associated with improved energy management, for promotion, research and development of energy efficiency initiatives and for a better control and monitoring of energy consumption in ports.
<p>R&I: cooperation and alliance to support knowledge transfer and strategy</p>	<p>Encouraging other marinas in the transition towards sustainability and the implementation of Smart grid systems.</p> <ul style="list-style-type: none"> - Forming an alliance with other marinas in the area for the purpose of joined promotion (sustainable and “clean” marinas). - Cooperation with universities, touristic communities, and travel agencies in order to promote sustainable tourism. - Multinational bodies with expertise in energy efficiency and renewable energy management technology should also be involved.

Analysis of marinas management and investments model

Scope of the activity

The purpose of this activity is to define the fundamental pillars for the best nautical ports management on the basis of the European best standards and Green Port policy, and to support the decision makers in future investment in efficient systems for mobility and environmental sustainable services. The report includes a state-of-the-art analysis of the best practices in port/marina management with focus on quality standards and green port management concept applicable to the port sector across the EU. Furthermore, insight analysis of existing port management practice in project partner's regions was carried out, that is actually Northern and Southern Adriatic but with greater focus on ports/marinas participating in the DEEP-SEA pilots.

Key results

A multicriteria-analysis tool was produced with the aim to evaluate investment opportunities, impacts of actions, and scenario developments applicable for each DEEP-SEA pilot site to support decision making process in the development of energy efficient mobility. This tool could be used for the development of investment plans for energy efficient mobility at each project pilot site and it can be applied to all nautical marinas across the Mediterranean region. In this way, each marina would be able to compare selected actions against to impacts that are expected or opportunities that may be identified if a specific action is implemented. Weighting coefficients have to be assigned for each criterion and for criteria groups (impacts area). All the defined criteria have then to be evaluated by the pilot marinas, according to qualitative scales to estimate the effects of the action. After the initial result, a sensitive analysis can be performed. Sensitive analysis may be performed according to the scenario that best matches with the marina/port strategy and development objectives. In this process, the weights for criteria groups are adjusted to user preferences and effects of the changes to the results are monitored.

Table 3 – Criteria explanation and indicators developed for the multicriteria analysis tool within the „Analysis of marinas management and investments model“.

Impact area	Criteria	Abbreviation	Description	Ratings
Environmental	GHG emission reduction	ER	Criterion reflects on the potential of CO ₂ emissions reduction as a result of the implementation of a specific action. It analyses the difference in the emissions level before and after the action has been implemented.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Noise reduction	NR	Criteria reflects on the reduction of noise as the result of the action, mostly caused by the maritime or road traffic and operations.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Spatial impact	SI	Criterion express the impact of the action on land usage, layout occupancy requirement, space limitation, conflict with other activities and similar issues that may complicate the implementation of the action.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Reduction in energy consumption	CR	Criterion considers the reduction in energy consumption as the result of the action, mostly as the result of the implementation of the new source of energy or savings resulted from implementation of new technologies in energy production.	Impact ratings (1-5): 1-lowest value, 5-highest value
Economic	Cost levels	CL	Criterion considers the overall costs required for the construction and implementation of specific action. It focuses on cost levels to be estimated according to expectation and complexity of the investment.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Cost effectiveness	CE	Cost effectiveness is evaluated according to the relationship between monetary inputs and the expected outcome with respect to the specific objectives.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Seasonal dependency	SD	This criterion measure the seasonal dependency of the action. It is general better than the benefits are equally distributed through the year and not limited to the seasonal period.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Development of business activities	BA	Criterion express the possibility of the expansion of economic activities in the nearby zone as the result of the action. The action may contribute more or less to the surroundings and may trigger some business activities with benefit to marina stakeholders.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Profitability levels	PL	This is the estimation of the profitability levels resulting from the action, or at what extend the action may result in increment of the profit.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Funding opportunities	FO	This criterion aims at considering the potential to support the action with feasible source of funding. If the indicator is low than the action may have financial constraints.	Impact ratings (1-5): 1-lowest value, 5-highest value
Technical	Mobility benefit	MB	This criterion measure the benefits in improved mobility resulting from the action. It may be improved by introducing new services or by facilitating the traffic movements.	Impact ratings (1-5): 1-lowest value, 5-highest value

	Quality of service impact	QS	Different impacts on service quality may result from the implementation of the action. Target group are nautical tourists and other marina end-users.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Technical feasibility	TF	Technical feasibility considers the technical aspects of the action, where it is assumed that the feasibility is in co-relation with complexity of the investment, less complex action means higher technical feasibility. Contextual condition of the area may also contribute to technical feasibility of the action.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Implementability	IM	Criterion refers to capacity of the stakeholders involved in the implementation of the action. It considers potential difficulties, barriers or conflicts that may occur during the implementation of the action.	Impact ratings (1-5): 1-lowest value, 5-highest value
Social	Contribution to local/regional development	RD	Criterion focuses on the effect on local and regional socioeconomic life activities. It aims at considering the change of dynamics in the mean of increasing potential for socioeconomic growth increase in the future.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Stakeholder acceptance	SA	Criterion reflects the overview of opinions related to the energy efficient systems and e-services by the local stakeholders and expectations from the action.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Social consciousness	SC	This criterion measures the opportunity to change the social awareness toward the energy efficiency and e-services resulting from the action.	Impact ratings (1-5): 1-lowest value, 5-highest value
	Enforceability	LE	Criterion focuses on the legal basis for enforcement of the implemented action. It aims to evaluate whether the action is supported by an existing legal framework, whether there is an authority responsible for implementing the action. The lack of legal framework may have a negative effect on the implementation or may postpone the implementation of the action.	Impact ratings (1-5): 1-lowest value, 5-highest value

AS IS analysis on current mobility services and related energy consumption

Scope of the activity

The AS IS analysis assessed the energy consumption and related CO2 emissions of the mobility associated to the marina pilot sites participating to DEEP-SEA and is the basis guiding the development of the Investment Plans for each pilot area of the project.

In particular, the analysis includes:

- a complete framework of the mobility services currently provided by the marinas involved in DEEP-SEA pilot actions;
- the volume of passengers using on-road vehicles generated by each marina;
- the volume of nautical mobility activities in each pilot site.

These data were collected through two ad-hoc questionnaires, one administered to marinas managers/owners, and a second one delivered to marinas visitors. The information were processed and served the assessment of the energy consumption generated by marinas traffic volumes and the consequent CO2 emissions. Calculations were performed based on the formulas referring to the most recent indicators (European Environmental Agency emission factors for road transport, 2019).

Key results

The AS IS analysis led to the estimation of traffic volumes, energy consumption profiles and CO2 emission levels of the marinas that answered to the DEEP-SEA questionnaires (Figures 1, 2 and 3). The identified values can be viewed as an indicator that shall be related to the total number of boats and vehicles that are travelling across the Adriatic Sea in a year. Besides these estimations, it is possible to draw the following considerations:

- None of the marinas that participated to the survey seem to be already equipped with charging stations for e-bike, e-motorbikes, nor with e-bikes or e-scooter rental services, except for those that already installed DEEPSEA technical solutions in the pilot sites, and were recently equipped with photovoltaic systems and/or wind generators to produce renewable energy to be consumed by the marina itself;
- As concerns e-boats, only one marina declared to have one specific plug for charging electric boats and yachts;
- The great majority of survey respondents declared to be interested in the possibility of having e-bikes, muscular bikes, e-cars and e-scooters sharing services, also to move within the inland site. These results highlight the need for Adriatic marinas to start investing in sustainable mobility solutions and technologies, starting from the development of basic services for marinas' users, such as electric bike, car or scooter sharing services, with the

possibility to demonstrate to the visitors the emissions avoided and the impact of personal mobility choices;

- In parallel, as only one marina declared to have ad-hoc charging plug for e-boats, another important investment would be to foresee the installation of electric charging stations for e-boats and vessels.

TYPE OF FUEL

Gasoline/petrol Diesel Electric/hybrid

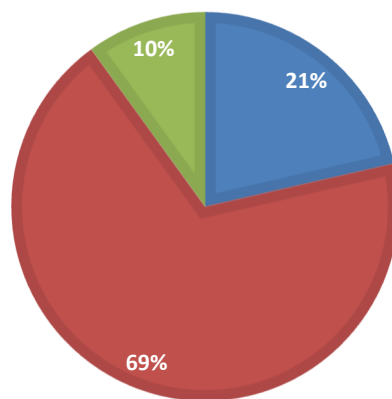


Figure 1 - Results from the questionnaire administered to marinas' users: type of fuel used to reach the marina.

MEANS OF TRANSPORT USED TO MOVE AROUND THE INLAND SITE

Private/rented vehicle Bike Mixed Taxi Public transport

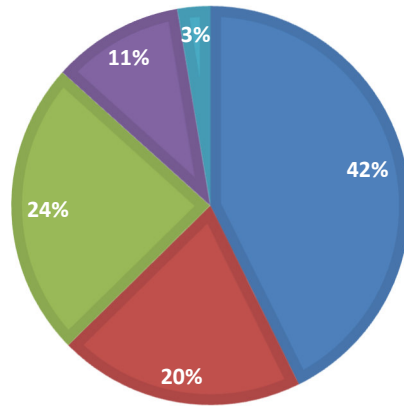


Figure 2 - Results from the questionnaire administered to marinas' users: means of transport used to move around the inland site.

AVERAGE CO2 EMISSIONS OF ADRIATIC MARINAS [T CO2 / YEAR]

Emissions to reach the marinas Emissions to move within the inland site
 Emissions offshore

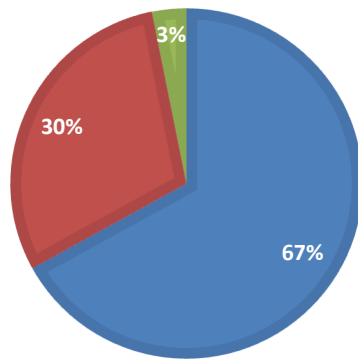


Figure 3 – Average CO₂ emissions (t CO₂ eq) per year of Adriatic marinas, based on the answers to the questionnaire administered to marinas users.

Investment plans for energy efficiency mobility at each project pilot site

Scope of the activity

The document is focused on the development of Investment Plans for the DEEP-SEA marinas to achieve improved coastal, inland and maritime transport and mobility services. Five investments plans were developed, one for each pilot site, each focused on pilot site's vision and strategy, and considering the related baseline energy consumption. Each Investment Plan has been designed to guide the site responsible institution for the definition of the action to be developed and implemented in terms of equipment and/or new services. The Investment Plans defined two models:

- One model for Public Authorities responsible for the site where the marina is located;
- A second model for Marinas Operators.

The two models match different types of Public Authorities, investments and private sectors, both including socio-economic Key Performance Indicators (KPIs) to monitor the investment process and measures of the related outputs.

Key results

Besides the definition of the two models and their relevant aspects, the structure of the Investment Plan, one for each pilot site, was structured as follows:

- Description of the managing institution, the site, the interaction with the other stakeholders and its strategic vision on accessibility and mobility;
- Analysis of current mobility services, traffic volumes and energy consumption baseline;; indication of targets to achieve and their indicator; identification of investment objectives in the sector of energy efficient mobility;
- Description of assets used to support the investment plan and classification of investments priorities;
- Investment requirements based on security selection process: investments options evaluated on the basis of Cost-Benefit and Multi-Criteria Analysis (CBA & MCA);
- Investment funding available and investor potential;
- Investment decision: risks related to the investment plan;
- Investment details: list and description of marinas investments;
- Structure and governance organisation;
- Networking.

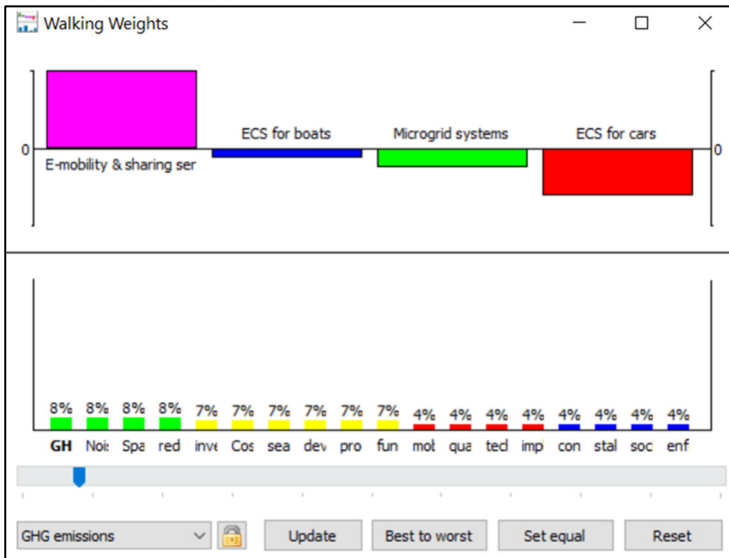


Figure 4 - Example of walking weights determined by Martinis Marchi marina (Croatia) in their investment plan, based on the approach defined by DEEP-SEA partners within the „Analysis of marinas management and investments model“. Rankings between action and weighting distribution between measurable criteria are shown in this figure. Walking weights option allows changing the weights of the criteria and therefore the simulation of different scenarios to see the impacts on the results. The upper part shows the ranking chart whereas the lower part shows the weighting bars of the criteria.

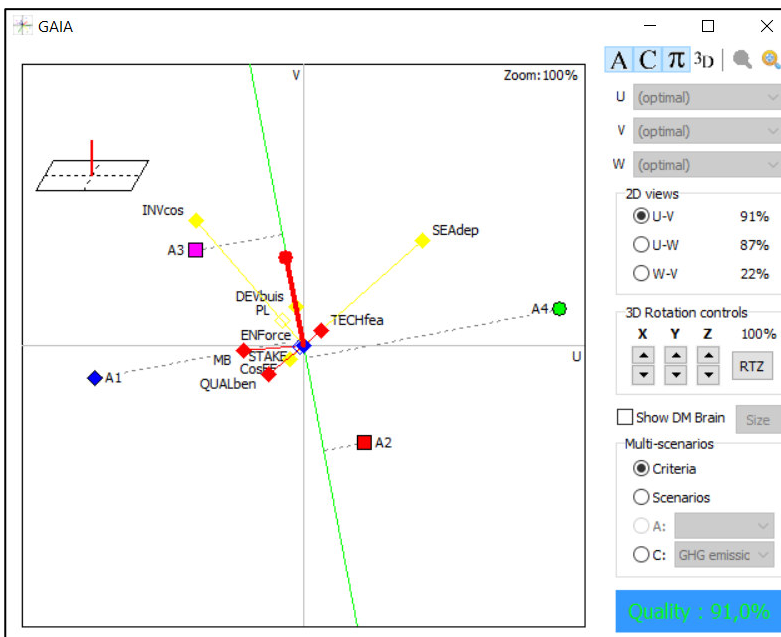


Figure 5 – Example of GAIA plain result of the actions, retrieved from the Investment Plan of Martinis Marchi marina (Croatia). Actions are presented by the points, while the criteria are presented by axes. Positions of the actions show their similarity. If the points are close to each other, that means that the actions have similar profiles, on the other hand, if the points are far away from each other, that means that actions have different characteristics.

Work package no. 4 - Pilots: small technological investments, equipment installations and new services start-up

Within this work package, DEEP-SEA project partners contributed to the development of new sustainable mobility services for passengers and tourists in Adriatic marinas, implementing them in selected pilot sites to improve services available and to promote new integrated approach in the inland, costal and maritime mobility services during the project and continue with them after. In order to achieve the highest impact on the marina since the very beginning, partners fine-tuned their pilot action according to the existing analysis of passengers' flows, needs and expectations, impacts on environment, energy consumption reduction, financial and economic sustainability. At the end of the deployment, the pilot results supported a review and the finalization of each Investment Plan, feeding the Guidelines elaborated in Work Package no. 5. The pilot development did not involve project partners only, but led to the engagement of further local stakeholders, such as Public Authorities responsible for local public transport, Marinas Operators, local and regional associations, tourism and promotion institutions. A direct action focused on the involvement of end-users testing the services quality and their usability. Pilots responsible also provided feedbacks to both investments plans and guidelines. The implemented services and installed equipment will be on usage of the passengers and tourists for their inland and coastal mobility and will indirectly support the increase of electric vehicles and e-boats in nautical mobility.

Key outcomes of this work package are:

1. **Pilots monitoring and measurement methodology** to ensure coherence with project and programme objectives and timeplan in order to be ready for use at the beginning of seasons 2019. It also pays attention to the economic, financial sustainability and action viability and transferability to other Adriatic Sea sites and beyond;
2. **Installation of 19 e-charging stations** (power of 22 kWh or more, with interoperable management system) **for e-cars and/or e-boats**.
3. **Installation of 8 racks with electric and muscular bicycles for bike sharing services**, with at least 4 muscular bikes and 4 e-bicycles, including a charging system for e-bikes and software for rental.
4. Purchase of 3 e-scooters for sharing services and 1 e-car sharing for passengers transport.
5. Start-up of e-car sharing services in 3 pilot sites.
6. Start-up of 1 e-scooter sharing in Krk island.
7. **Start-up of 1 e-car mobility service** for tourist transport in Maslinica Šolta.
8. **Installation of Micro-grid systems** in 4 sites, made of: photovoltaic system; electrical storage system; monitoring and power management systems, display; connection to the electrical grid.

Pilots Methodology and Evaluation

Scope of the activity

This document is intended to define a roadmap for the set-up of pilots, selection of results to implement in pilots' Investment Plans and to include in the Guidelines, with particular attention to the terms of coherence with the overall Programme and project objectives. It provides the monitoring framework for pilot evaluation through the KPIs here defined. Pilots monitoring and measurement methodology ensured coherence with project and Interreg Italia-Croatia Programme objectives as well, according to the agreed time plan and economic-financial sustainability. Designed as internal tool, the roadmap ensured the correct monitoring and measurement of the new installations and e-services as well as action viability and transferability to other Adriatic Sea sites and beyond. At the end of the project, the monitoring system developed during the project life-time will be used as a tool for future monitoring of mobility services by Mobility Operators, defining KPIs for the evaluation of pilot impacts in terms of accessibility, quality of mobility services, eco-social sustainability, environmental impacts and energy efficiency. Stakeholders (Mobility Operators, Public Authorities, end-users and others) will be called to validate the set of selected criteria and the pilot results. Evaluation results were collected by each pilot site every 6 months through specific pilot evaluation reports.

Key results

DEEP-SEA implemented 5 pilot actions targeting marinas in 5 areas across the Italy-Croatia region, as follows:

- Venezia Giulia area, Italy, coordinated by LP ARIES and University of Trieste;
- Foggia area, Italy, coordinated by Province Foggia;
- Krk Island, Croatia, coordinated by Ponikve Krk;
- Malinska, Croatia, coordinated by the Municipality of Malinska-Dubašnica;
- Maslinisca-Solta, Croatia, coordinated by HL Dvorac.

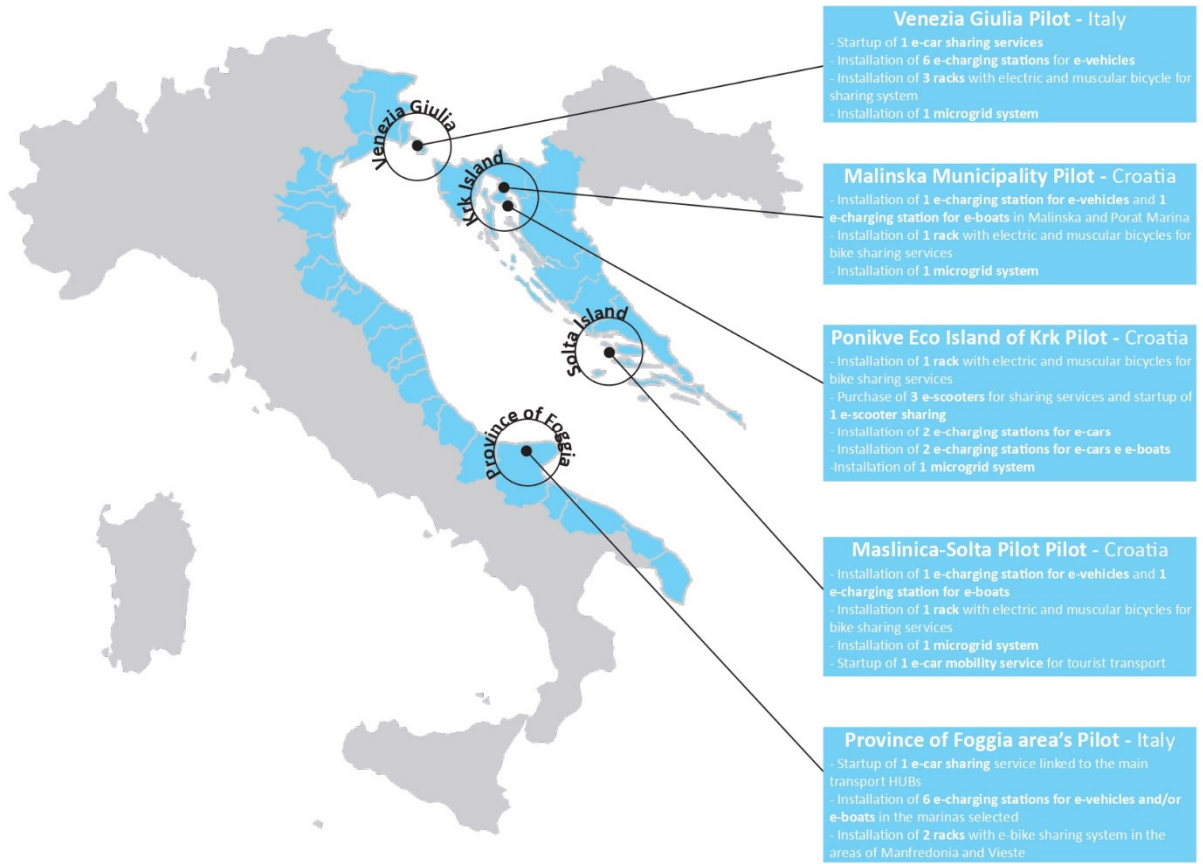


Figure 6 – Locations of the DEEP-SEA pilot sites, with description of the equipment installed in each area.



Figure 7 – Installations in DEEP-SEA pilot sites.

Work package no.5 - Guidelines for the energy efficient mobility in the Adriatic marinas and its transferability

Project partners completed the definition of a model to improve the sustainable inland coastal and maritime mobility of passengers and tourists in the Adriatic marinas to ensure viability and transferability of DEEP-SEA results and outputs during and after the project life-time. In particular, the project led to the following outcomes:

1. DEEP-SEA Model for Elaboration of intervention and investment plans related to mobility services based on the pilots results and on the scientific knowledge, tested on the field;
2. A cross-border community of Public Authorities, marinas operators and other decision-makers, investors, infrastructure and public service providers, SMEs, sectoral agencies and end-users.
3. DEEP-SEA card for the end-users, to be received at the online registration or directly during the first registration in one of the marinas, and it will allow an easy access to sustainable mobility services.
4. Adriatic Memorandum of Understanding (MoU) for the strategic implementation of the DEEP-SEA findings in regional and local policies related to passengers and tourist's mobility.

Guidelines for Elaboration of intervention and investment plans related to mobility services

Scope of the activity

Ad-hoc Guidelines were developed for the elaboration of intervention and investment plans related to mobility services in the Adriatic marinas, with the contribution of all project partners and the involvement of other stakeholders such as Public Authorities, operators, shipyards, tourism and promotion institutions, associations and local SMEs in nautical and tourism sectors.

Taking the lead in planning and implementing a comprehensive e-mobility infrastructure and mobility services in the Adriatic Sea is a challenge for the marinas involved in the DEEP-SEA project. Marinas should therefore think on how to develop efficient e-mobility infrastructures and mobility services both at local and at regional level, through a step-by-step process:

- Enhancing the ability to deal with the planning challenges and issues, building and/or developing a comprehensive infrastructure, able to support the e-mobility, through the involvement of motivated and interested subjects;
- Defining the role that the marinas (and the responsible authorities) will play, from the monitoring to the planning and the development of e-mobility;
- Building an efficient and favorable framework for the development and management of infrastructures able to respond to the issues;
- Understanding and identifying the logistic features for a charging infrastructure for e-vehicles;
- Selecting, motivating partners and create a network of cooperation among them;
- Supporting citizens and the society in using the e-mobility infrastructure;
- Facilitating the possibility of using of e-mobility infrastructures, explaining their benefits and promoting incentives;
- Sustaining a general use of e-mobility infrastructures and service in other sectors, reducing the global use of fossil fuels.

Key results

Public municipal and regional authorities, services providers, ports and marinas, citizens should always promote the development of environmentally friendly infrastructures and mobility solutions. Some of the most relevant experiences that could be experimented in the pilot areas of technologies installation and implementation are:

- Enhancing innovative exchanges between marinas/ports and providers;

- Supporting the regional network of marinas and companies;
- Motivating and supporting marinas to involve users to know more about e-mobility and have feedbacks from them through questionnaires;
- Sharing and diffusing the potentialities and the benefits that the e-mobility has, in particular in the nautical tourism sector.

Practical recommendations to develop energy efficient marinas and sustainable infrastructures and e-mobility services in the Adriatic Sea are the result of different activities of knowledge and experience exchange. Recommendation can be a valid support to the diffusion of e-mobility and in energy sustainable solutions, in particular in the installation and diffusion of specific technical solutions such as charging stations and microgrids.

DEEP-SEA ICT Application and *Service CARD*

Scope of the activity

Project partners developed two key instruments for pilots' activation and equipment usage: (i) an ICT Application web-based to put in communication the network of marinas and end users, to promote and map the sustainable mobility instruments and services; (ii) a DEEP-SEA CARD that brands and promotes the network, for end users' easy accessibility to the sustainable mobility services.

Key results

The DEEP-SEA Application is available for iOS and ANDROID and can be downloaded at the following links:

ANDROID <https://play.google.com/store/apps/details?id=com.ethoslab.deepsea>

iOS <https://apps.apple.com/it/app/deepseaapp/id1536396039>

The Application:

- Enables users to register, find and use the charging stations or shared mobility services: book electronic moorings, e-charging stations in parking lots or electric vehicles;
- Sends notifications of new services, in particular during the high and low tourist season;
- Links the end-user's needs with mobility services offered by marinas;
- Is a ready-to-use tools applicable to any other marinas that wants to be involved, develop and implement greener mobility.

The registered user will have a profile and will receive a CARD for the DEEP-SEA e-mobility services.

Name: Municipality of Malinska-Dubasnica

Address: 51511, Malinska, Croatia

Description: 1 ECS for e-vehicles (1 plug) and installation of 1 rack with electric and regular bicycle with sharing system and purchase of 4 regular bikes and 4 e-bicycles, including a charging system for e-bikes 1 Micro-grid system for e-vehicles and e-boats in Malinska

Connectors available: 1

Cost kwh-€:

Cost per minute-€:

Availability message: Out of service

Future availability: Construction permit obtained

Provider: Municipality of Malinska-Dubasnica

Service type: 1 ECS for e-cars (1 plug)

Latitude: 45.12125

Longitude: 14.526694

Connectors: 2 x 22kW-e-cars

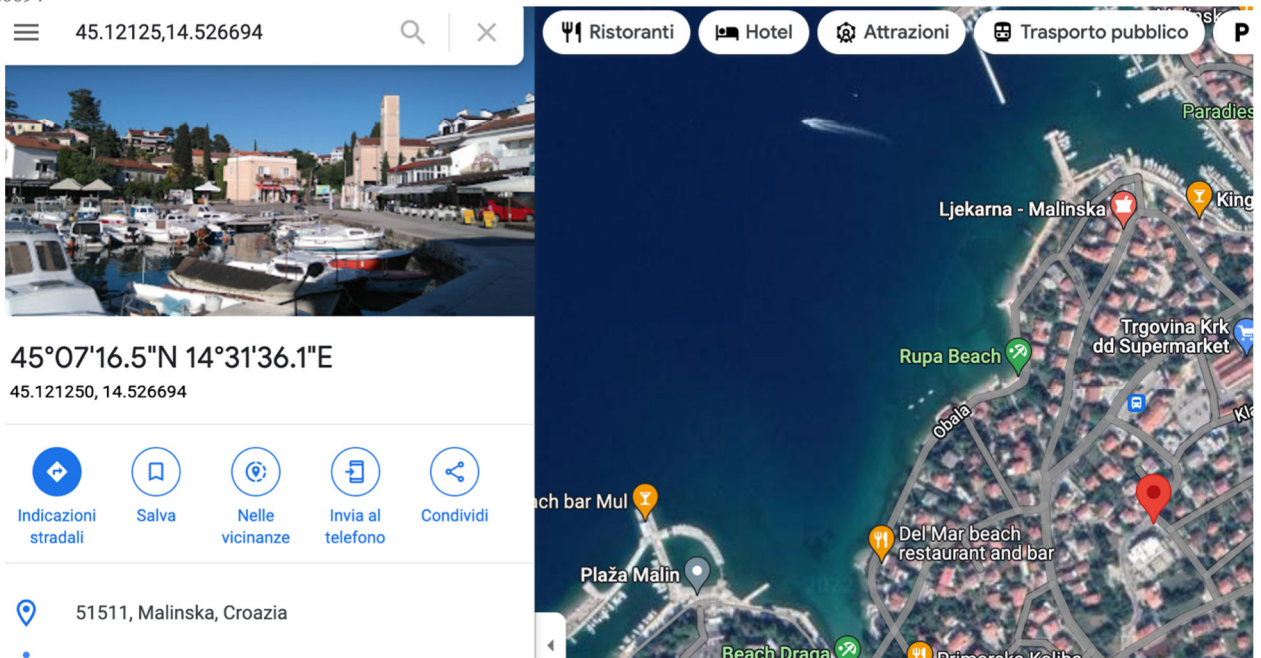


Figure 8 – DEEP-SEA ICT Application.

Adriatic marina mobility Memorandum of Understanding

Scope of the activity

Project partners established the Adriatic Memorandum of Understanding (MoU) for the strategic implementation and mainstreaming of the DEEP-SEA findings in regional and local policies. With the Adriatic MoU, Public Authorities responsible for mobility in the marina pilot sites were involved. MoU was shared also with other Public Authorities and Mobility Operators in order to actively involve other stakeholders and marinas along the Adriatic Coast. The MoU explains the goals of the project, recalls key regulations and policy measures at EU and macro-regional level, defines the areas of cooperation, the commitments of the signers, the modalities of the collaboration, and sets the renewal and duration provisions.

Key results

40 MoU were signed by the following target groups since project start:

- Local, regional and national public authorities (17%)
- Regional development agencies (7%)
- Marinas and mobility operators (57%)
- Transport associations (17%)
- Universities and research centres (2%)

Cross-border Network and transferability – The transferability plan

Scope of the activity

The aim of this activity is to define the method for transferability of the results of the project between DEEP-SEA partners and across stakeholders, i.e. how the partnership will connect vertically to other stakeholders of the project pilot locations and horizontally to other marinas and countries of the EU, by transferring the body of knowledge generated by the project. The intention is to capture the key achievements and lessons learnt by project's partners and participating marinas and spread the relevant outcomes to anyone interested in replicating the experience or transferring in other sites.

Key results

Starting from vision and aim, the Transferability Plan defined the targets and the content to be transferred through the deployment of ad-hoc DEEP-SEA tools and activities. The document also analyzed the timescale, introducing the preliminary schedule of the activities for the transfer of results, as per DEEP-SEA Workplan.



The DEEP-SEA Partnership



ARIES
VENEZIA GIULIA

Organization's name: ARIES Chamber of Commerce Venezia Giulia – DEEP-SEA Lead Partner

Type of body: public

Economic activities: Business and other management consultancy activities

Country: Italy

Municipality: Trieste

Competences: Aries, former Special Agency of the Chamber of Commerce Venezia Giulia, as of June 4th 2018 is a Limited liability Consortium, formed by an all-public partnership. Its mission is the implementation of activities for the development of enterprises. Specific sectors (maritime, logistics, biotech, fisheries, tourism) or themes of economic interest (blue economy, territorial/transnational promotion, internationalisation, environment, clusters, fairs/exhibitions, innovation transfer) serve as guidelines for the development and management of projects funded by public sources.



UNIVERSITÀ
DEGLI STUDI DI TRIESTE

Organization's name: University of Trieste, Department of Engineering and Architecture

Type of body: public

Economic activities: tertiary education

Country: Italy

Municipality: Trieste

Competences: The Department of Engineering and Architecture (DIA) of the University of Trieste carries out research, offers teaching, and scientific and technological support to the industry, in most of the key areas of engineering and architecture. All activities are carried out as part of publicly or privately funded projects and collaborations aimed at addressing the main societal challenges, including transportation and energy. In these fields in particular, an interdisciplinary research team - which includes researchers from other Departments of the University - has formed over the past years and has been involved in a number of projects.



Organization's name: Chamber of Commerce of Foggia

Type of body: public

Economic activities: general public administration activities

Country: Italy

Municipality: Foggia

Competences: The Chamber of Commerce (CCIAA Foggia) is competent for the whole territory of the province of Foggia (61 municipalities, population of 628.221). Referring to 2014, the Chamber of Commerce gathers about 80.114 companies, of which 71.766 regularly operate on the territory. The functions of the Chamber of Commerce of Foggia are essentially three: administrative functions assigned by law and delegated by the State; commercial functions/regulation of the market; promotional functions: initiatives to support economy and business system of the Province, activities by means of special agencies to carry out services with a high level of specialist expertise through streamlined and flexible structures, organisation of training courses, conferences and seminars, support for participation in exhibitions/fairs, projects of particular importance for the economy of the area (ex., in tourism, energy management), information and support to local entrepreneurs.



Organization's name: University of Rijeka, Faculty of Maritime Studies

Type of body: public

Economic activities: tertiary education

Country: Croatia

Municipality: Rijeka

Competences: PFRI has been involved in the various projects and studies development: National Master plan for development of County and local ports of Croatia, technical study, 2016; Development study for County port in Primorsko-Goranska County, 2015; Strategy for Nautical Tourism Development in Croatia, 2006; Study for development of Cruising tourism; Harmful factors of cruise tourism on ship environment, scientific paper, 2011; High Voltage Shore Connection Implementation in Croatian Ports, scientific paper, 2013.



Organization's name: Municipality of Malinska – Dubašnica

Type of body: public

Economic activities: general public administration activities

Country: Croatia

Municipality: Malinska – Dubašnica

Competences: Municipality of Malinska-Dubasnica is a local government authority responsible for conducting of a referendum of self-management issues, local self-government, organization and operation of public services, cooperation with other units of local and regional self-government. Supervises the work of some public organizations such as Touristic board of Malinska, communal society Dubasnica and elementary school. Activities of Municipality are dedicated to safeguarding and valorising the environment and its natural resources (sea),as well as the historical-cultural heritage. Also, thanks to long experience in the touristic promotion, Municipality has a long experience in organizing of national events.



UNIVERSITY OF SPLIT
FACULTY OF CIVIL ENGINEERING,
ARCHITECTURE AND GEODESY

Organization's name: University of Split, Faculty of Civil Engineering, Architecture and Geodesy

Type of body: public

Economic activities: tertiary education

Country: Croatia

Municipality: Split

Competences: UNIST-FGAG has a strong experience in development of organizational solutions, and development of energy efficient solutions for coastal and nautical mobility in collaboration with public authorities and mobility services providers. During the CAMP- sUmp (Interreg MED) project, UNIST-FGAG gained expertise in mobility analysis and mobility planning which will be essential for the implementation of the project.

rerasd

Organization's name: Public Institution RERA SD for coordination and development of Split Dalmatia County

Type of body: public

Economic activities: general public administration activities

Country: Croatia

Municipality: Split

Competences: PI RERA SD was established with the objective of creating an operating entity serving as an instrument of development for the region with emphasis on European integration. Its goal is to be the promoter of sustainability of mobility through energy efficiency at the county level.

MARTINIS
MARCHI



Organization's name: H. L. DVORAC D.O.O

Type of body: private

Economic activities: holiday and other short-stay accommodation

Country: Croatia

Municipality: Šolta

Competences: H.L. Dvorac manages a marina on the Island of Solta. Inside of the marina, there are 50 berths, equipped with moorings, electricity and water. It has more than 30.000 guests and more than 6.500 boat days per year. Due to successful management of marina, H.L. Dvorac has all the necessary thematic competences and experiences relevant for the project.



Organization's name: Province of Foggia

Type of body: public

Economic activities: holiday and other short-stay accommodation

Country: Italy

Municipality: Foggia

Competences: The Province of Foggia is an autonomous and intermediate territorial entity/authority of a wide area, between the municipalities of the Province of Foggia and the Region of Puglia. It marks its activity on the principles of Constitution, the laws of the State, of the Region, and to those of the European Union and the O.N.U. The Province works for the development of the territory of the Capitanata, enhancing its essential peculiarity of Province – Region which, thanks to its natural function as a crossroad between North and South of Italy, thanks for its extension and territorial richness, for its human and natural resources, it has an important role in the development processes of Puglia and Southern Italy.



Organization's name: Ponikve Eco Island of Krk

Type of body: public

Economic activities: collection of non-hazardous waste

Country: Croatia

Municipality: Krk

Competences: Ponikve eko otok Krk is a public utility for waste management, energy efficiency and sustainable development of Krk Island. One of our main goals is sustainable development of Krk - zero emissions and energy independence. In 1986 there was a merger of PONIKVE and KOMUNALAC Omišalj. Today PONIKVE operates the production and distribution of water, the collection, treatment and disposal of waste water with its sister company Ponikve voda. Since 2012, PONIKVE EKO OTOK KRK invested in photovoltaic electricity production, public EV charging stations and bike sharing system, across the island of Krk.