D.5.1.1 Guidelines for Elaboration of intervention and investment plans related to mobility services

WP5 Guidelines for the energy efficient mobility in the Adriatic marinas and its transferability

Document: Public / Confidential			
Responsible partner: ARIES **Involved partners: All**			
Version	**Status**	**Date**	**Author**
1.0	Draft	12/2019	ARIES
1.1	Final	11/2022	ARIES with review by all partners
Notes:			

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Executive Summary

The report will focus on the definition of Guidelines for Elaboration of intervention and investment plans related to mobility services, which will represent a standard model for all Marine Operators (MOs) and Public Authorities (PAs) responsible for accessibility to sustainable inland, coastal and maritime mobility services of passengers and tourists. Guidelines will represent the main tool of transferability of the DEEP-SEA project main outputs to be promoted at the local, regional and national level. They will include universal recommendations on e-mobility and on energy-efficient mobility services and they will be replicable in other contexts. The chapters of this document will focus on the state of art of sustainable mobility and energy efficiency, a description of the local analysis, the experiences on calculation of passengers' flows and transport, the proposal of guidelines for decision makers and technicians. The document will also explain how to set short and long terms objectives and will give indications on the elaboration of the investment plans.

1. Introduction

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 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 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.

2. Outlook on the state-of-art of sustainable mobility and energy efficiency in marinas

In the last years, the alarms sounded by scientists about the climate change caused by greenhouses gas emissions produced by fossil fuels have been increased and spread both through the society and through public authorities. This awareness has rapidly increased the widespread deployment of renewable energy resources and the request for the development of sustainable ways of transport and mobility, and the nautical sectors is strongly involved into this process of renovation.

At the moment, electric mobiltiy is taking shape mainly in th ediffusion of Electric Veichles (EV), and the market is currently offering an increasing number of hybrid and full-electric models and, as consequences, aslo battery charging stations.

Nowadays two energy transitions are occurring. The first one is from fossil fuels to renewable energy sources; the second one is the unification towards the energy carrier electricity, where distributed generators and electric vehicles are the leaders. The Development of renewable energy is driven by a real boom, in which the main contributing factors are:

- Targets for emission reduction;
- Increased public awareness of the risk related to climate change;
- Reduced availability and consequent price increase of conventional energy resources;
- Deterioration of air quality in urban areas;
- Low installation time of distributed generators;
- Low cost of electric energy from wind power and photovoltaic plants.

Electric vehicle charging technologies

Battery of EVs can be charged in three different ways: conductive charging, inductive charging, battery swapping. The first one is currently the most diffused one in the market, even if both inductive charging and battery swapping are now objecting of increasing interests and laboratory researches.

Conductive charging transfers energy from the supply network to the battery through conductive connection, which implies the connection of the vehicle to the charging station trough a conductor cable. The battery charger can be on-board (usually used for slow charging) the vehicle or off-board. EV conductive systems are the subject of the Standard IEC 61851[1], approved by CENELEC as the European Standard EN 61851, and the International Standard IEC 62196[2], approved by CENELEC as the European Standard EN 62196.

Inductive charging is carried out by charging systems where a transmitting section transfer power to a receiving section by means of variable magnetic field[3]. Advantages of inductive charging are safety also under adverse weather conditions, increased user comfort and possibility of recharging the vehicle while running.

Battery swapping is based on the presence of battery swapping stations,[4] where users can swap their empty batteries with fully charged ones. Advantages are short charging time, long battery life,

[1] CENELEC, "Electric vehicle conductive charging system – Part 1: General requirements", EN 61851-1: 2011-8 – "Part 21: Electric vehicle requirements for conductive connection to an a.c./d.c. supply", EN 61851-21: 2002-01 – "Part 22: AC electric vehicle charging station", EN 61851-22: 2002-01 – "Part 23: DC electric vehicle charging station", EN 61851-23: 2014/AC 2016-06 – "Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging", EN 61851-24: 2014-05.

[2] CENELEC, "Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conducting charging of electric vehicles – Part 1: General requirements", EN 62196-1: 2014-11 – "Part 2: Dimensional interchangeability requirements for a.c. pin and contact-tube accessories", EN 62196-2: 2017-4 – "Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers", EN 62196-3: 2014-11.

[3] G. Buja, M. Bertoluzzo, and K. N. Mude, "Design and experimentation of WPT charger for electric city car", IEEE Trans. on Industrial Electronics, Vol. 62, No. 12, pp. 7436-7447, December 2015.

[4] Q. Kang, J. B. Wang, M. C. Zhou, and A. C. Ammari, "Centralized charging strategy and scheduling algorithm for electric vehicles under a battery swapping scenario", IEEE Trans. on Intelligent Transportation Systems, Vol. 17, No. 3, pp. 659-669, March 2016.

low managing cost tanks to collection and management of batteries in centralized locations and increased possibility to operate as vehicle to grid system.

Available electric vehicles and charging stations in Europe

At present most of the EV are equipped with Lithium-ion batteries, the ones with better performances in terms of power and energy densities. Battery chargers for EV can be unidirectional or bidirectional. Unidirectional chargers allow electric charger to flow only from the supply system to the battery to be charged, while bidirectional chargers have two stages.

In Europe charging of EVs is usually divided in two power levels:

- Normal power charging (<22kW);
- High power charging (>22kW).

There are 6 types of charging stations currently available in Europe:

- Type 1 - Yazaki connector: it uses 5 pin connectors and allows AC slow charging;
- Type 2 – Mennekes connector: it uses 7 pin connectors, is the most diffused charging type in Europe;
- Type 3 – Scame connector: is not installed anymore since 2012 but it is still diffused;
- Type 4 – CHAdeMO: it uses 10 pins connectors and allows DC charging;
- Combined Charging System: it allows both type 2 AC slow charging and DC fast charging;
- Tesla destination charger and Tesla supercharger: the first allows AC slow charging, while the second one DC fast charging.

Figure 1:connectors of the different types of charging stations: a) type 1; b) type 2; c) type 4; d) CCS Combo 2

The market of EVs is currently characterized by the presence of car marker specialized in the production of EVs and other that are now specializing in this sector. Most common are: Tesla, American Fisker, Estrims, Audi, BMW, Chevrolet, Citroen, Ford, Hyundau, Honda, Jaguar, KIA, Land Rover, Mercedes-Benz, Mini, Mitsubishi, Nissan, Opel, Peugeot, Porsche, Renault, Smart, Toyota, Volkswagen, Volvo.

E-boats and e-boats charging system

In parallel to the increase of the electric cars sector, electrification is greatly progressing in the marine sectors, spanning from hybrid ships to full-electric small boats.

One of the first examples is the 110 m-long ferries Aurora and Tycho Brahe, that since November 2018 have been crossing more then 20 times a day each the 4 km between Helsingborg in Sweden and Helsingor in Denmark. Examples demonstrate that technologies are also ready for plug-in hybrid mega yachts and full electric yachts. Long Range 23 produced by Ferretti Group is one of the first hybrid yachts produced from 2009 to 2011. Following Ferretti Group, other shipyards started to produce hybrid and electric yachts, such as Cantieri Navali Vizianello, Greenline Yachts, Repower. Repower is the cabin evolution on Reboat, an open full electric boat active for passenger's transportation since 2016 on Lake Garda, and is now active as water-taxi on Varese Lake. Other examples of charging station for boats can be found at the yacht Club de Monaco, where in May 2019 speedy supercharges 2019 were installed. These installations are the first of a planned network along the French Riviera, where each station supports AC and DC charging. Another example can be found on the Lake Como, where -since 2017- 17 charging stations for e-cars, e-bikes, e-boats have been installed. Electric boats can be rent at Econoleggio Lake Como in Colico, and boats are produced by Cantiere Nautico Matteri and Cantiere Ernesto Riva.

What is nowadays supporting the development of e-infrastructures is the growth of ICT technologies, used to support and manage the availability and the deployment of charging stations. Among them, it is possible to find:

- Mapping services: online maps or App to localize charging stations positions;

- Access services to the charging stations: usually trough certified card or App;
- Payment services: direct payment (by credit card) or with the registration with invoice of the Electric Mobility Provider.

Two main features are requested for a charging station to be usable and upgraded:

- Interoperability: the ability of two or more systems of components to share information and manage it;
- Non-discriminatory access: users without account or registration should have the possibility to use (and pay) the energy they need.

3. Summary of the local analysis

3.1. Territorial framework

DEEP-SEA project WP4 “Pilots: small technological investments, equipment installations and new services start-up” will implement five pilot actions targeting marinas in five areas across the Italian and Croatian regions. This activity is focused on the analysis of the technical feasibility and structural constrains in order to start the purchase of the equipment and installation and discussing the implementation of the pilot with the local stakeholders.

Tourism trends in Italy and Croatia

Pilot areas are located in a territory, the Adriatic Sea that, due to the pandemic situation, has registered negative trends in the e-mobility sector supporting local tourism. In Italy, a country where this sector represents almost 26 billion of euro every year (7% of the national GDP), the situation is dramatic. 35 million visitors less and 119 million fewer overnight stays, losing 23.3 billion euros in incoming tourism spending[5], and the same situation for what concerns the sea tourism, where the BlueMonitorLab Study Centre has estimated 125 billion less turnover on the sea economy. Similar situation can be found in Croatia, where the negative impact on the tourist demand is more on the

[5] https://www.repubblica.it/cronaca/2020/06/19/news/turisti_stranieri_tedeschi-259594062/

Southern than the Northern Adriatic coast of Croatia: demand is between 30% (South) and 60% (North), if compared to the last year total demand for the same period. Therefore, in the Italian and Croatian regions the focus on the touristic sector cannot overlook the nautical tourism sector.

Although also this economic area has been hit by the crisis, data from the Tourism Responses report revealed that there are contrasting expectations for what concerns the 2020 season. According to the report, more than 89% of marinas predict that 2020 will close with drops in traffic; but 32.9% of companies in the sector believe that for this summer period alone there will be a growth in demand[6].

Considering the trends in the dockyard/yacht industry in the next years and the shift towards electric nautical mobility, DEEP SEA partners foresee two possible scenarios, based on the evolution of the pandemic. Firstly, the situation where the pandemic emergency will end. In such case, in the next few years the number of marinas and berths will grow, especially when taking into consideration the new docks for cruise ships, large (+12 m) and mega (+20 m) yachts. This is the result of increased nautical activity and popularity of the Croatian sea and coastline. As a result, more charter agencies could open and this would lead to the purchase of new vessels by both them and the people willing to invest in their own boats.

On the other hand, if the pandemic continues, the decrease of nautical activity will result in sale drops in the nautical and yachting industry. Following the trends in the automobile industry and its grown electrification the technology will find its application in the yachting industry on a world scale. There are already several manufacturers with different concepts of e-vessels that could, if widely produced, lead to cheaper sea transportation, thus having a positive impact on the sea and marine ecology. The biggest obstacle is still the high price of such technology and production as well as the need of upgrading the existing dockyards to meet the requirements of e-vessels. This is also

[6] http://www.risposteturismo.it/Public/RisposteTurismo_SpecialeCrociere2020.pdf

followed by a decrease in the economic welfare caused by the pandemic situation and by a low level of security and safety, especially fires, mostly connected to electric installations, and stealing.

Pilot areas: localization and features

The pilot areas identified by the DEEP-SEA project are:

- Venezia Giulia area, Italy, coordinated by LP Aries and University of Trieste;
- Foggia Area, Italy, coordinated by the Province of Foggia;
- Krk Island, Croatia, coordinated by Ponikve KrkM
- Malinska, Croatia, coordinated by the Municipality of Malinska-Dubaśnica;
- Maslinica-Solta, Croatia, coordinated by HL Dvorac.

The Marinas of the pilot areas have been asked to fill in a questionnaire about: their functions, the availability of e-charging stations, the features of their moorings, the number of boats and users that pass through the marina, how they reach the marina and where they come from.
From the above-mentioned survey, six types of marinas have been identified:

- Departing Hub: where users starts their journey without stopping in there;
- Transit Marina: mainly used for fuel supply or documents provision without staying for visiting;
- Touristic Marina: where the cruiser arrives for visiting the coast and inland area;
- Residence Marina: marinas with residences or flats where tourists stop;
- Camping Marina: sleeping dock;
- Small cabotage marina: small or medium docking area for small boats.

Venezia Giulia pilot area

The pilot area of Venezia Giulia is interested by the Regional Energy Plan (PER), which, following the Regional Law (LR) 3/2015 "Rilancio delle imprese", aims at enhance a sustainable development, promote sustainable mobility, reduce gas emissions, diffuse better knowledge of the potentialities and the benefits of renewable resources. The marinas in which site inspections and visits have been done:

- Porto San Rocco, Muggia;

- Marina san Giusto, Trieste;
- Assonautica, Trieste;
- Marina Lepanto, Monfalcone;
- Ocean, Monfalcone;
- Marina Hannibal, Monfalcone;
- Darsena San Marco, Grado;
- Porto San Vito, Grado;
- Navigare 2000, Grado.

Assonautica Provinciale di Trieste in Trieste is considered a Departing Hub and a Small Cabotage Marina, where 20 passengers per day, 200 per year and 127 boats per year use the marina, coming mainly by private car. The Marina is characterized by the presence of 18 moorings with electric supply but there are not photovoltaic system and wind generators available.

Marina Lepanto, in Monfalcone, is considered a Transit and Residence Marina. Around 150 passengers per day, 50000 per year and 250 boats per year use the marina, and 60% of them come by Italy (90% by private car). The Marina is characterized by the presence of 210 moorings with electric supply but there are not photovoltaic system and wind generators available.

Porto San Rocco Marina Resort SRL, in Muggia, is considered a Departing and a Touristic Marina, where 818 boats per year use the marina (65% of them are from Italy). The Marina is characterized by the presence of 546 moorings with electric supply but there are not photovoltaic system and wind generators available.

The selected marinas are listed below:

- Porto San Rocco, Muggia;
- Marina Lepanto, Monfalcone;
- Ocean, Monfacolone.

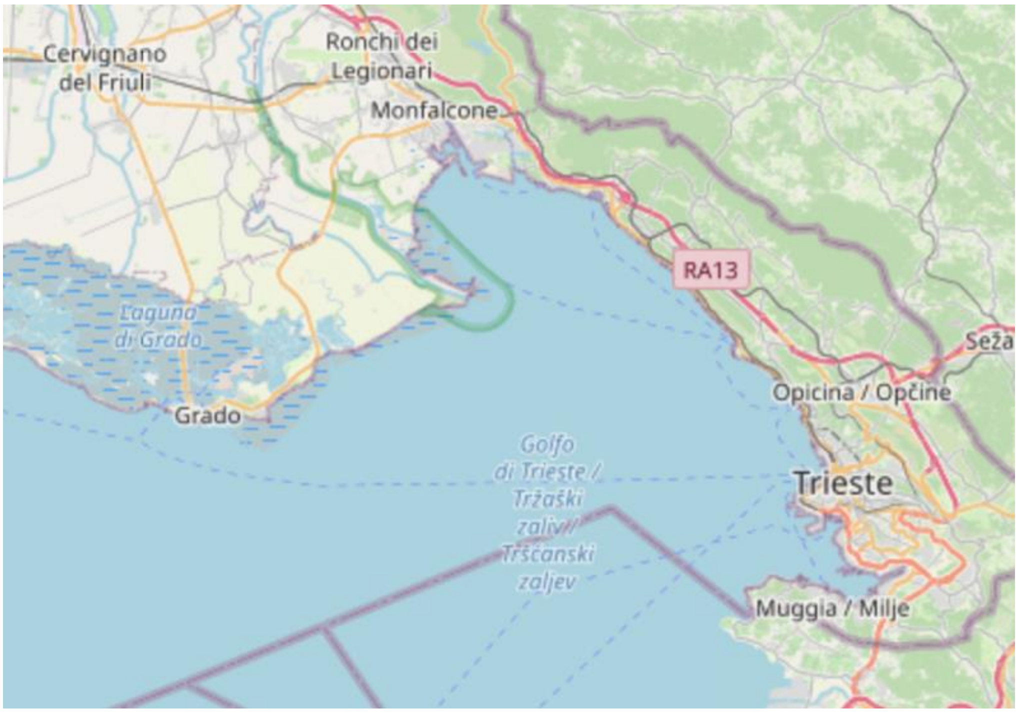

Figure 2: Venezia Giulia pilot area territory

Foggia pilot areas

The city of Foggia, part of a wider area covered by the Province of Foggia, is the hub for the intermodal connections with the Foggia Railways Bus Stations and Bari Airport. The area will be covered by new services for e-mobility (cars bike, boats) in the area of Vieste, Manfredonia, Rodi Garganico, Mattinata and Peschici.

The marinas/sites in which site inspections and visits have been done are listed below.
Marina del Gargano in Manfredonia is considered a Departing Hub and a Touristic Port. The marina is used every year by 450 boats (90% from Italy) and 96% of users reach the Marina by private car. The Marina is characterized by the presence of 700 moorings with electric supply but there are not photovoltaic system and wind generators available.

Porto Turistico Rodi Garganico in Rodi Garganico is considered a Departing Hub, Transit Marina, Touristic Marina and a Small Cabotage Marina. Around 500 boats per year use the marina and they mostly come from Italy (90% come to the marina by private car). The Marina is characterized by the presence of 310 moorings with electric supply but there are not photovoltaic system and wind generators available, and there are 300 charging station for e-boats.

The Lega Navale Italiana Sezione Ischitella in Ischitella is considered a Small Cabotage Marina, where 150 passengers per day use the marina, 30000 per year and 70/80 boats per year. 98% of them come from Italy, and they always reach the marina by private car. Mariana is characterized by the absence of moorings with electric supply and there are not photovoltaic system and wind generators available.

The selected marinas are listed below:

- Manfredonia;
- Mattinata;
- Rodi Garganico;
- Vieste;
- Foggia (Foggia Airport for the car sharing system): to be finalized.

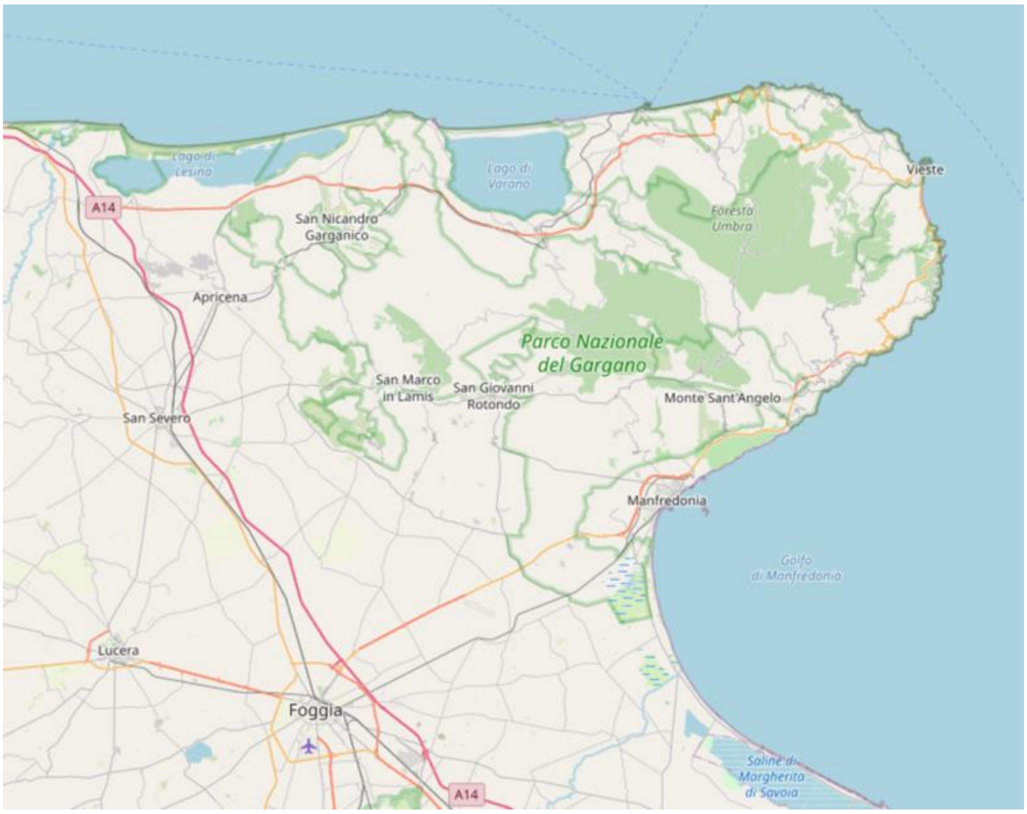

Figure 3: Foggia pilot area territory

Ponikve Eco Island of Krk pilot area

According to the questionnaires submitted to the marina, the Marina could be considered a Transit Marina. The marina is used by 1000 boats per year, 200 passengers per day and 3500 per year (mostly from Germany and Slovenia), and the 95% of them reach the marina by private car. The Mariana is characterized by the presence of 10 moorings with electric supply but there are not photovoltaic system and wind generators available, and there is 1 charging station for e-cars and e-motorbikes and 10 e-bikes in a rental service.

The selected for the technical installations are listed below:

- Ponikve;
- Vrbnik;
- Njivice.

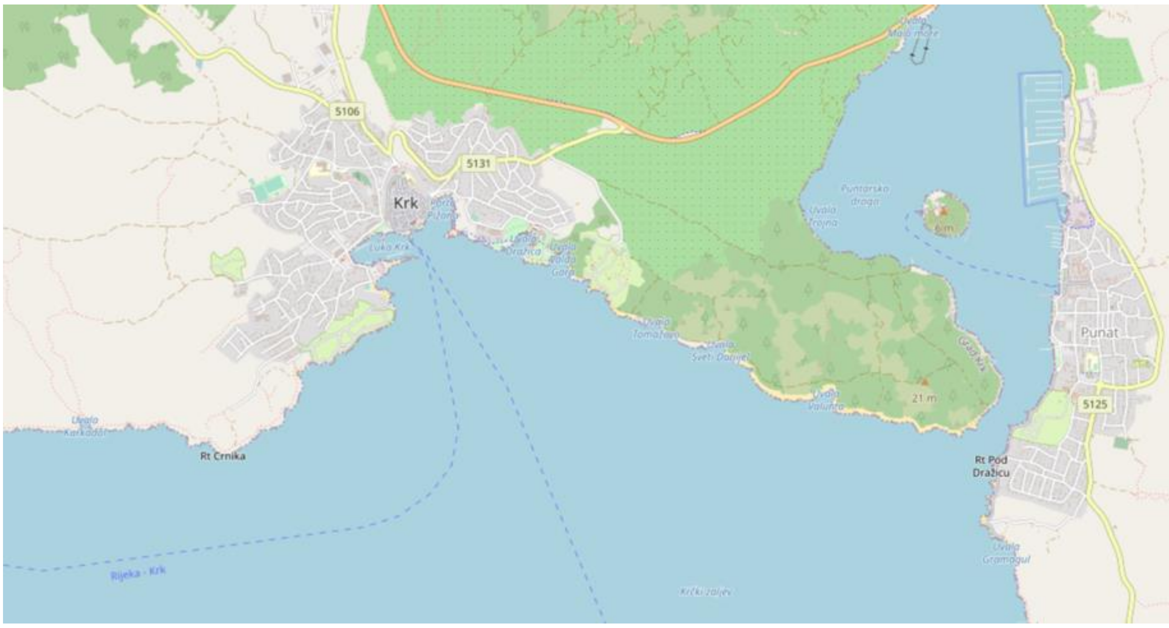

Figure 4: Ponike Krk pilot area territory

Malinska Municipality pilot area

According to the questionnaires submitted to the marina, the Marina of Malinska could be considered a Departing Hub. Around 250 boats per year, 60 passengers per day and 750 per year use the Marina (40% from Slovenia) and they reach the area always by car.

The Marina is characterized by the presence of 9 moorings with electric supply but there are not photovoltaic system and wind generators available. There are not specific plugs available for charging e-boats, e-cars and e-motorbikes and the marina does not offer an e-bike rental service.

The selected for the technical installations are listed below:

- Marina Porat;
- Malinska Kindergarten.

Figure 5: Malinska municipality pilot area territory

Maslinica-Solta pilot area

According to the questionnaires submitted to the marina, the Marina of Maslinica is considered a Touristic marina. Around 6800 boats per year, 200 passengers use the Marina daily, for 27,000 passengers per year (mostly from Germany and Austria), and 95% of them reach the Marina by boat. The most used transportations tourists use to move around the marina are private vehicle, public transport, taxi and bike.

The Marina is now currently characterized by the presence of 50 moorings with electricity supply but there are not photovoltaic system and wind generators available. There are not specific plugs available for charging e-boats, e-cars and e-motorbikes and the marina does not offer an e-bike rental service.

Figure 6: Maslinica-Solta pilot area territory

3.2. Management models

The fundamental pillars for the best nautical ports managements are elaborated based on the European best standard and "Green Port" policy, taking into consideration infrastructure need, quality of service, operational activities, operational requirements and other data. Questionnaires submitted to marinas have collected data on ownerships, number of employees and expert capacities, internal organization, collaboration with stakeholders, marina function, economic activities, funding sources, investments need, in order to define a complete framework and a general overview on the marina's management and investment models.

State of art of best practices in nautical port management and Green Port policy

The development of marinas in Europe, after a strong and rapidly growth at the end of the 20th century, has now slowed down, mostly due to the environmental regulations and protective policies, such as the PRF Directive 2000/59/EC, which requires vessels to land the waste they produce during voyages to and between EU ports to port reception facilities. Further regulations to take into consideration are the Directive 2011/92/EU, which has harmonized the principles for the environmental impact assessment of projects by introducing minimum requirements, the Water Framework Directive, The Urban Waste Water Treatment Directive 91/271/ECC, the Bathing Water Directive, the Drinking Water Directive 1998/83/EC, the Marine Strategy Framework Directive 2008/56/EC, the Habitat Directive 92/43/ECC, the Environmental Noise Directive 2002/49/EC, the Renewable Energy Directive 2018/2001/EU, the Energy Efficiency Directive.

Key factors for marina management

Among the multitude of factors that determine the successful management of marinas, according to the study on specific challenges for a sustainable development of coastal and maritime tourism in Europe (2016) there are six main factors relevant for marina management:

- Ownership structure (private or public);
- Public-private cooperation. Specialized knowledge and professionalism in each single step from planning to operational management are essential for its success. Public-Private Partnerships (PPPs) combine the resource of the government with those of private agents, and PPPs models are usually classified in 5 categories: supply and management contracts, turnkey contracts, Affermage/Lease, concessions, Private Finance Initiative PFI, Private ownerships;[7]
- Size and target group of a marina. Big marinas have bigger services offer and hire a large number of employees, and bigger than deeper berths allow super yacht to enter the marina;
- Programs and tools for marina management, such as Blue Flag Programme, Blu Star, ISO certificate, Gold Anchor;

[7] Rossi, M., Civitillo, R. (2014): *Public Private Partnerships: a general overview in Italy*, 2nd World Conference On Business, Economics And Management – WCBEM2013. Procedia – Social and Behavioral Sciences 109, 140-149

- Cooperation between marinas. Clusters of marinas may generate synergies from different stakeholders engaged in tourism industry. Examples are TransEurope Marinas Initiave, Adriatic Croatia International Club;
- Seasonality. It is a key point that each marina should take carefully in consideration. During the winter long-term berth management arrangements, maintenance work training programs, or social events may be in focus of business activities.

Green Port management concept

Both public ports and private marinas need to achieve acceptable management standards. Port and marinas are not just service providers, but energy consumption and production centers. Green Port is a synonymous for responsible behavior of all stakeholders in the port business, from the individual employee and port manager to ports users and local population. According to PIANC (2014) key element in the concept of green port management, for a shift from fossil fuels towards clean fuel sources and renewable energy sources are:

- Long-term vision towards an acceptable footprint on environmental nature;
- Transparent stakeholders' participation and stakeholders approved strategies;
- Shift from sustainability as a legal obligation to sustainability as economic driver;
- Active sharing of knowledge with other ports and stakeholders;
- Continuous striving towards innovation in process and technology.

This means that ports that aim to achieve the Green Port status should establish the system for monitoring energy consumption as well as overall environmental quality monitoring. What can make possible to achieve this aim is a set of features:

- Port management roles and responsibilities: management of port areas, landlord-based management, traffic and mobility management, pricing and enforcing, port operation, community partnership;
- Pressure and response measures. The major issue is how to reduce energy consumption (maritime industry generates 3% of worldwide CO_2 emissions) and energy cost through increase of efficiency of port activities and how to develop long-term renewable energy sources;

- Social responsibility and cooperation with stakeholders such as: public administrations and port authorities, port operators and concessionaries, nautical tourists and marina users, contractors and technical experts, financial institutions, NGOs.

Quality standards in Marina port management

Certifications, programs and initiatives aim at confirming and enhancing the quality and the standards of ports and marinas, as well as at boosting their development. Most common and used are:

- Certification standards. Different certification standards exist with the purpose to formally confirm that port/marina fulfil certain characteristic of the quality of services. Most used are ISO9001 (Quality Management System), ISO 14001 (Environmental Management System), ISO26000 (Social Sustainability), Environmental Management System (EMS), Self-Diagnosis Method (SDM), Port Environmental Review System (PERS), European Eco Management and Audit Scheme (EMAS), Port Index ESPO;
- Blue Flag programme. Started in France in 1985, it defines 36 criteria and requirements for the implementation covering water quality, safety and services, environmental management, environmental education and information;
- Gold anchor scheme. It was developed with the purpose of raising standards and providing customer centric services. It is jointly administrated by The Yacht Harbor Association (TYHA) and the Marina Industries Association (MIA). The Scheme provides a template for customer friendly marina development and it is based on a self-assessment and site assessment across six categories: ambience; planning policies and procedures; customer service; environmental, on water facilities and infrastructures, on shore facilities and infrastructures;
- Blue Star Marina Certification. The certification, provided by the International Marine Certification Institute (IMCI), uses a range between 1 and 5 stars to indicate the quality of certified marinas;
- ADAC rating system. Is a self-developed classification system of group of marinas, that helps skippers distinguish between simple and superior marinas.

3.3. Traffic volumes and energy consumption baseline

This AS IS analysis is based on the most recent data available from the marinas in terms of traffic volumes and energy consumption on annual basis. As the survey administered during 2019 touristic season did not provide enough data to allow a robust analysis, the project partners were asked to set up a further questionnaire round during July/August 2022.

ON-SHORE (inland) MOBILITY analysis includes:

- Access to marinas;
- On-site transport.

OFF-SHORE (sea side) MOBILITY analysis includes:

- Docking;
- Traffic flows of boats gravitating around the marinas.

Nautical marinas that answered the questionnaire on current situation of mobility services inside the marinas and energy consumption were:

Marina	Location	Marina typology
Porat	Malinska-Dubašnica, Croatia	Departing hub
Martinis Marchi	Maslinica, Croatia	Touristic marinas
Punat	Punat, Croatia	Departing hub, transit marina, camping marina
Assonautica Provinciale Trieste	Trieste, Italy	Departing hub, small cabotage marina
Lepanto	Monfalcone, Italy	Tranist marina, residence marina
Porto San Rocco	Muggia, Italy	Departing Hub, Touristic marina
Lega Navale Italiana Ischitella	Foce Varano, Italy	Touristic marina, Residence marina, Camping marina, Small cabotage marina
Marina del Gargano	Manfredonia, Italy	Transit marina, Touristic marina, Residence marina, Camping marina
Rodi Garganico porto turistico	Rodi Garganico, Italy	Departing Hub

Table 1: marinas that answered to the questionnaries

Nautical marinas that administered the questionnaire to end users were:

Marina	Location	Number of questionnaires
Porat	Malinska-Dubašnica, Croatia	41
Martinis Marchi	Maslinica, Croatia	65
Punat	Punat, Croatia	20
Marina del Gargano	Manfredonia, Italy	6
Marina di Vieste	Vieste, Italy	11
Total number of questionnaires		**143**

Table 2: Nautical marinas that administered the questionnaire to end users were:

The methodology used for the estimation of traffic volumes and energy consumption has followed five main steps:

- Consumption profiles of the vehicles used to reach the marina, to move within the inland site and offshore mobility;
- The average fuel consumption is multiplied by CO2 Emission factors to obtain an estimation of the average CO2 emissions currently generated (EMEP/EEA inventory);
- Vehicles/boats reaching the marinas: the average CO2 emissions are calculated based on the average number of vehicles and boats that reach the marinas;
- Vehicles moving around the inland site: the average CO2 emissions are calculated based on the average number of vehicles/boats reaching the marinas each year and the percentage of respondents who have declared to move around the inland site in each marina;
- Offshore movements: it is considered the average number of boats travelling to/from the marina each year. To obtain the average CO_2 emissions per year, the average CO_2 emissions per trip is multiplied by the average trips made in one year by the visitors.

Passengers' volume and energy consumption in pilot areas

Questionnaire to marinas point out that the main transports used to access the marina are private cars (75%), while public transports such as public bus, taxi, train, flight represent together only the 7%. Questionnaire to marinas users point out that the means of transport used to reach the marina is mostly represented by private vehicle (36%), while public transport represents only the 3%.

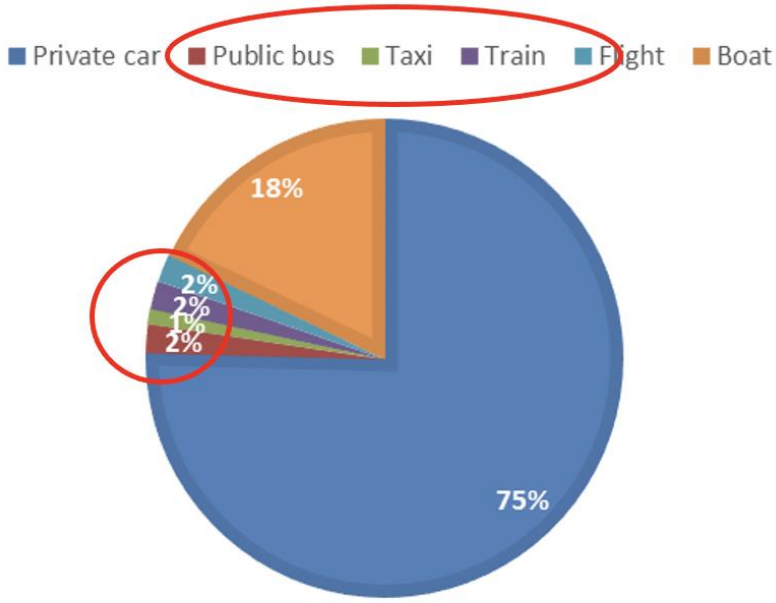

Figure 7: Transport used to reach the marinas from questionnaire to marinas

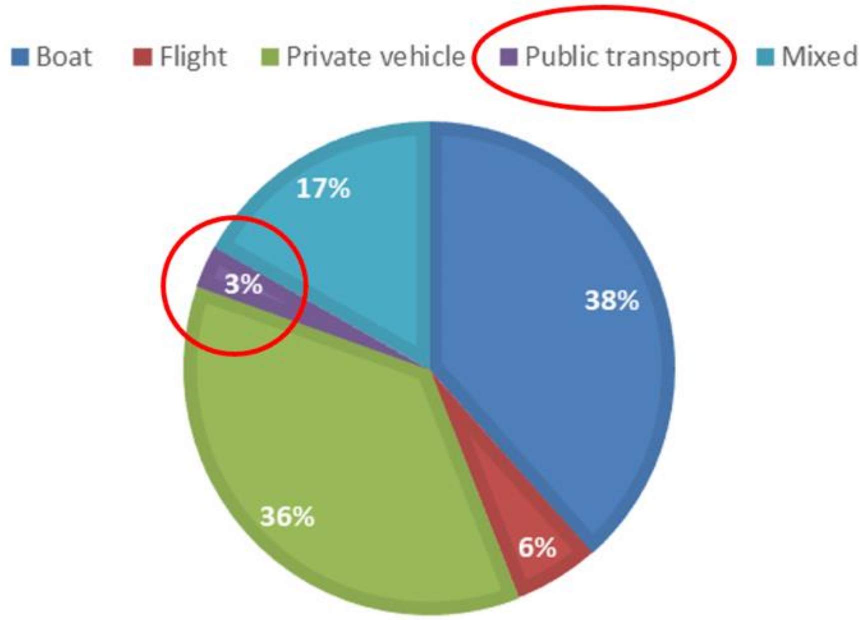

Figure 8: Means of transport used to reach the marina

Regarding passengers' provenience, questionnaires show that:

- the 63% of passengers come from a distance lower than 300km;

- in the Croatian Marinas, the most relevant percentages of passengers are: 23% from Slovenia and Germany, 21% from Austria, 8% from Serbia and Hungary, 4% from Italy and United Kingdom;
- in the Italian Marinas, the most relevant percentages of passengers are: 77% from Italy, 9% from Austria, 6 % from Germany.

Regarding onsite mobility analysis, data show that, from questionnaires to marinas, the mobility in mainly represented by private/rented vehicles (36%), followed by bikes (27%) and public transport (14%), while from questionnaires to marina's users the means of transport used to move around the inland site is mostly represented by private/rented vehicles (42%), followed by mixed type of transports (24%) and bikes (20%).

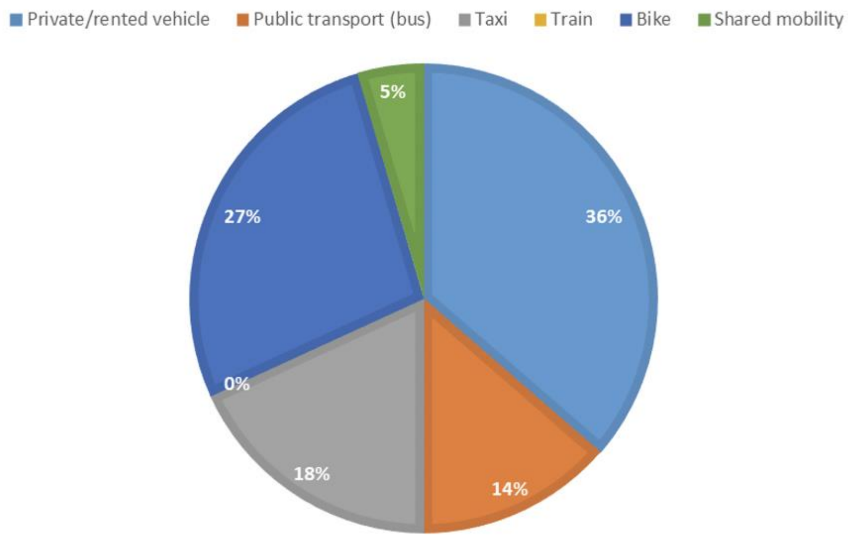

Figure 9: On-site mobility analysis

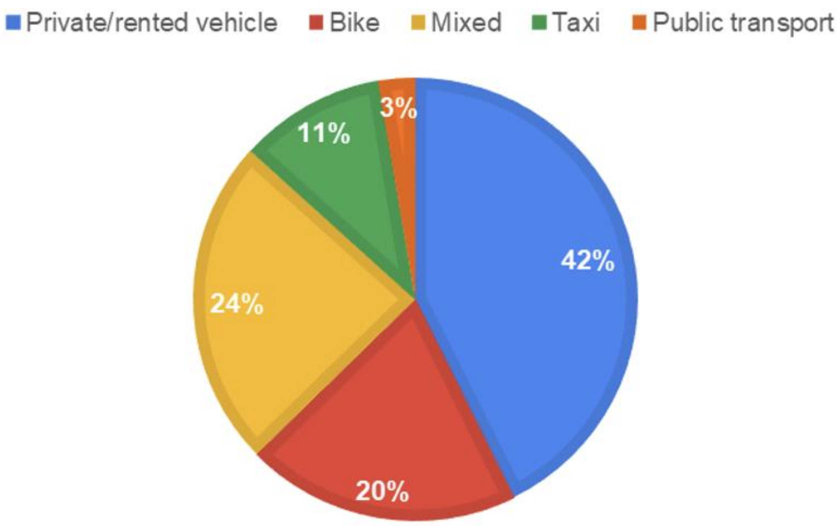

Figure 10: Means of transport used to move around the inland

Regarding traffic flows, the following pictures describe the data of number of passenger/day, number of passenger/year, number of boats/year. What can be pointed out is:

- Porto Turistico Rodi Garganico is the marina with the highest number of passengers per day (around 400), followed by Martins Marchi Marina (around 250);
- Marina Lepanto is the marina with the highest number of passengers per year (around 50.000), followed by Martins Marchi Marina (around 43,000);
- Marina Punat is the marina with the highest number of boats per year (around 8,000), followed by Martins Marchi Marina (around 5,700).

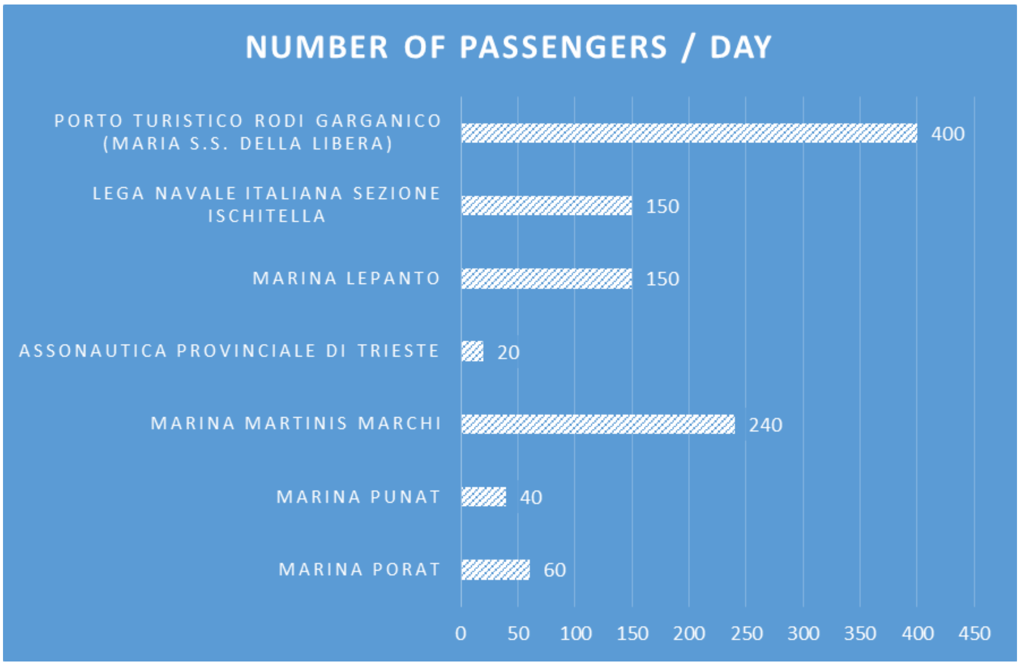

Figure 11: Number of passengers/day

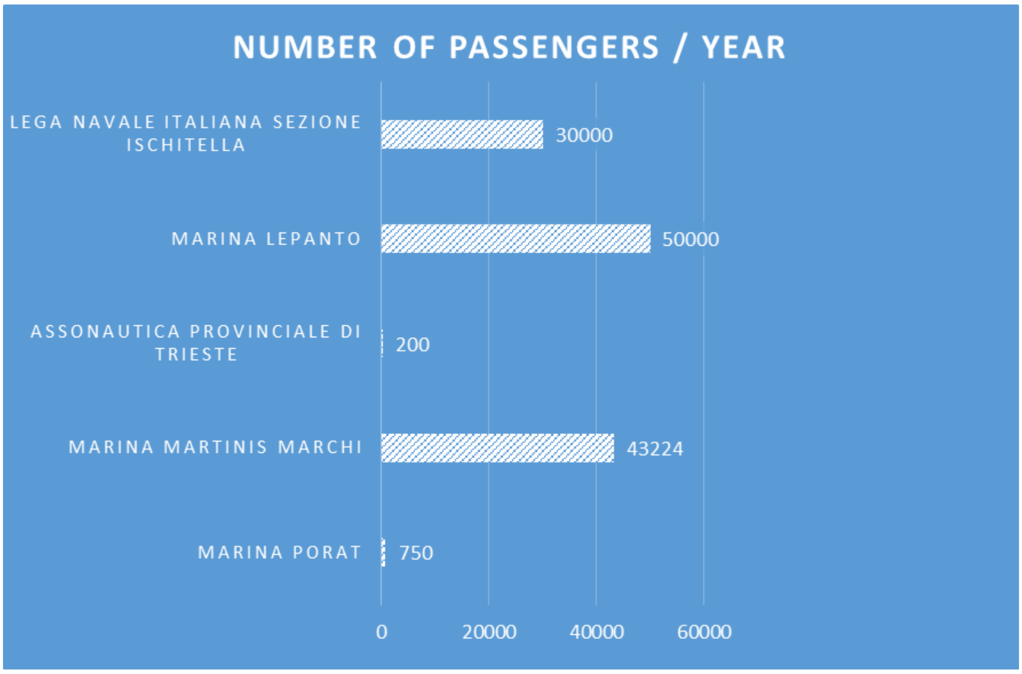

Figure 12: Number of passengers/year

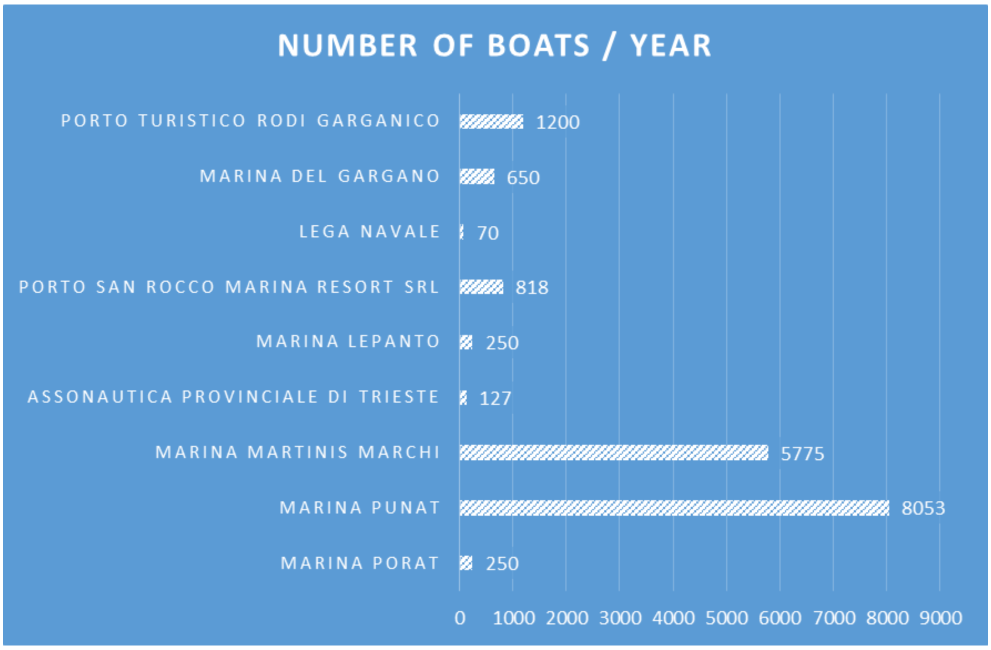

Figure 13: Number of boats/year

Regarding energy consumption data, questionnaires show that:

- The average total electric consumption per year, measured in kWh is 341,253 kWh/Y;
- The average CO_2 emission from total electric consumption, measured in t CO_2 eq per year is 147,6 t CO_2 eq/y;
- Marina del Gargano is the marina with the highest number of moorings with electric supply available (around 700), followed by Porto San Rocco (around 550);
- The average of energy consumed by moored boats is 126365 kWh/y.

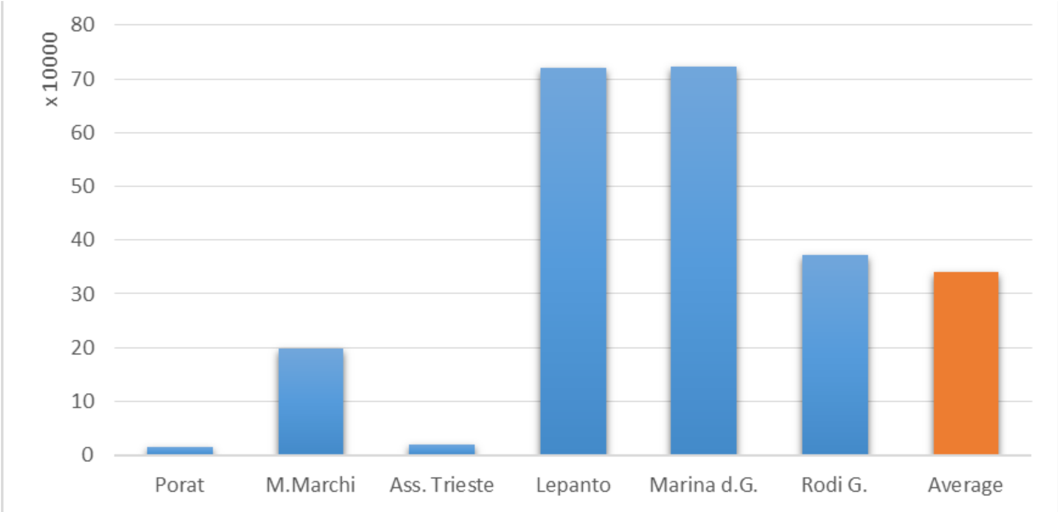

Figure 14: Average total electric consumption per year (kWh)

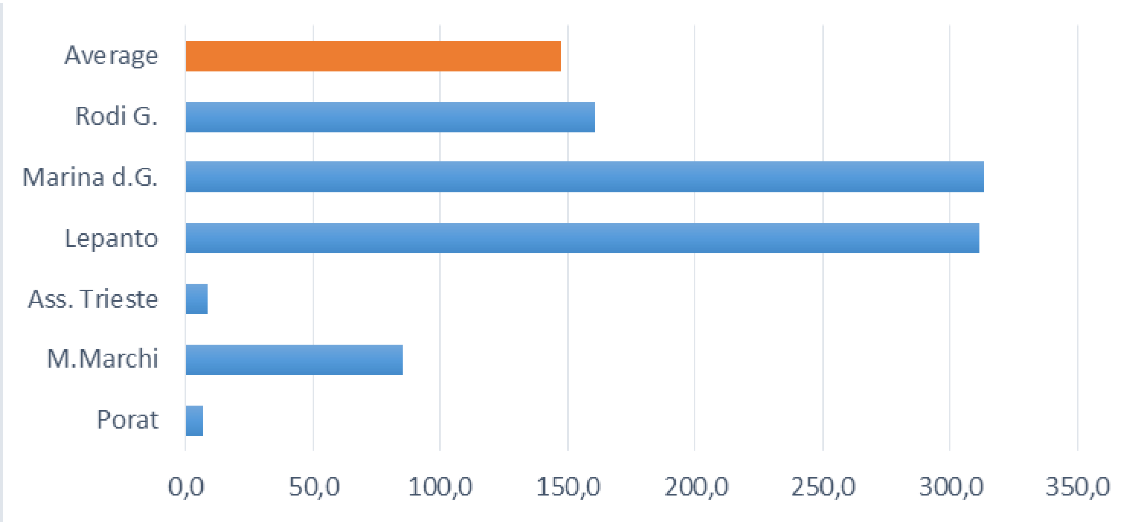

Figure 15: average CO2 emission from total electric consumption

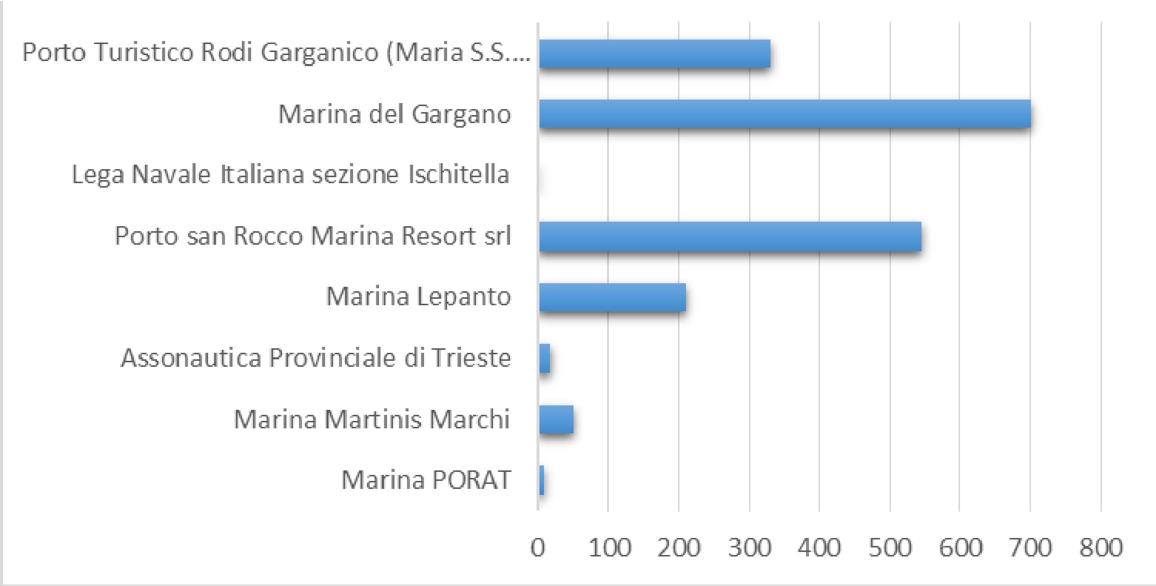

Figure 16: Moorings with electric supply available

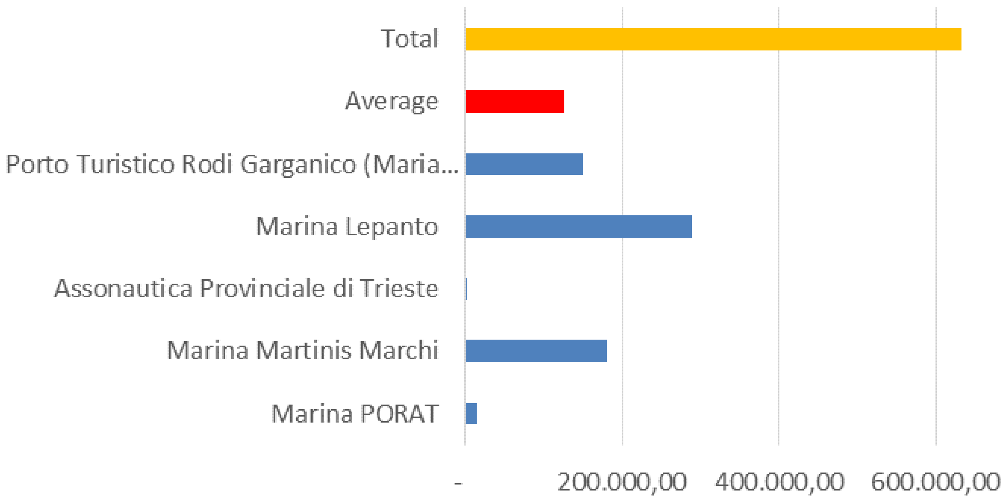

Figure 17: Energy consumed by moored boats (kWh/y)

Emissions generated by passengers' volume

Concerning fuel consumption and emissions profile, fuel consumption profiles were gathered for "Porat" (HR), "Martinis Marchi" (HR), "Punat" (HR), "Marina del Gargano" (IT) and "Marina di Vieste" (IT) marinas. The information collected from these sites were then aggregated and used to estimate CO2 emissions generated by road access to marinas, onsite road transport (within and around marinas), boat traffic.

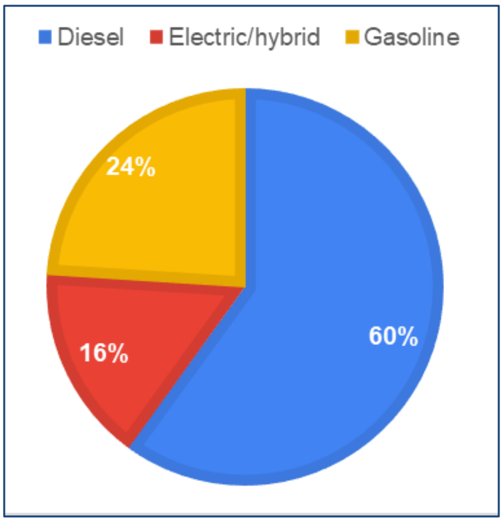

Figure 18: type of fuel

The tables below present the average fuel consumption and the consequent CO2 emissions considering the access to the marinas, the onsite road transport and the boat traffic.

Gasoline/petrol	
Average fuel consumption [kg gasoline]	10,911.4
Average CO2 emissions per year [t CO2 per year]	55,662.2
Diesel	
Average fuel consumption [kg diesel]	35,973.3
Average CO2 emissions per year [t CO2 per year]	129,826.7
Average CO2 emissions per year (gasoline and diesel) [t CO2 per year]	185,488.9

Table 3: Average fuel consumption and the consequent CO2 emissions to reach the marinas

Gasoline/petrol	
Average fuel consumption [kg gasoline]	1,017.9
Average CO2 emissions per year [t CO2 per year]	500
Diesel	
Average fuel consumption [kg diesel]	45,270.4
Average CO2 emissions per year [t CO2 per year]	142,679.1
Average CO2 emissions per year (gasoline and diesel) [t CO2 per year]	143,179.1

Table 4: Average fuel consumption and the consequent CO2 emissions of onsite road transport

Gasoline/petrol	
Average fuel consumption [kg gasoline]	43,029.0
Average CO2 emissions per year [t CO2 per year]	8,631.9
Diesel	
Average fuel consumption [kg diesel]	2,393.3
Average CO2 emissions per year [t CO2 per year]	15,523.7
Average CO2 emissions per year (gasoline and diesel) [t CO2 per year]	24,155.6

Table 5: Average fuel consumption and the consequent CO2 emissions of boat traffic

These data above shall be viewed as an indicator that should be related to the total number of boats and vehicles that are travelling across the Adriatic Sea in a year. E.g. Number of sail and yacht berths in Adriatic Sea ports in 2018:

- Italy 49,186;
- Croatia 17,459

Ex-ante evaluation with possible intervention investments

The analysis points out four main considerations regarding the mobility services and the energy consumption in the marinas in the Adriatic Sea:

- Questionnaire filled in by marinas' managers/owners describes that none of the marinas 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 the "Martinis Marchi" marina (Croatia) declared to have one specific plug for charging electric boats and yachts;
- Considering the answers given by the marinas' users, the great majority of the 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.

4. Guidelines for decision makers

According to the current experiences and realities observed in the Marinas of the Adriatic Sea, based on site visits, analysis and questionnaires submitted to marinas and to users, the absence of a framework and a common strategy among the different stakeholders involved (private marinas, public ports, service providers, public administration, municipal and regional authorities) create a not-homogenous environment in which the e-mobility could be developed. For these reasons, in order to reach the aims of the project, to improve current marinas mobility services and turn them into low-carbon (or zero emission) efficient systems, the first key element is to develop a framework of cooperation between all the subjects involved, to facilitate and coordinate the development of a homogenous and efficient system of infrastructures in the specific territories, both in the coastal areas and in the inner territories (airport, railways, etc.).

4.1. Guidelines on how to set vision, strategy, short and long terms objectives

Visions and strategies for energy efficient marinas are usually structured around common goals and objectives, that are related to problems of the predominance of single-modality land transport (cars), high polluting maritime transports (motor boats with endothermic engines), limited integration of mobility services. Visions are oriented towards energy efficient marinas, environmentally and energy friendly infrastructures and e-mobility systems, structured on the enhancement of the cooperation between private and public operators and local and regional services providers, development of renewable energy resources, the conduction of analysis and researches on new and innovative services and technologies.

In order to make possible the diffusion of an efficient infrastructural framework on which the e-mobility services could be developed, one of the first steps is to understand and know the scale on which the e-mobility infrastructures and services will be developed.

The main actions that could be suggested at the regional and territorial level are:

- Decide specific and minimum technic requirements to develop infrastructures;
- Define specific infrastructural requirements for the new buildings and the charging stations;

- Canalize the economic sources (European, national, regional) in the best efficient way possible;
- Create and develop informative campaigns and educational programs and coordinate the actions of the different stakeholders and operators;
- Coordinate the different planning activities of the regional and territorial authorities, creating synergies between territorial planning, urban planning, traffic and mobility planning, environmental planning and other forms of strategic planning.

Simultaneously, the actions that could be suggested at the local levels (single marina/port) are:

- Work as stimulus in the development of the infrastructures, without intervening in a direct way in the realization and management of it;
- Support the installation of charging station both in public and private areas;
- Include the e-mobility as key element of the local planning;
- Keep a constant attention at the regional and territorial rules, laws and suggestions;
- Intervene in the management of local traffic and vehicles flows to boost the use of e-services and e-vehicles and create better economic conditions to the e-mobility service providers.

One of the key elements in the definition of e-mobility and infrastructures visions is the analysis and understanding of the localization of charging stations, the study of the future possible demand of e-vehicles and of the technical requirements that are needed.

The estimation of the correct number of charging stations depends on a large number of factors and by the ownership, that can be public (usable h 24 by everyone), private (only specific group of users can use it), semi-public (public infrastructure but with restricted use (time, only under registration, reserved to specific users, vehicles, boats).

The following chart describes an overview on the factors that should be considered to estimate the needs of charging station in a specific area:

Title	Description
	Number of existing charging stations
	Localization of existing charging stations

Existing charging infrastructure and planned	Charging stations features: power, accessibility, level of use
	Which infrastructures are planned for the future?
Existing and planned e-vehicles	Number of current e-vehicle used
	Future scenarios (estimation)
Territorial and demographic data	Number of inhabitants
	Population density
	Urban or rural areas
	Building density
	Demographic Development
Economic data	Employment
	Number/dimension of important companies (related to infrastructures and vehicles)
	Commute flows
	Per capita income
Touristic data	Attractiveness of the area
	Number of touristic attractions
	Number of tourists (daily)
	Number of touristic accommodations
Data on transport and mobility	Modal share
	Vehicles registered (cars, boats, bikes, scooter, etc.)
	Availability of public transport
	Availability of car sharing services
	Number of places per parking/berth and relation between private parking/berth and the total number of parking
Energetic infrastructure	Energy providers
	Electricity manager

Table 6: List of factors to be considered in the localization of charging stations

It should be also underlined that, even it happens rarely, there could be some areas characterized by a total absence of infrastructures, and these issues is related both to land mobility and to sea mobility. In the land territories it usually happens in mountain or isolated areas, while in the sea territories is more related to isolated port/marinas that are characterized by small flows of vehicles. These areas are usually called “market failure”, where traffic (cars and/or boats) is usually scarce and the charging stations will not create economic advantages for the service providers.

How to develop interoperable infrastructures and mobility services

One of the first step that public ports and private marinas should take in consideration to develop an efficient infrastructure is to be aware on the current systems, legislations and policies related to the cooperation and e-mobility development. The stakeholder involvement is crucial to create a cooperation framework able to be efficient. The involvement of the active stakeholders (interested citizens, investors and operators, service providers) create multiple benefits:

- In the infrastructure development phase stakeholder networks can be used to implement mobility Plans and Programs;
- Investors and operators could play an active role in the implementation phase;
- Private marinas and public ports could base analysis and investment on the feedbacks that come from the SHs during meeting and events.

Another important element to be considered is the visibility that infrastructures and e-mobility services have in the society, and what is crucial is to develop environmentally friendly solutions which use and development is promoted both by public and private subjects. The easiest way to promote the presence of charging station is though road/nautical signs, better if with a specific graphic that could be strongly recognize compared to the traditional one. Another method to promote the charging station is to guarantee the presence of charging station in the most used Apps and Navigation systems.

4.2. Guidelines on the elaboration of the investment plans

Specific investment plans are here elaborated for each project pilot site thanks also to specific meetings and working tables with marinas' managers and stakeholders and site surveys carried out during the project. The investment plans are finally fine-tuned thanks to pilot implementation and potentially transferred to marinas and relevant stakeholders outside the DEEP-SEA partnership and pilot areas for potential replication and uptake.

The process for the development of an Investment Plan in the field of sustainable mobility services is structured on the following main steps:

- Description of the site and the state of the art: institutions involved in the territory and in the project sectors, network of stakeholders, territorial framework;
- Analysis of the state of the art of mobility services;
- Analysis of traffic volumes and energy consumption;
- Definition and structure of a strategic vision related to tourism, accessibility, mobility: description of the marina's vision considering the general contest where the specific marina is operating;

- Identification of targets that the marina wants to achieve, indicators (mobility, sustainability, energy efficiency) and objective of investment;
- Description of investment details: specific description of marinas investment and technical installations;
- Description of the assets used to support the investment plan: financial indicators;
- Description of the investment requirements based on security selection process: Cost Benefit Analysis CBA, Multi Criteria Analysis MCA;
- Definition and classification of investment priorities;
- Analysis and Return of Investment ROI: revenues, costs, expenses, utilities, savings, overheads, flow, values, etc;
- Analysis of investment risk: demand risk, human resource risk, marketing risk, supplier risk;
- Description of the structure and governance organization: members, organizational structures, administrative management;
- Communication and Networking activities

4.3. Guidelines on setting up Marina Energy Management Plan

In order to improve environmental and energy performances in the ports the European Sea Ports Organisation (ESPO) has defined group of action structured on five pillars, which are shown in the figure below.

The process for the development of a Marina Energy Management Plan is structured on the following steps:

- Definition of Port Management goals and objectives;
- Identification of the energy policies standards and regulations;
- Collection of main energy consumption data;
- Definition of the energy needs measures for improvement;
- Selection of the criteria for energy improving measures;
- Selection of the measures to be adopted;
- Definition of the timeline for plan implementation action.

These pillars may help ports and marinas to establish a development model with a specific time horizon, strategic objectives and actions, to mapping the overall energy consumption and to collect data on port services, nautical operations, boat supplies, maintenance and service activities, general purpose facilities, etc.

Resiliency

The ability to sustain business continuity during a power outage and resume operations after a catastrophic event

Availability

Access to energy sources that are required to meet present and future power demand of port operations

Reliability

Availability of high-quality and consistent energy that can meet predicted peaks in demand

Efficiency

Reductions in energy demand through management practices and technologies that maximize operational productivity and cost effectiveness

Sustainability

Integration of energy management practices and renewable power generation providing economic, social and environmental benefits

Figure 19:Energy pillars for the development of port EMP

The five pillars are followed by a series of action towards the improvement of the port environmental performance:

- Exemplifying: setting good example towards the wider port community by demonstrating excellence in managing the environmental performance of their own operations, equipment and assets;
- Enabling: providing the operational and infrastructural conditions within the port area that facilitate port users and enhance improved environmental performance within the port area;
- Encouraging: providing incentives to port users that encourage a change of behavior and induce them to continuously improve their environmental performance;
- Engaging: engage port users and/or competent authorities in sharing knowledge, means and skills towards joint projects targeting environmental improvement in the port areas;

- Enforcing: making use of mechanisms that enforce good environmental practice by port users where applicable and ensuring compliance.

Results of analysis of existing port management practice in DEEP-SEA partner's region

Marinas and ports involved in DEEP-SEA project were asked to fill in questionnaires and to collect internal information and data. The main objective of the conducted analysis was to give an overall description of existing port management practices in project partner's region, focusing on pilot areas in the Italian and Croatian Marinas of Adriatic Sea. Questionnaires submitted[8] to marinas (16) were based on:

- General data on the marina/port features;
- Service quality indicators: ISOs, Blue Flag, berth capacities, electricity connection and water supply connection;
- Environmental impact/pressures: noise from the boats, air pollution, energy consumption and supply needs, risk of accidents during fuel supply, discharges from boats, traffic in the port areas and approaching roads, parking issues in the port areas;
- Energy indicators: energy plan/policy, availability of the Energy plan/policy, energy standards beyond required, annual energy review, designated personnel, energy management system, energy consumption monitoring, energy indicators to monitor energy performance, led or lighting, solar power on roof tops, air conditioner and ventilation energy reducement measures, e-document software, electric equipment for handling operations, promotion for ride share or shuttle bus or e-vehicles for rent, e-charging station, solar bench charger, shore power for vessels with e-power, energy efficiency control system, microgrid, promotion of Green Port concept;
- Investments needs and priorities: reduced energy consumption, renewable energy sources, sustainable mobility, environmental protection and Green Port concept, infrastructure, more services for users;

[8] Complete results of the questionaries are included in the D.3.2 Analysis of Marina Management System and Investment model, with charts and sheets for each port/marina of DEEP-SEA project.

- Marina categorization: private (56%), public (31%), owned by regional or municipal authority (13%);
- Ownerships structures;
- Number of employees;
- Internal organization;
- Education of employees and expert capacities: financial issues, manager activities, safety at work, languages, data protection regulation, etc.;
- Collaboration with public and private stakeholders and other organizations: 2/3 of the marinas collaborate with scientific organization, professional associations or 3rd party organizations;
- Marina functions and focus of action: nautical function with short-term or long-term berth arrangements, port in function of community and local citizens, public port function with public service berthing priorities: tourism, fishing, shipbuilding's and servicing, diving, agriculture, industry;
- Economic activities nearby marina area;
- Distance from main traffic nodes and quality of traffic infrastructure;
- Funding source.

5. Guidelines for technicians: examples of possible implementation of actions "on-field" based on marina features and pilot experiences

5.1. Technical features

DEEP-SEA project pilot areas will focus on small technological investments, equipment installations and services startup to develop new energy efficient services and create synergies in the mobility sector. Marinas and the pilot areas are considered as a unique interchange point of multimodal transport and mobility system, where activation of innovative types of sustainable mobility services is needed.

The five pilot areas (Venezia Giulia and Foggia Area in Italy, Krk Island, Malinska, Maslinica-Solta in Croatia) will be characterized by:

- The installation of 19 e-charging station (power of 22 kWh or more with interoperable management system): 7 for e-vehicles charging, 5 for e-boats, 7 for both charging purposes;
- The installation of 7 racks with electric and muscular bicycles;
- The purchase of 3 e-scooters sharing services;
- Startup of e-car sharing services in 4 pilot areas;
- Startup of 1 e-scooter sharing;
- Installation of microgrid system in 4 sites.

The **Venezia Giulia** pilot area will be characterized by the:

- Startup of 1 e-car sharing services;
- Installation of 6 e-charging stations for e-vehicles;
- Installation of 3 racks with electric and muscular bicycle for sharing system;
- Installation of 1 microgrid system.

The **Foggia pilot** area will be characterized by the:

- Startup of 1 e-car sharing service for the Province of Foggia, linked to the main transport HUBs;
- Installation of 6 e-charging stations for e-vehicles and/or e-boats in the marinas selected;
- Installation of 2 racks with e-bike sharing system in the areas of Manfredonia and Vieste.

The **island of Krk** pilot area will be characterized by:

- Installation of 1 rack with electric and muscular bicycles for bike sharing services;
- Purchase of 3 e-scooter for sharing services and startup of 1 e-scooter sharing;
- Installation of 2 e-charging stations for e-cars;
- Installation of 2 e-charging stations for e-cars e e-boats;
- Installation of 1 microgrid system.

The pilot **Malinska Municipality** pilot area will be characterized by:

- Installation of 1 e-charging station for e-vehicles and 1 e-charging station for e-boats in Malinska and Porat Marina;
- Installation of 1 rack with electric and muscular bicycles for bike sharing services;
- Installation of 1 microgrid system.

The pilot **Maslinica-Solta** pilot area will be characterized by:

- Installation of 1 e-charging station for e-vehicles and 1 e-charging station for e-boats;
- Installation of 1 rack with electric and muscular bicycles for bike sharing services;
- Installation of 1 microgrid system;
- Startup of 1 e-car mobility service for tourist transport.

Microgrids

Among the different actions, in the Marinas of the Adriatic Sea area, the realization of the microgrid is essentially the most innovative one. This type of implementations can intelligently integrate the actions of producers, consumers, prosumers and distribution system operators in order to efficiently deliver sustainable, economic and secure electricity supplies. Microgrid consist of:

- a photovoltaic generator;
- a storage system;
- a power monitoring and management system;
- a display (optional);
- a power grid connection.

The photovoltaic generator can be installed on a surface that allows maximizing the energy production, which can be a roof, an unused area or any other available surface to capture solar energy. Its characteristics are:

- performance ratio during the first year of operation: at least 85%;
- photovoltaic module technology: crystalline silicon, CIGS, CdTe;
- Minimum efficiency photovoltaic modules; 16 % crystalline silicone, 14% for other technologies;

- Warranty on the rated of the PV modules after 25 years; at least 85% of nominal power;
- Tolerance on rated power: positive;
- NOCT: less than 45°C;
- Absolute value of temperature coefficient: less than 0.4%/°C.

The batteries of the storage system will be able to be charges both with the energy produced by the photovoltaic generator and with the one coming from the electricity grid. In addition, the storage system can be used both to partially power the charging station and to feed energy into the local grid power.

General characteristics of the inverter are:

- Grid voltage: 230-400 V;
- Power factor: 0.9 capacitive – 0.9 inductive;
- Minimum efficiency: 95%.
- General characteristics of the energy storage system are:
- Battery life: 10 years;
- Useful life cycles: at least 10.000

A recent example of microgrid installation is the one installed at the University of Trieste within the MUSE - Cross border collaboration for a sustainable and energetically efficient university mobility, a project co-financed by the European Regional Development Fund via the cross-border cooperation program Interreg Italy-Slovenia.

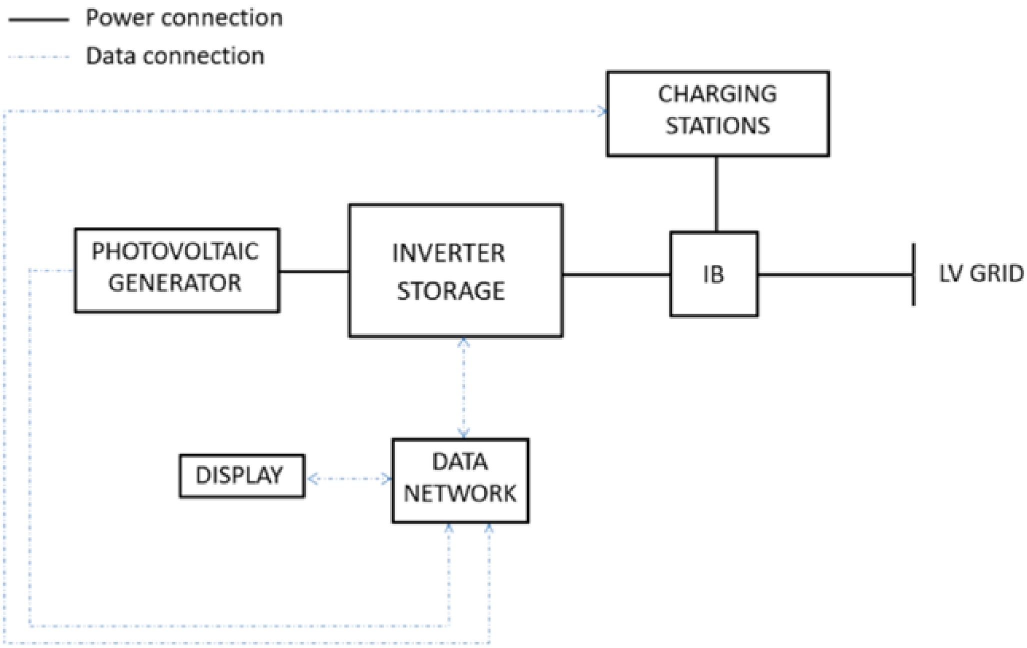

Figure 20: microgrid block scheme

E-cars charging station

The charging station is equipped with the vandal-proof system and customizable front panels. In addition, it may be equipped with RFID badges and a web server management system.

Technical features are:

- Rated voltage: 400 Vac;
- Nominal current: 63 A;
- Frequency: 50-60 Hz;
- Working temperature: -30°C +50°C;
- UV rays: resistant;
- Saline solution: resistant.

Figure 21: E-cars charging station in Manfredonia, Italy

E-boats charging station

The main features of this charging station are same as the e-car charging station, while the position, the safety, the monitoring system are quite different. The charging of cars and boats could also be performed by a unique deice providing the two services. In this case, they are usually installed near the dock. Due to particular position close to seawater, it must be realized using materials and technologies suitable to protect it from external agents and sunlight, such as steel Aisi 304.

Figure 22: E-boats charging station in Manfredonia, Italy

E-bike charging station

Technical features are:

- Rated current: 2 A (each plug);
- Rated voltage: 230 V (Shuko/Italian sockets);
- Rated power: 460 W (each pug);
- RFID and free charging station.

Figure 23: e-bikes sharing charging station in Manfredonia, Italy

Display

An outdoor LED display can be mounted to control the daily production data of the system and the energy used for charging vehicles (cars and boats). The display can be supported by a software that will create a screen on which will be transmitted in real time the states and variables of the microgrid operation, and communicate the most important information related to DEEP-SEA project and the results achieved. Some basic characteristics of the display are:

- Dimensions: 43’’ or larger;
- Maximum weight: 60 kg;
- Maximum power: 80 W;
- Power supply: 230 V;
- Minimum duration: 30,000 hours.

5.2. Lessons learnt from DEEP SEA and final practical recommendations

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

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. The following recommendations could be considered the main relevant, divided into two main categories:

Key recommendations from DEEP SEA partners on e-mobility

e-mobility	Key recommendation
Business: adoption of services and technologies related to e-mobility	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.
Governance: request of policy from the decision makers to support e-mobility diffusion	Continue enforcing existing climate/energy strategies, (such as “Krk 0% CO_2 emissions” strategy) and push for better implementation among businesses by incentivising them to use smart mobility solutions. Advocating for: The promotion of e-mobility between residents with the local authorities. The development of local polices 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.
R&I: cooperation and alliance to support knowledge transfer and strategy	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 7: Key recommendations from DEEP SEA partners on e-mobility

Key recommendations from DEEP SEA partners on renewables and smart grids

Renewable energy and Smart Grid	Key recommendation
Business: adoption of services and technologies related to e-mobility	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.
Governance: request of policy from the decision makers to support e-mobility diffusion	Establish a body in charge of promoting and encouraging the switch to renewable energy; Incentivize switch to clean energy Advocating for: 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 micro grid 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
R&I: cooperation and alliance to support knowledge transfer and strategy	Encouraging other marinas in the transition towards sustainability and the implementation of Smart grid systems; Forming an alliance with other marinas in the area for 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.

Table 8: Key recommendations from DEEP SEA partners on renewables and smart grids

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