D.3.3.1 AS IS analysis on current mobility services and related energy consumption

WP3. Nautical marinas framework analysis and investment plans

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1.0	First Draft	22/01/2020	University of Split
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Notes:			

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1. Introduction

This AS IS analysis aims to assess the energy consumption and related CO_2 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 (activity 3.4) for each pilot area of the project.

The analysis is based on the methodologies used in the framework of SECAPs (Sustainable Energy and Climate Action Plans), Mobility Management Handbook, SUMPs (Sustainable Urban Mobility Plans) and EEA (European Environmental Agency) air pollutant emission inventory guidebook 2019 for the calculation of traffic and maritime flows and related CO2 emissions. It 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.

Starting from there, the energy consumption generated by these traffic volumes and the consequent CO_2 emissions are estimated based on indicators/formulas/table referring to the most recent indicators (EEA emission factors for road transport, 2019). The data collection is supported by questionnaires and data sheet submitted to the participating marina and their users.

2. Definition of the methodology and timing

2.1. Scope of analysis

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. The reference years are the 2019 touristic season when available (pre-pandemic data), alternatively the most recent year (2021-2022).
The analysis starts with an overview of the services offered by each marina, followed by the analysis of traffic volumes, including both on-road and boat transport.

ON-SHORE (inland) MOBILITY analysis includes:

1) **Access to marinas**: Analysis of traffic flows to and from the marinas: how many users arrive to each marina each year by road in order to start their cruise; which vehicle they

use; how many people per vehicle; total distance covered by starting location up to the marina and return; total consumption per fuel and consequent emissions.

2) **On-site transport:** Analysis of road traffic flows generated for on-site touristic visits (generally passengers disembarking in the marina and visiting the nearby sites before setting off again). Number of visitors, vehicles used, distance covered, total consumption per fuel and consequent emissions.

OFF-SHORE (sea side) MOBILITY analysis includes:

1) **Docking:** Energy consumption of boats docking in the marinas and consequent emissions;
3) **Traffic flows of boats gravitating around the marinas**: analysis of number of boats, divided by main usage (long distance/short distance journeys, chartered/private), type of boats (sail/motorboat), fuel type, total distance covered per year/journey; total consumption per fuel and consequent emissions.

2.2. Survey methodology

In order to collect the data for both analysis two questionnaires have been produced:

1) **Questionnaire on current situation of mobility services inside the marinas and energy consumption**: elaborated in coordination with task 3.1 and submitted to marinas participating to DEEP SEA in order to collect data on electricity supply, consumption and costs, renewable energy, passengers flows and mobility patters, services provided by the marinas.
2) **Questionnaire for marina users:** submitted to a sample of each marina users to collect the following information and data on:
    - their mobility choices and pattern both to access the marina and to visit the nearby sites;
    - boat data (type, engine, fuel), consumption profile and typical use;
    - their perception of the services offered by the marina and services they would like to have in the future.

The questionnaires are provided in Annex I and II. In particular, as during the first round of questionnaires administration (between 2019 and 2020) only a few users filled in all the entries of the survey, thus not allowing the gathering of enough data and the elaboration of a robust analysis, the questionnaire for marina users (questionnaire no.2) was revised, simplified and used to collect additional data during two survey rounds in summer 2022.

Hence, the AS IS Analysis has been performed in 3 phases, and the results are summarised in this report:

1) Submission of a questionnaire to marinas participating to DEEP-SEA pilot projects (questionnaire no.1);
2) Submission of a questionnaire to a sample of each marina's users (questionnaire no.2);
3) Analysis of questionnaires' results and data elaboration.

The nautical marinas that answered the questionnaire on current situation of mobility services inside the marinas and energy consumption (questionnaire no.1) were:

Table 1 – Nautical marinas that answered the questionnaire on current situation of mobility services inside the marinas and energy consumption (questionnaire no.1).

Marina (name)	Location	Pilot site	Marina definition
„Porat" marina	Malinska-Dubašnica, Croatia	Malinska, Croatia	Departing hub
„Martinis Marchi" marina	Maslinica, Croatia	Maslinica, Croatia	Touristic marina
„Punat" marina	Punat, Croatia	Krk, Croatia	Departing hub, transit marina, camping marina
Assonautica Provinciale di Trieste	Trieste, Italy	Friuli Venezia Giulia, Italy	Departing Hub, Small cabotage marina
„Lepanto" marina	Monfalcone, Italy		Transit marina, Residence marina
Porto San Rocco Marina Resort srl	Muggia, Italy		Departing Hub, Touristic marina
Lega Navale Italiana sezione Ischitella	Foce Varano, Italy	Foggia, Italy	Touristic marina, Residence marina,

			Camping marina, Small cabotage marina
Marina del Gargano	Manfredonia, Italy		Transit marina, Touristic marina, Residence marina, Camping marina
Touristic Port of Rodi Garganico (Maria S.S. della Libera)	Rodi Garganico, Italy		Departing Hub

Definitions:

- **Departing Hub**: marina that users use to start their journey (renting or with their own boat), without stopping there.
- **Transit marinas**: mainly used for fuel supply or documents (customs passports, taxes, etc.) without staying or visiting.
- **Touristic marinas**: access points to tourist sites (historical or landscape) where the cruiser arrives for visiting.
- **Residence marinas**: marinas with residences or flats where the tourist stops.
- **Camping marinas**: sleeping dock (houseboat, camping boats, boat & breakfast).
- **Small cabotage marinas**: small/medium dockings area for small boats (day trip, especially outboards or sailing boats, fishing boats ,etc.).

As regards the questionnaire administered to marinas users (questionnaire no.2), a total number of 143 surveys were collected from the following marinas:

Table 2 – Number of questionnaires administered to marina users (questionnaire no.2).

Marina (name)	Location	Pilot site	Questionnaires number
„Porat“ marina	Malinska-Dubašnica, Croatia	Malinska, Croatia	41
„Martinis Marchi“ marina	Maslinica, Croatia	Maslinica, Croatia	65

„Punat“ marina	Punat, Croatia	Krk, Croatia	20
Marina del Gargano	Manfredonia, Italy	Foggia, Italy	6
Marina di Vieste	Vieste, Italy		11

2.3. Methodology for the estimation of traffic volumes and energy consumption

The analysis of mobility services and related energy consumption was coordinated by the University of Split and adopted an integrated approach to ensure consistency, create synergies and increase cost-efficiency aspects. The analysis provides a complete framework of the mobility services and the volume of passenger using private vehicles in nautical marinas, leading to the description of the passenger volumes per transport mode including the indication of energy consumption, which constitutes the baseline for the further investment plan that has to be developed by each pilot site.

Furthermore, it is possible to retrieve a description of main services offered by each marina, the equipment used in service provision and the integration with the local planning.

It is important mentioning that the estimation of traffic volumes and energy consumption mainly relies on the overall results of the questionnaires administered to marinas' owners/managers, as they provided more details and data upon the the traffic flows and the energy used by marinas. The historical data about the average total electric energy consumption per year were deployed to estimate the average CO_2 emissions per year of each nautical site, based on the methodology used by the Greenhouse Gas Equivalencies Calculator (March 2022 data. U.S. Environmental Protection Agency, Washington, DC.).

2.4. Methodology for the estimation of emissions

Calculation of the CO_2 emitted by the vehicles and boats moving within and/or around the marinas took into account the data gathered by the questionnaire administered to the users of the following Croatian and Italian marinas, i.e. Porat, Martinis Marchi, Punat, Marina del Gargano and Marina di Vieste.

It was possible to gather the consumption profiles of the following movements:

1. Average fuel consumption [liters, l] of the means of transport used to reach the marinas;
2. Average fuel consumption [liters, l] of the means of transport used to move around the inland site;
3. Average offshore fuel consumption [liters, l] per trip of the boats/yachts moored at the marinas.

Average fuel consumption in liters is first converted into average fuel consumption expressed in kg, by considering the real weight of 1 liter of gasoline (0.68 kg) and diesel (0.835 kg).

The average CO_2 emissions [kg CO_2] were calculated by multiplying the average fuel consumption [kg] of each marina by the Emission Factor (EF) selected. However, since the guidelines for maritime shipping do not mention any specific EF for CO_2, it was decided to deploy the EF considered in the EEA guidebook 2019 for road transport, as recreational crafts use the same type of fuel from gas station as road vehicles do. In light of this, CO_2 EFs for both petrol and diesel according to EEA sources are equal to 3.169 g CO_2/kg fuel.

In order to calculate the average CO_2 emissions per year to reach the marinas, the average CO_2 emissions is multiplied by the average number of vehicles and boats that reach the marinas of "Porat", "Martinis Marchi", "Punat", "Marina del Gargano" and "Marina di Vieste" in a year, using the data provided by marinas managers/owners in questionnaire no. 1, i.e.:

Table 3 – Calculation of the emissions profile to reach the nautical marinas that provided data (questionnaire no.1).

Marina (name)	Location	Pilot site	Average number of passengers per year	Average number of passengers per vehicle/boat	Average number of vehicles/boats per year
„Porat" marina	Malinska-Dubašnica, Croatia	Malinska, Croatia	750	3.1	241.9
„Martinis Marchi" marina	Maslinica, Croatia	Maslinica, Croatia	43224	3.4	12712.9

„Punat“ marina	Punat, Croatia	Krk, Croatia	8053*	3.2	2516.6
Marina del Gargano	Manfredonia, Italy	Foggia, Italy	650*	4	162.5
Marina di Vieste	Vieste, Italy		11	n.a.**	n.a.**

*For “Marina del Gargano” and “Marina di Vieste”, the average number of passengers entering the marina each year was not provided. Instead, it was assumed one passenger at least for each boat entering the marina in a year.
**For “Marina di Vieste”, the average number of passengers and/or boats entering the marina each year was not provided. Hence, for this marina it was not possible to estimate the average CO_2 emissions in a year, but only the average CO_2 emissions of the vehicles/boats moving within and/or around the marina analyzed by the present survey.

Nonetheless, for the emissions related to inland/onsite movements, the average number of vehicles/boats reaching the marinas each year is multiplied by the percentage of respondents who have declared to move around the inland site in each marina, i.e.:

Table 4 – Percentage of respondents for each marina declaring to move around the inland sites.

Marina (name)	Location	Pilot site	% respondents declaring to move around the inland site
„Porat“ marina	Malinska-Dubašnica, Croatia	Malinska, Croatia	68%
„Martinis Marchi“ marina	Maslinica, Croatia	Maslinica, Croatia	37%
„Punat“ marina	Punat, Croatia	Krk, Croatia	55%
Marina del Gargano	Manfredonia, Italy	Foggia, Italy	50%
Marina di Vieste	Vieste, Italy		45%

Considering offshore consumptions and emissions, it is considered the average number of boats travelling to/from the marina each year, as per what declared by the respective marina managers/owners in questionnaire no.1. However, 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 passengers interviewed in each marina.

3. Results

3.1. Passenger volumes and energy consumption in pilot areas

As mentioned in chapter 2 (section 2.2), a total number of 9 marinas answered to the questionnaire "on current situation of mobility services inside the marinas and energy consumption" (questionnaire no.1). Most of them classified themselves as departing hubs, transit marinas, touristic marinas, residence marinas, camping and small cabotage marinas, as presented in Figure 1.

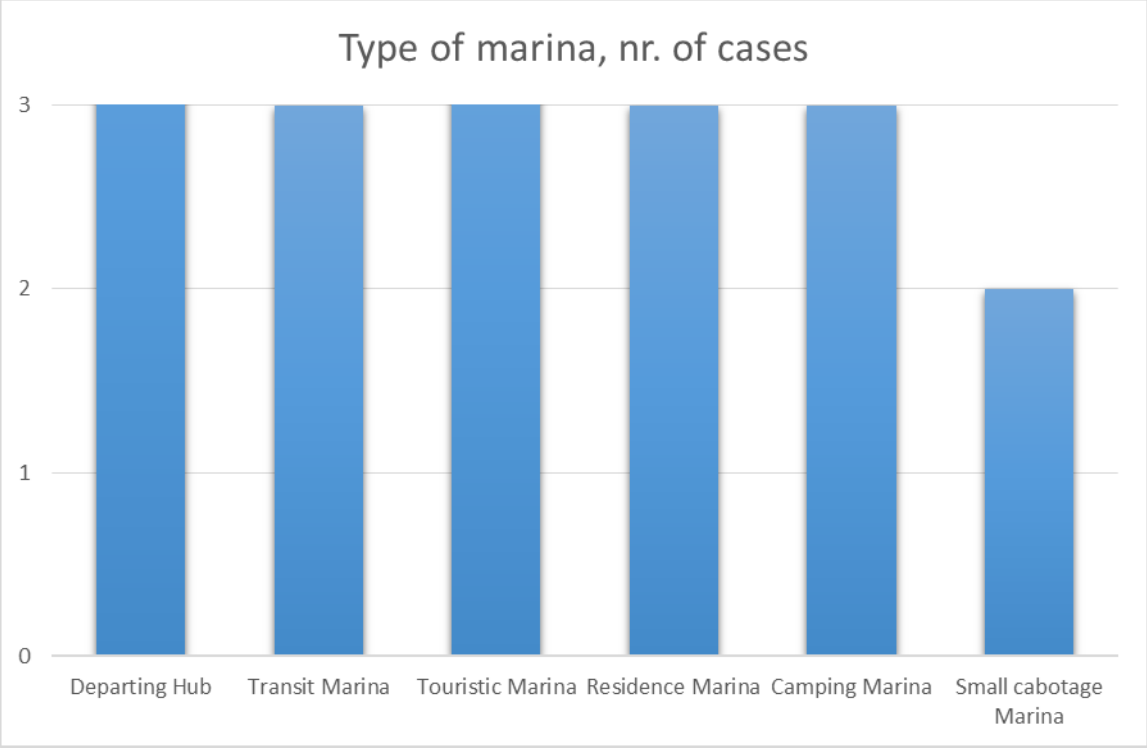

Figure 1. Results from the questionnaire administered to marinas: type of marinas.

As reported in Figure 2, the main means of transport used by visitors to access these marinas from the inland are private or rented cars (75%), followed by boats (18%), while public transport such as bus and train are the least utilized, as well as taxis (equal to or lower than 2%). Nonetheless, if we consider the answers received from the questionnaires administered to marina users of "Porat", "Martinis Marchi", "Punat", "Marina del Gargano" and "Marina di Vieste" sites (Figure 3), marinas are reached by boat mainly (38% of the respondents), although the use of private vehicles (cars/vans) and mixed means of transport (i.e. flight, boat, private/rented vehicle) represent a relevant share as well (36% and 17%, respectively).

More than a half of the visitors entering the marinas by boat declared to come from Croatia (65.4%), while the ones using private/rented cars and mixed means of transport generally come from farther countries (usage of private/rented cars: 27% Austria, 25% Germany).

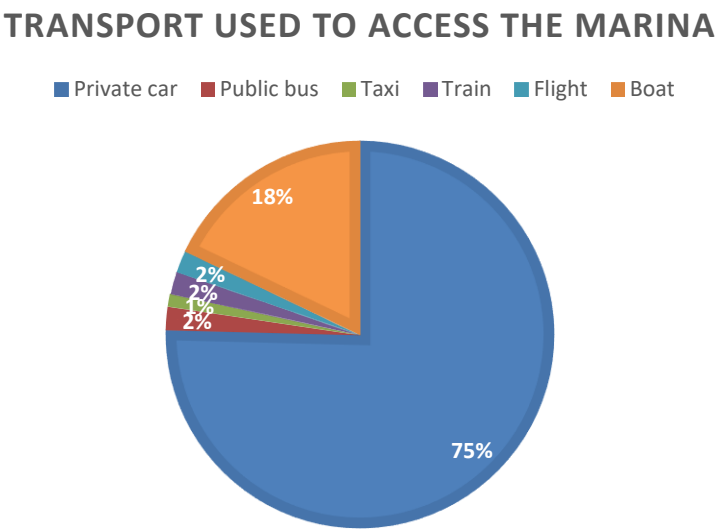

Figure 2 - Results from the questionnaire administered to marinas: type of transport used to reach the marina.

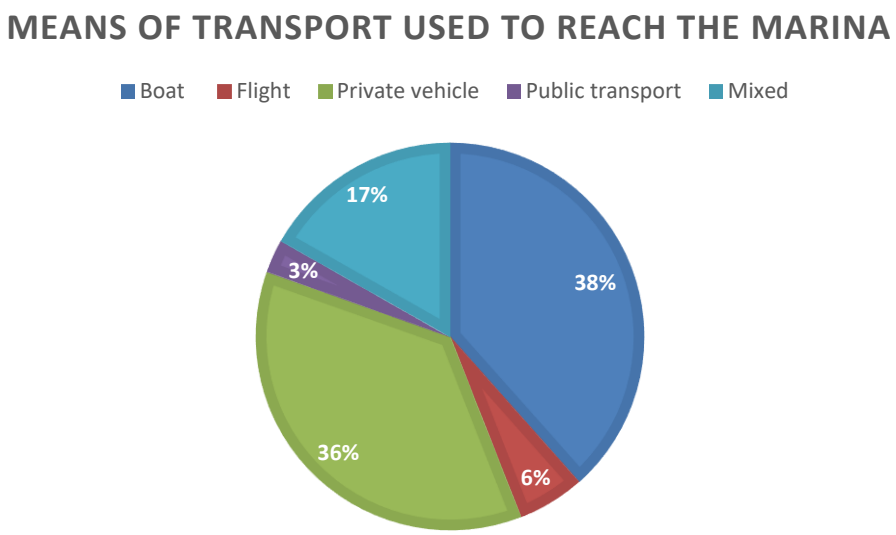

Figure 3 - Results from the questionnaire administered to marinas' users: type of transport used to reach the marina.

As concerns the place of departure of most passengers, marinas' managers declared that 63% of the visitors are coming from places that are distant less than 300 km away from the marina, thus highlighting the presence of mostly local visitors, coming from the same country or from neighboring areas (Figure 4). Considering that 6 out of 9 marinas are located in Italy, it is therefore expected that most visitors come from Italy or from the neighboring countries. Figure 5 indeed shows that 52% of the marinas managers indicated "Italy" as country of departure, 14% "Austria", 12% "Slovenia" and 11% "Germany".

If we consider the results of the questionnaire filled in by the marinas users, the trend is confirmed, although with a prevalence of Croatian visitors (Figure 6), since the highest number of questionnaires was collected in the Croatian marinas, i.e. 37.4% of the passengers are from Croatia, 17.3% from Italy, 15.1% from Germany and 12.2% from Austria.

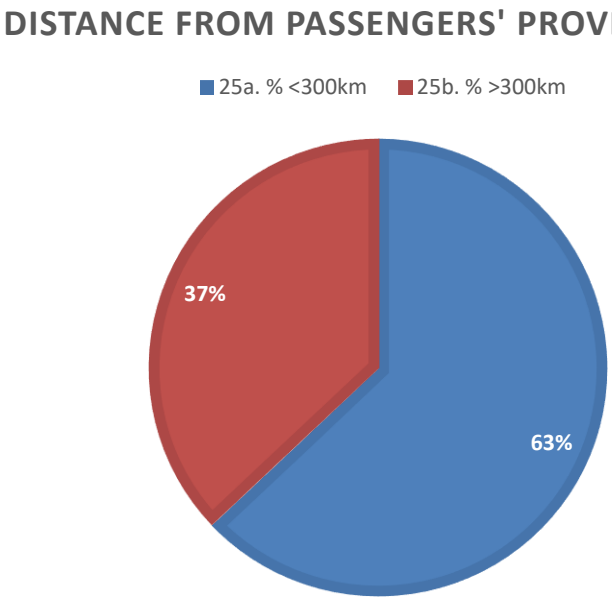

Figure 4 - Results from the questionnaire administered to the marinas: distance from passengers' place of departure.

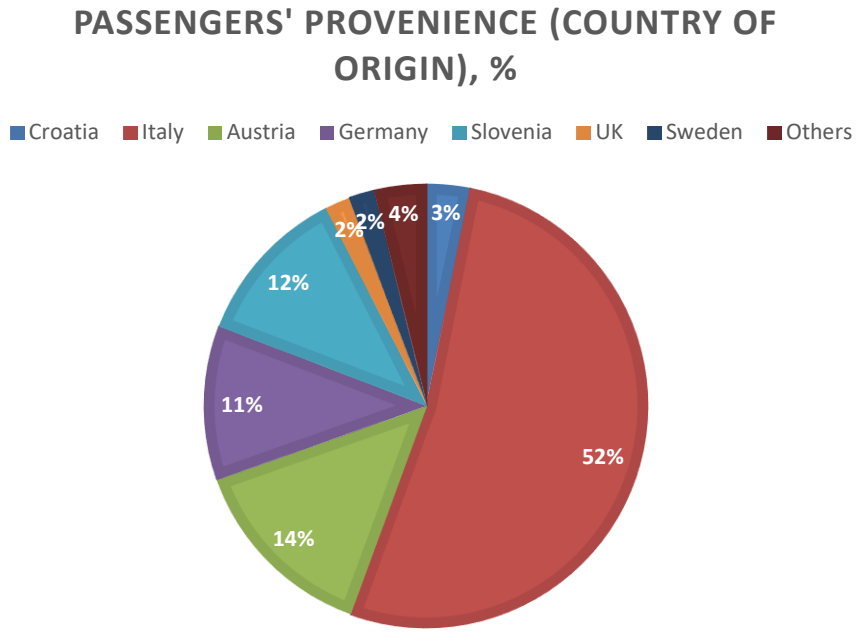

Figure 5 - Results from the questionnaire administered to the marinas: passengers' provenience.

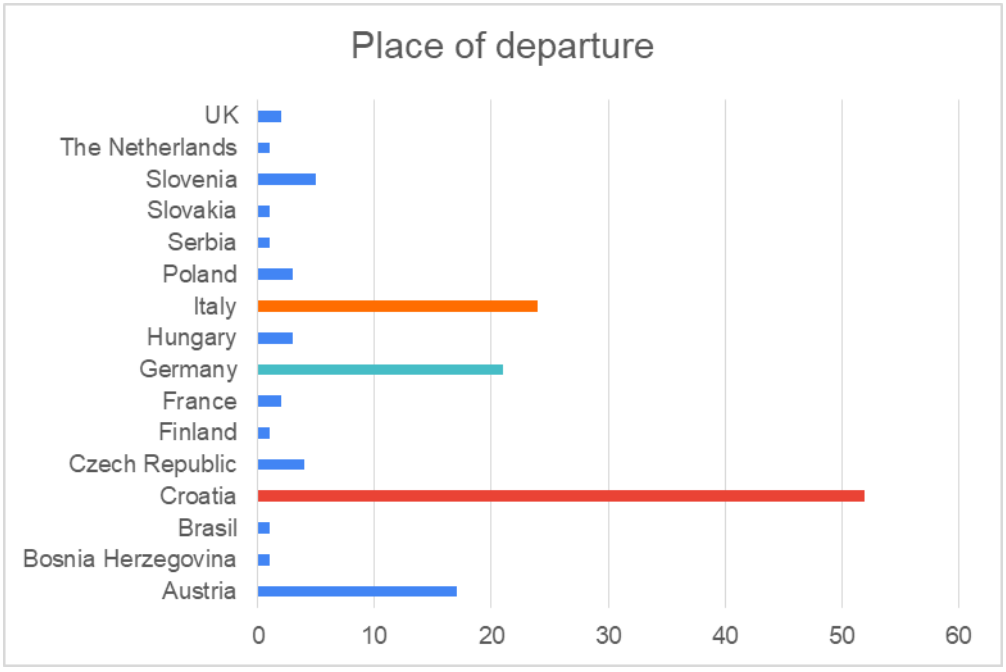

Figure 6 - Results from the questionnaire administered to the marinas users: visitors' provenience.

In order to identify the type of services offered by each marina, it was asked to marinas' managers to define the means of transport generally used by visitors to move around the inland site. The results reveal that 36% of passengers/tourists tend to use private or rented cars, 27% prefer to use bikes, 18% uses taxi, 14% public transport (bus mainly, while none makes use of trains), and only 5% select shared mobility services (Figure 7). This trend seems to be confirmed by the results gathered from marinas' users, which see also a prevalence of private vehicles, followed by mixed means of transport (e.g. private/rented car and bike or taxi, public transport and bike) and bikes, while public transport is the least utilized (Figure 8).

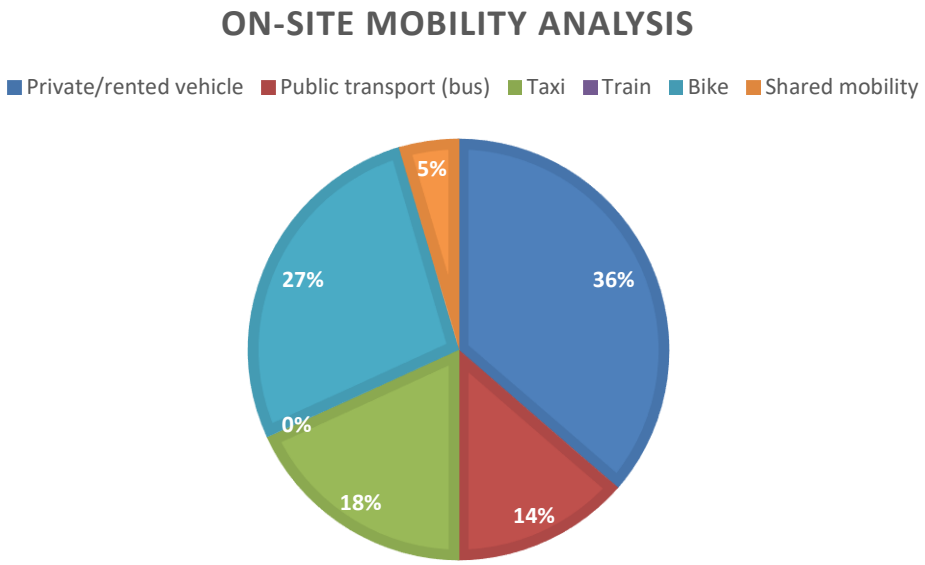

Figure 7 - Results from the questionnaire administered to the marinas: onsite mobility.

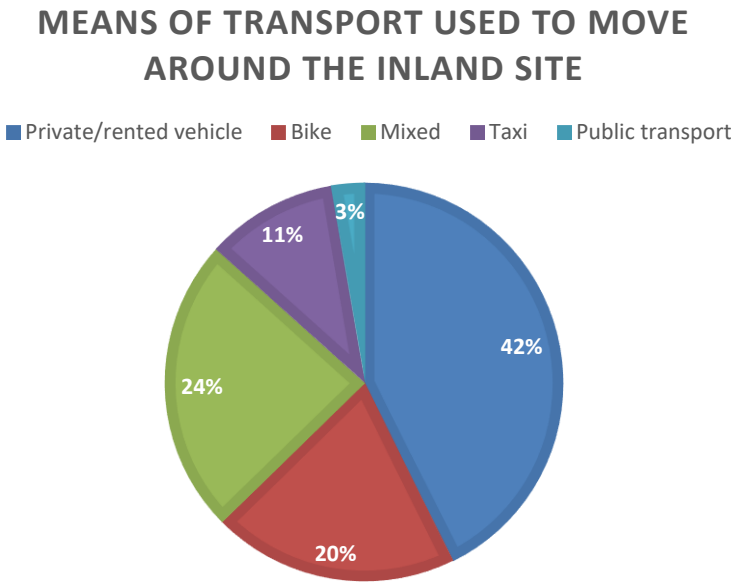

Figure 8 - Results from the questionnaire administered to marinas' users: onsite mobility.

The predominance of rented or private vehicles may be explained also by the general lack of bike/e-bike rentals within or in the premises of the interviewed marinas, except for those sites where the (e-) bike rental service has been only recently activated thanks to the DEEPSEA project (e.g. Marina del Gargano, Porat and Martinis Marchi).

As regards further services provided by the marinas, only “Punat”, “Lepanto”, “Lega Navale Ischitella”, “Marina del Gargano” and “Porto Turistico Rodi Garganico” specified the type of services. “Punat” marina provides to visitors a dedicated App, proactive boat care, a shuttle to Medane pool, luggage transport, nautical shop, 4-star hotel, bungalows, pool, restaurants, and transfer services to Rijeka. “Lepanto” marina provides to its users with a swimming pool, a restaurant, bar, fitness area, wifi connection, park, conference room, WC and showers. “Lega Navale Ischitella” mentioned only general port services for members’ assistance, besides video surveillance. “Marina del Gargano” offers a shipyard and a bunkering station, while “Porto Turistico Rodi Garganico” provides an electric car, golf car, 2 car rentals, 2 scooters, transfer from/to Termoli/Foggia/Tremiti islands/Gargano coast, sailing/boat excursions, boat/dinghy renting, charter, market, bar and restaurants, shipyard and bunkering station.

Considering traffic flows and as shown in Figure 9, the marina registering the highest number of passengers per day is “Porto Turistico Rodi Garganico”, in Italy (400 passengers/day), followed by the Croatian “Martinis Marchi” (240), “Lepanto” and “Lega Navale Ischitella” marinas (150 visitors/day). Nonetheless, the number of passengers per year is higher in the “Lepanto” marina and in “Martinis Marchi” (Figure 10), thus demonstrating that in these locations traffic flows might be more concentrated during specific months and “peak” seasons of the year, such as in summer. However, “Punat” and “Martinis Marchi” marinas seem to be the biggest marinas, as they are generally hosting 8053 and 5775 boats or yachts each year, respectively (Figure 11).

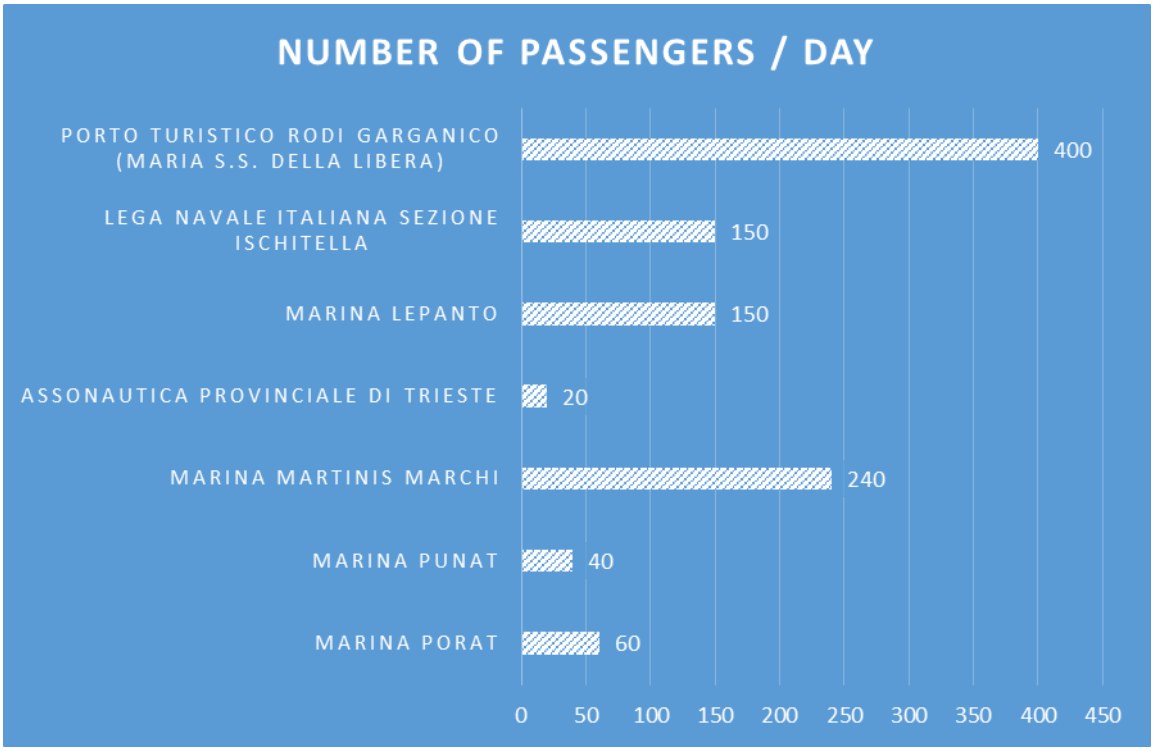

Figure 9 - Results from the questionnaire administered to the marinas: number of passengers per day.

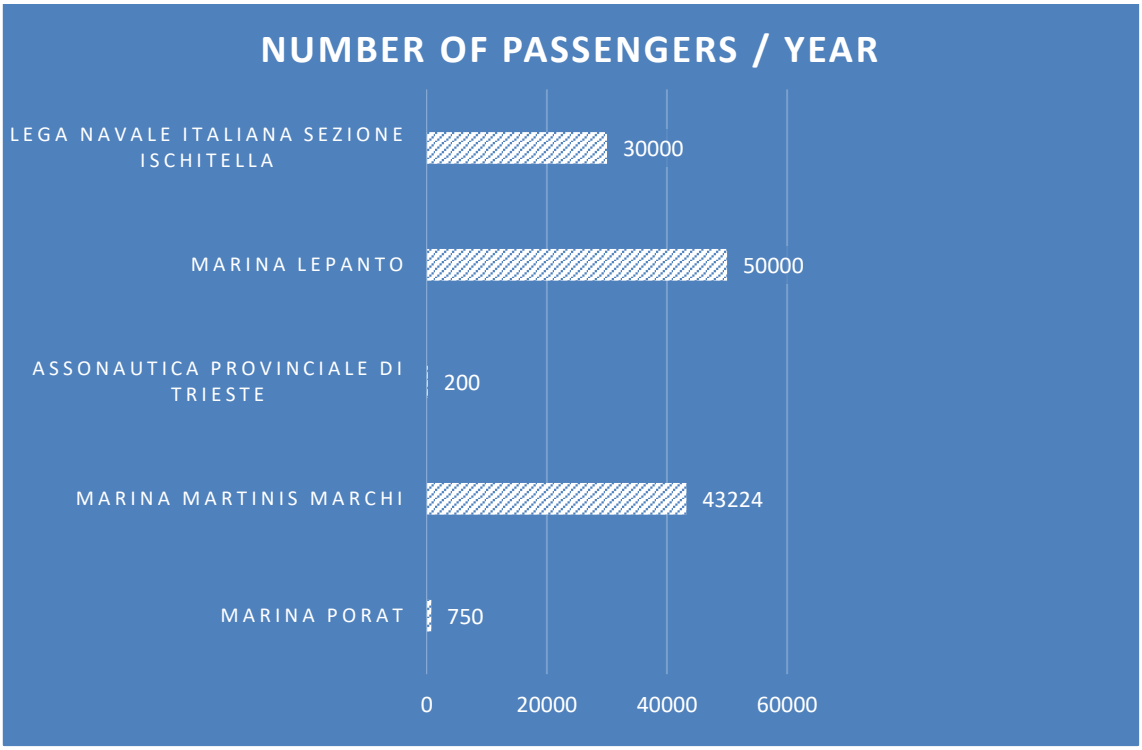

Figure 10 - Results from the questionnaire administered to the marinas: number of passengers per year.

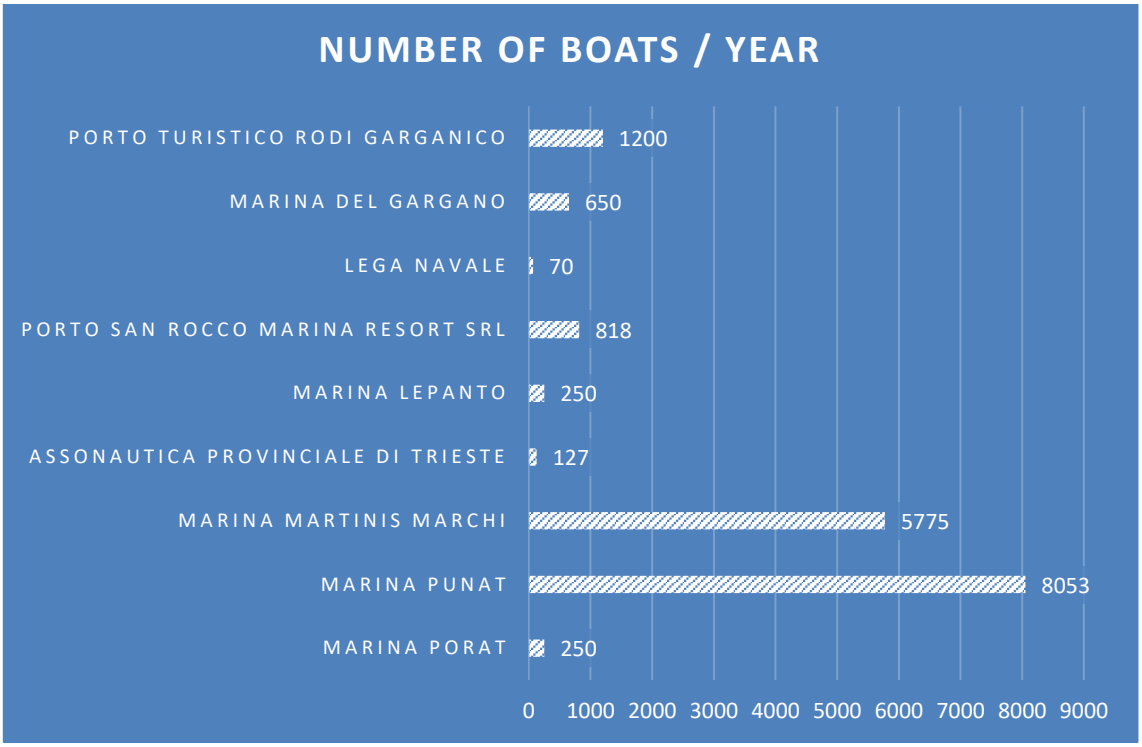

Figure 11 - Results from the questionnaire administered to the marinas: number of boats per year.

Concerning the energy consumption and the connection to the electric grid, the total contract nominal power provided by interviewed marinas corresponds to 20,686.4 kW, whereas the total nominal voltage is 21,460.4 kV. However, it is worth mentioning that only “Lepanto” marina itself covers almost 20,000 kW as contract nominal power, while the other sites have much lower values, well below 5,000 kW.

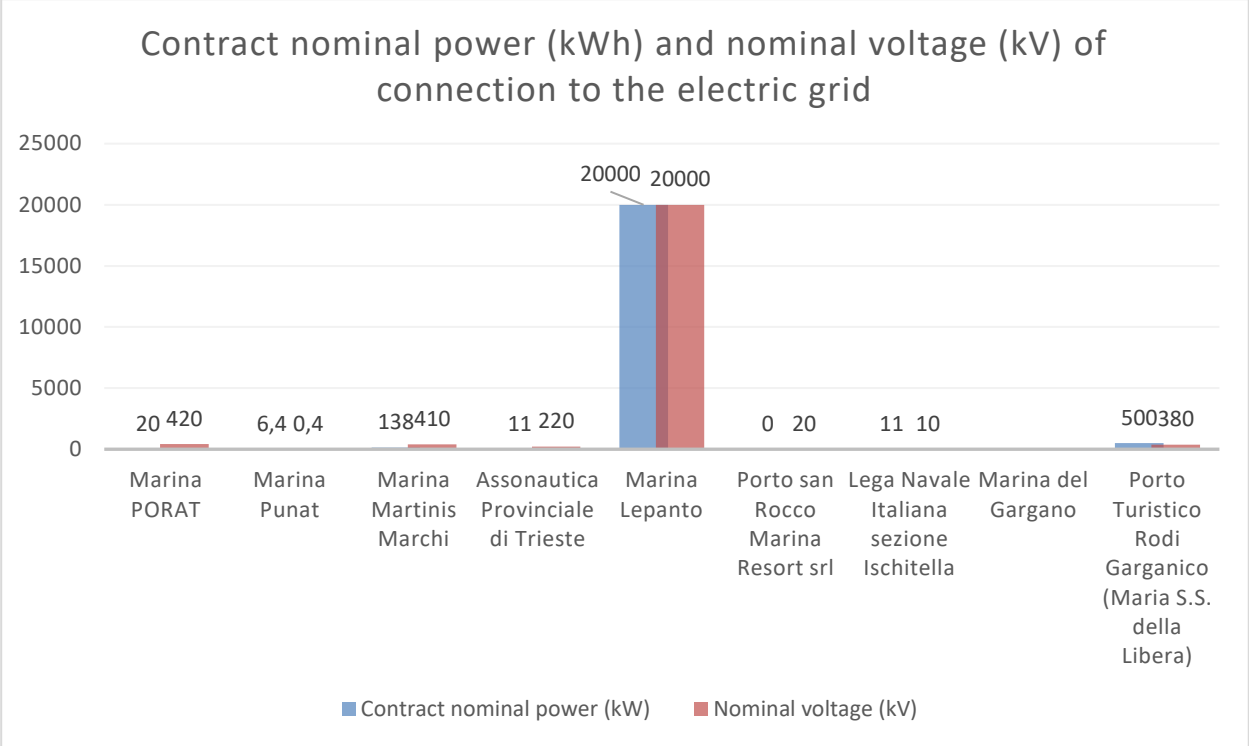

Figure 12 - Results from the questionnaire administered to the marinas: nominal power and voltage of connection to the electric grid.

Three marinas rely on a three-phase system only, and two on a single-phase, while four marinas are connected to the electric grid through both a single and three-phase power supply (Figure 13). In addition, six marinas are directly connected to the electric grid, while three are connected by a dedicated transformer.

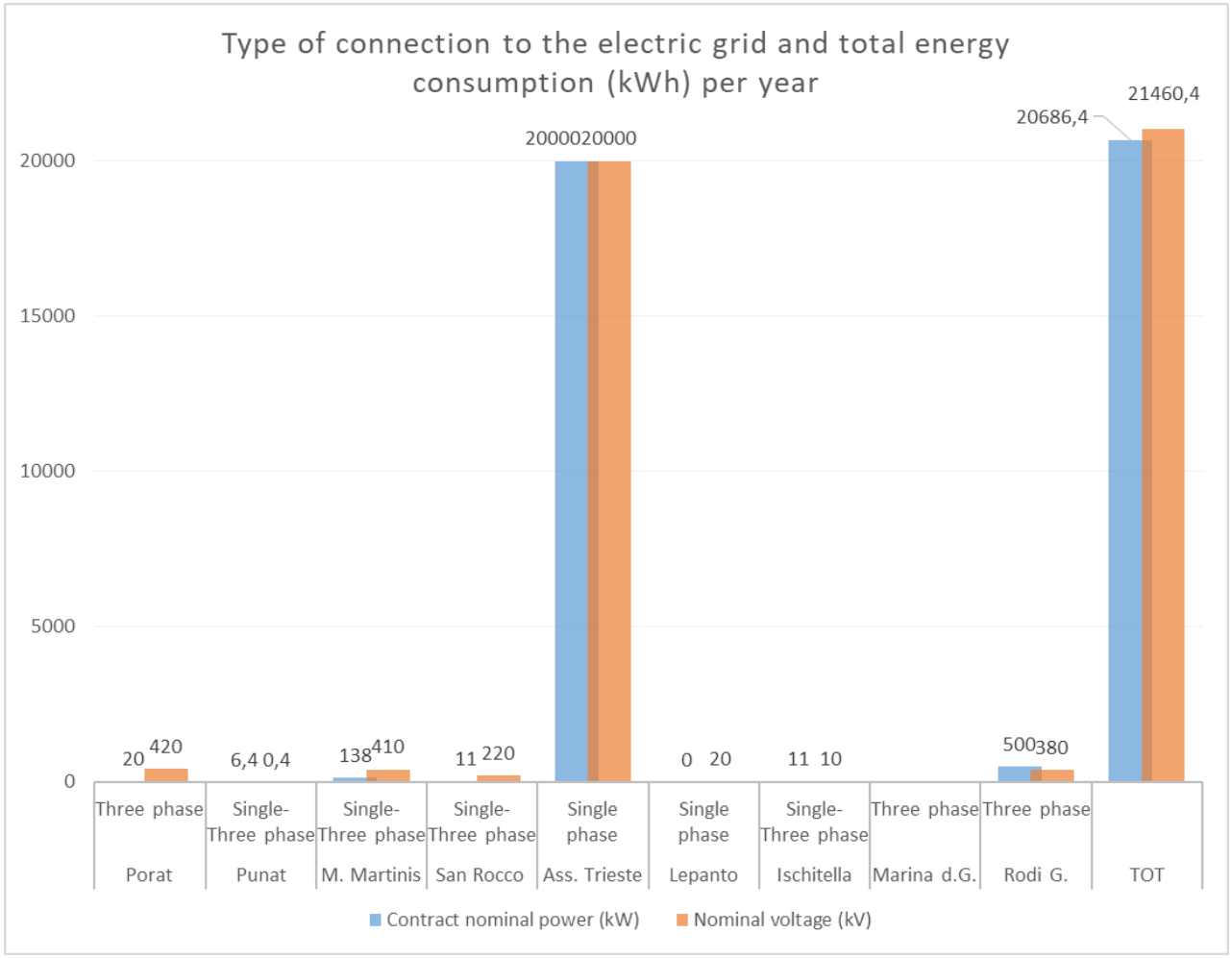

Figure 13 - Results from the questionnaire administered to the marinas: main features of the connection to the electric grid.

Concerning the possibility to host e-boats, almost all marinas declared to be equipped with specific plugs for electric charging, except for “Lega Navale Ischitella”. “Marina del Gargano” (Italy) is the one with the highest availability (700), followed by “Porto San Rocco” (546) and “Rodi Garganico” (310), all located in Italy. “Punat” marina declared to have 70% of the mooring spots equipped with electric supply. “Assonautica Trieste” (Italy) and Porat (Croatia) count only 18 and 9 plugs, respectively (Figure 13).

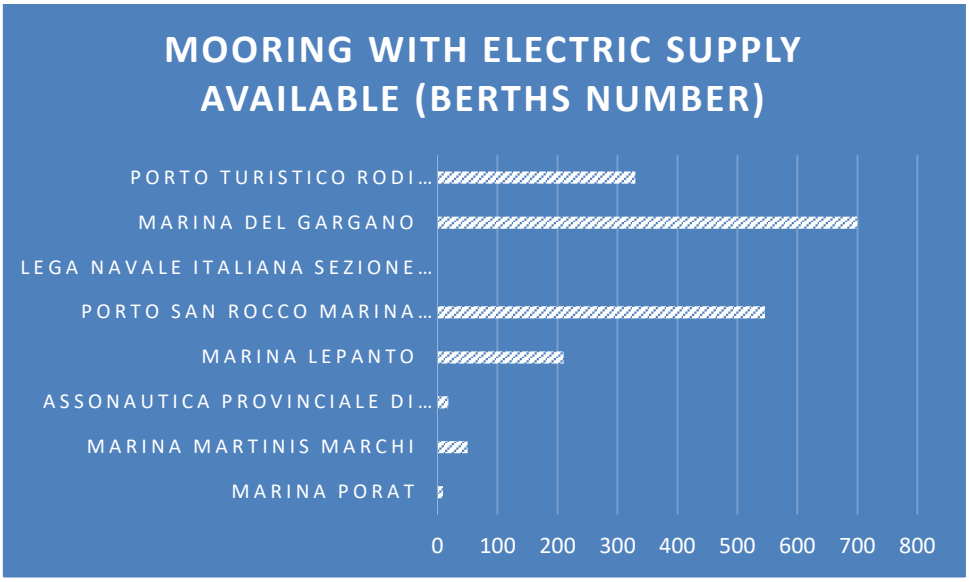

Figure 14 - Results from the questionnaire administered to the marinas: availability of moorings with electric supply for e-boats.

Historical data about the average total electric consumption of each marina per year were provided by 6 out of 9 sites, with "Lepanto" and "Marina del Gargano" consuming respectively a total of 720,000 kWh and 723,440kWh per year. An average of 341,253.3 kWh/year could be estimated for the six marinas (Figure 15). These electric consumption data were also used to calculate the corresponding average CO_2 emissions per each marina, as shown in Figure 16 and using the Greenhouse Gas Equivalencies Calculator of US EPA, with emission factors updated in March 2022.

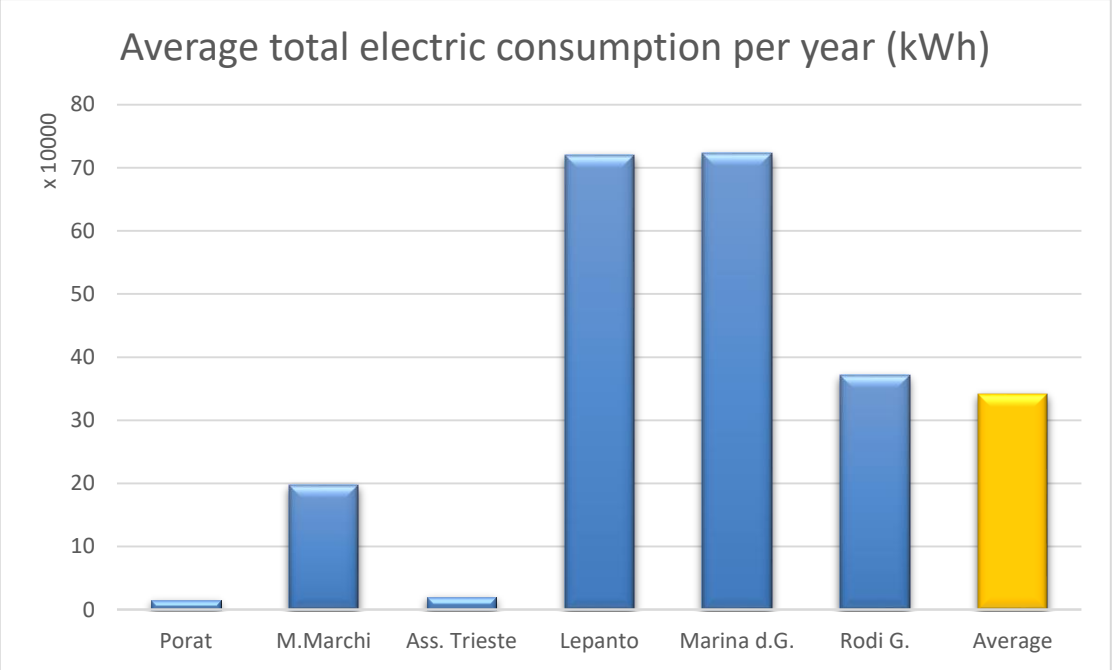

Figure 15 - Results from the questionnaire administered to the marinas: historical data about the average total energy consumption per year, in kWh.

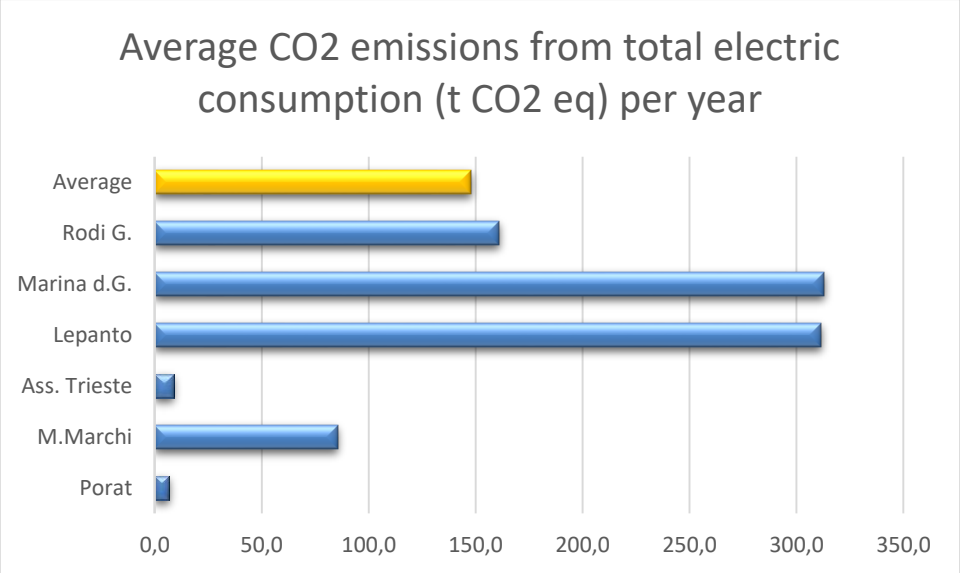

Figure 16 - Results from the questionnaire administered to the marinas: average CO_2 emissions from total electric consumption (t CO_{2eq}), per year.

Since only 5 out of 9 marinas filled in the questionnaire with the percentage of electric energy absorbed by moored boats and yachts, it was possible to estimate the electric energy consumed by moored boats/yachts and the corresponding CO_2 emissions only for these sites. “Lepanto” remains the marina with the highest energy consumption (kWh/year), followed by “Martinis Marchi” and “Rodi Garganico”. The total energy consumed by moored boats corresponds to almost 632,000 kWh per year, while the total CO_2 emitted to power those boats is equal to 301 tons of Carbon Dioxide (CO2) equivalent (Figure 18), when non-renewable sources of energy are considered.

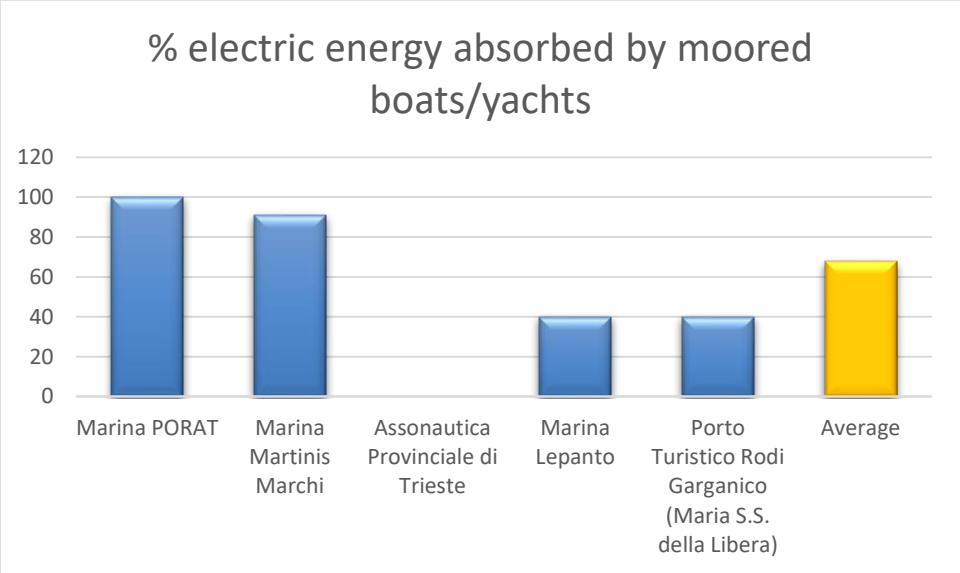

Figure 17 - Results from the questionnaire administered to the marinas: percentage of electric energy absorbed by moored boats in each marina.

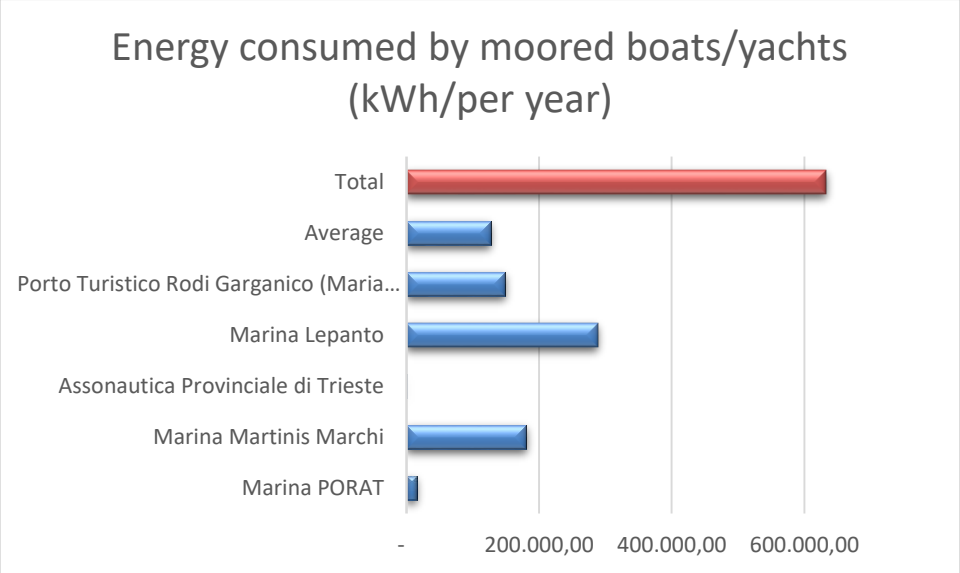

Figure 18 - Results from the questionnaire administered to the marinas: electric energy consumed by moored boats, expressed as kWh per year.

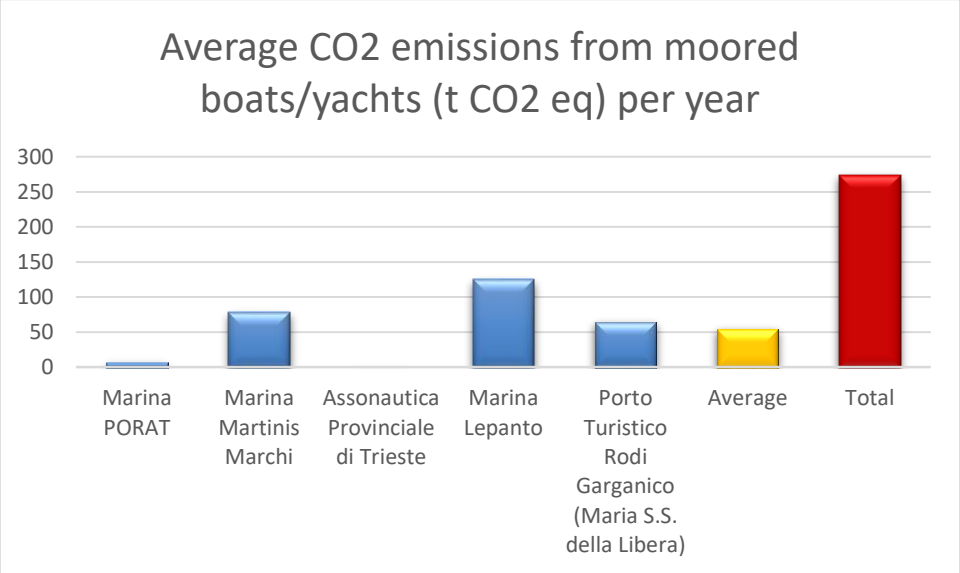

Figure 19 – Results from the questionnaire administered to the marinas users: average CO2 emissions of moored boats/yachts per year (t CO_2 eq per year).

3.2. Emissions generated by passenger volumes

As specified in the methodology, in order to calculate the CO_2 emissions from inland and offshore transport, data about fuel consumption over the different means of transport in each marina is needed. It was possible to retrieve data from the questionnaire administered to marina users of "Porat", "Punat", "Martinis Marchi", "Marina del Gargano" and "Marina di Vieste" marinas. The information collected from these sites were then aggregated and used here to estimate CO_2 emissions generated by:

- Access to marinas
- Onsite road transport (within and around marinas)
- Boat traffic

As shown in Figure 20 below, 69% of questionnaire respondents declared to have used a diesel vehicle to reach the marina, while 10% selected the "electric vehicle/hybrid" option.

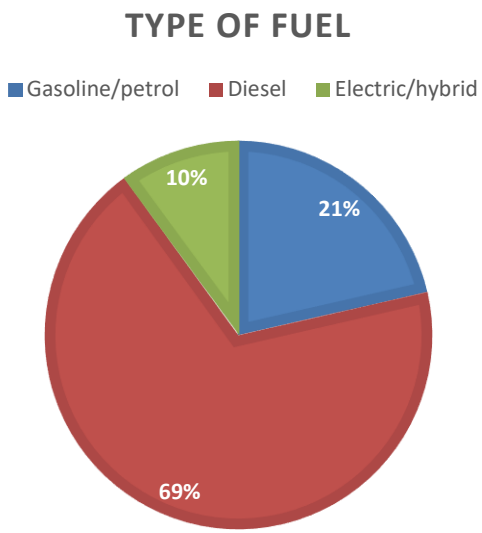

Figure 20 - Results from the questionnaire administered to marinas' users: type of fuel used to reach the marina.

Based on the type of fuel used (gasoline/petrol and diesel), it is possible to calculate the average fuel consumption to reach each marinas:

Table 5 – Average fuel consumption (gasoline/petrol and diesel) to reach the marinas.

Gasoline/petrol	
	Average fuel consumption [kg gasoline]
Martinis Marchi	4,679.6
Porat	1,225.0
Marina di Vieste	1,919.6
Marina del Gargano	0.0
Punat	3,087.2
Total	10,911.4
Diesel	
	Average fuel consumption [kg diesel]
Martinis Marchi	15,962.2
Porat	13,643.7
Marina di Vieste	464.1
Marina del Gargano	797.4
Punat	5,106.0
Total	35,973.3

The average CO_2 emissions per year for each marina are calculated by considering the Emission Factor (3.169 g CO2/kg fuel), the average number of vehicles/boats travelling to each marina in a year, and the average percentage of vehicles/boats consuming gasoline or diesel.

Table 6 – Average CO_2 emissions per year for each marina.

Gasoline/petrol		
	Average CO_2 emissions [t CO_2]	**Average CO_2 emissions per year [t CO_2 / year]**
Martinis Marchi	14.8	55,427.5
Porat	3.9	234.8
Marina di Vieste	6.1	n.a.
Marina del Gargano	0.0	0.0
Punat	9.8	0.0
Total	34.6	55,662.2
Diesel		
	Average CO_2 emissions [t	**Average CO_2 emissions per**

	CO_2]	year [t CO_2 / year]
Martinis Marchi	50.6	98,934.2
Porat	43.2	4,082.2
Marina di Vieste	1.5	0.0
Marina del Gargano	2.5	342.2
Punat	16.2	26,468.1
Total	114.0	129,826.7

A similar calculation can be done to estimate the total tonnes of CO_2 emitted per year by the vehicles used by the tourists moving within and in the premises of the marinas. The estimation takes into consideration the average percentage of passengers that are actually moving around the inland site, mainly using private/rented cars, as per what declared in the questionnaires administered to marinas users:

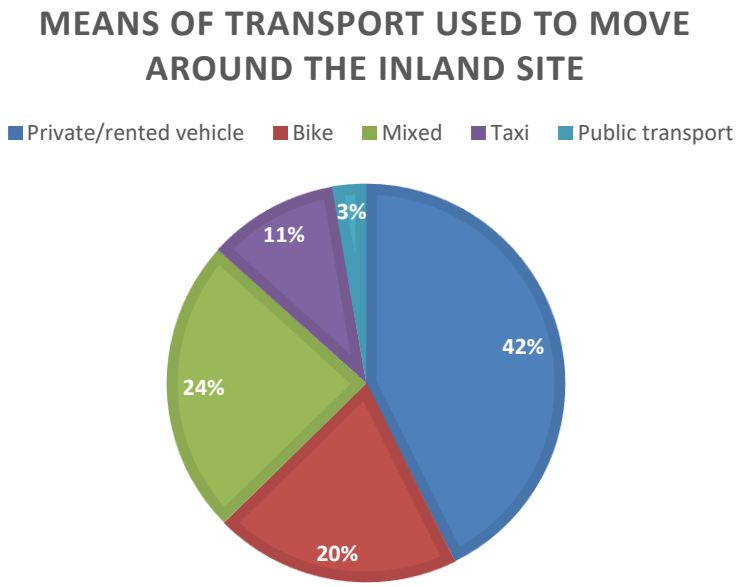

Figure 21 - Results from the questionnaire administered to marinas' users: means of transport used to move around the inland site.

Table 7 - Total tonnes of CO2 emitted per year by the vehicles used by the tourists moving within and in the premises of the marinas.

Gasoline/petrol		
	Average fuel consumption [kg gasoline]	**Average CO_2 emissions per year [t CO_2 / year]**
Martinis Marchi	150.9	467.5
Porat	867.0	32.4
Marina di Vieste	0.0	0.0
Marina del Gargano	0.0	0.0
Punat	0.0	0.0
Total	1,017.9	500.0
Diesel		
	Average fuel consumption [kg diesel]	**Average CO_2 emissions per year [t CO_2 / year]**
Martinis Marchi	35,016.0	130,218.5
Porat	3,253.3	730.0
Marina di Vieste	501.0	0.0
Marina del Gargano	1,789.7	460.8
Punat	4,710.4	11,269.7
Total	45,270.4	142,679.1

Concerning offshore fuel consumption and CO_2 emissions of the marinas' users, the following data were gathered, taking into account the average number of boats counted by each marina in a year:

Table 8 - Offshore fuel consumption and CO2 emissions of the marinas' users.

Gasoline/petrol		
	Average fuel consumption [kg gasoline]	**Average CO_2 emissions per year [t CO_2 / year]**
Martinis Marchi	131.6	2,168.2
Porat	406.2	229.9
Marina di Vieste	40,800.0	0.0
Marina del Gargano	630.4	432.8

Punat	1,060.8	5,801.1
Total	43,029.0	8,631.9
Diesel		
	Average fuel consumption [kg diesel]	**Average CO_2 emissions per year [t CO_2 / year]**
Martinis Marchi	167.0	305.6
Porat	10.0	1.1
Marina di Vieste	569.9	0.0
Marina del Gargano	952.7	1,308.3
Punat	693.6	13,908.6
Total	2,393.3	15,523.7

Based on these results, the total average CO_2 emissions released per year by the boats and other vehicles gravitating around the Adriatic marinas of „Porat“, „Martinis Marchi“, „Punat“ and „Marina del Gargano“ are 352,823.6 t CO_2/year.

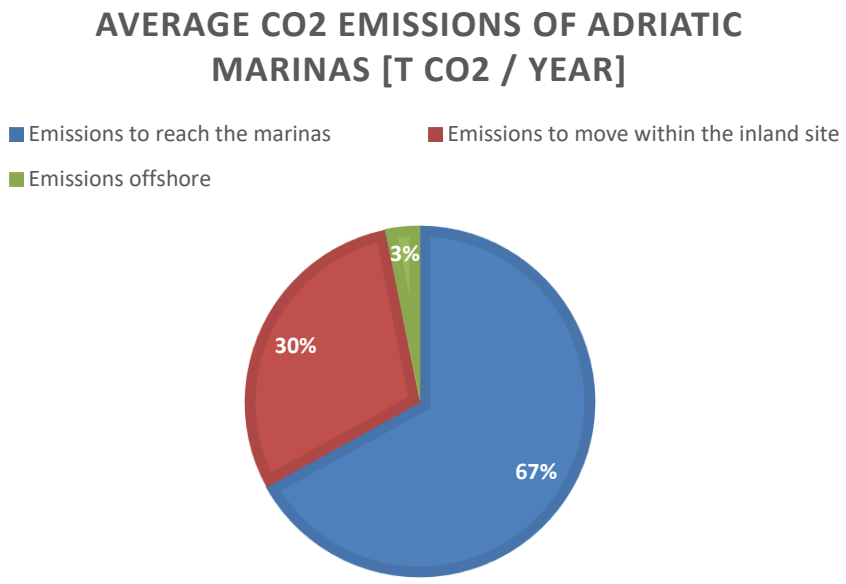

Figure 22 – Average CO_2 emissions (t CO_2 eq) per year of Adriatic marinas, based on the answers to the questionnaire administered to marinas users.

From the pie chart above (Figure 22), it is possible to see how the major source of emissions are the vehicles (mostly private/rented) used to reach the marinas (67% of the total emissions) and to move around the inland site (30%). However, since only a smaller sample of marinas users correctly filled in all the relevant entries related to the fuel consumption of own/chartered boats/yachts, it is suggested to enrich this analysis by retrieving more accurate and robust data for better estimating the offshore emissions and the related share in the total emission scenario.

4. Mitigation report, Monitoring and Adaptation Report

In order to mitigate the CO_2 emissions produced by the traffic flows generated by the Adriatic marinas, it is pivotal to start supporting in a concrete way the diffusion of e-mobility and in general energy sustainable solutions in the coastal areas. At the moment, electric mobility is taking shape mainly in the diffusion of electric vehicles, and the market is offering an increasing number of hybrid and full-electric car models and, as a consequence, also battery charging stations.
In this framework, examples of potential mitigation measures analyzed by the DEEP SEA project in task 3.1 „Catalogue of best available technological and organizational solutions for the energy efficiency and sustainable mobility in the coastal and nautical sector“ can be listed as follows:

- Charging stations for plug-in full electric (or hybrid) vehicles and boats/yachts at marinas' premises.
- Charging stations and rental services for e-bikes and e-scooters within or close to the nautical site.
- Adoption of bike sharing and car sharing services
- Design and installation of micro-grid solutions to support the installation and deployment of renewable energy technologies at marinas', such as photovoltaic systems.

5. Ex-ante evaluation with possible intervention investments

If we look at the questionnaire filled in by marinas' managers/owners, 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.

In addition, 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 in 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 show to the visitors the emissions avoided.

This action would require both infrastructural works (e.g. installation of charging systems) and the purchase of electric vehicles and bikes, based on the traffic flow and the number of passengers hosted by each marina.
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. Furthermore, to enhance the energy transition (and energy independence) of the marinas, a key step would be the development and installation of "micro grid" solutions (the "building blocks" of "smart grids"), as those investigated by activity 3.1 in DEEPSEA and already activated in some pilot sites.

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ANNEX I - 3.3.1 Questionnaire submitted to marina pilot sites

QUESTIONNAIRE ON CURRENT SITUATION OF MOBILITY SERVICES INSIDE THE MARINAS AND ENERGY CONSUMPTION

Produced by DEEP-SEA partners:
University of Split - FACULTY OF CIVIL ENGINEERING, ARCHITECTURE AND GEODESY
University of Trieste DEPARTMENT OF ENGINEERING AND ARCHITECTURE

PURPOSE OF THE QUESTIONNAIRE AND INSTRUCTIONS

The purpose of this questionnaire is to collect relevant information about the electric energy services, consumption and production inside the marina (data records are particularly welcome).
Information collected via this questionnaire, as well as the previous questionnaire on management issues, will be the basis for multicriteria analysis and creation of investment plans and scenarios for each pilot site.
The marina is asked to provide all the information requested where available. The supply of any further information useful for the formulation of investment plans is strongly encouraged.

Thank you for your time!

Privacy *– the data provided in this questionnaire will be treated by DEEP-SEA project partners in a strictly confidential way according to the EU General Data Protection Regulation (GDPR), and will not be made public. Collected responses will be processed with the purpose to produce Investment plans for energy efficient mobility at each project pilot site (Act 3.4) and the related preparatory deliverable 3.3 AS IS Analysis of current mobility services and energy consumption.*

MARINA IDENTIFICATION	
Marina/port name	
City, Country	
Contact person	
Email	_____@_____.____
phone	+__ _____

Connection to the grid

1) Type of connection to the electric grid	☐ single phase	☐ three phase
2) Contract nominal power:	_____kW	
3) Nominal voltage	_____kV	
4) Connection of marina:	☐ directly connected to the grid ☐ connected by a dedicated transformer Type of transformer _____ Transformer main data (rated power [kW], primary voltage [V], secondary voltage [V]) _____ _____	

Electricity supply and consumption

5) How many mooring with electric supply are available?	_____											
6) Which is the rated power (Potenza nominale / nominal power) of each one?	_____kW											
7) What kind of plugs do you have (if available, please enclose data sheets)?	_____											
8) Historical data about the average total electric energy consumption per year (if available)	☐ not available ☐ yes: …… kWh (referring to year :……) percentage of electric energy absorbed by moored boats/yachts ☐ %											
9) If you have historical data, please specify the electric energy consumption for the different months in kWh/month: Please specify the year data refer to year: ……	JAN	FEB	MARCH	APR	MAY	JUNE	JUL	AUG	SEPT	OCT	NOV	DEC
10) Do you have a power monitoring system	☐ not available ☐ yes											

11) If available please provide the following **consumption data per usage and cost**: Berths …….kWh/year…….€/year Offices …….kWh/year…….€/year Other electric intensive services (please specify): Service: ……. ……kWh/year…….€/year Service: ……. ……kWh/year…….€/year Service: ……. ……kWh/year…….€/year

Renewable energy generation

12) Are there available photovoltaic systems and wind generators?	☐ not available ☐ yes											
13) If you answer yes to question 12) what is their nominal power [kW] and surface [m^2]: _____												
14) If you answer yes to question 12), do you have any historical data about the energy produced in a year?_____												
15) If known, what is the energy produced for the different months	JAN	FEb	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
16) Do you have any monitoring system logging the daily production?												
17) Is there any available space for (additional) the installation of photovoltaic or wind power generators: ☐ yes m2……. ☐ no (if yes please enclose pictures of the potential space for installation)												

Services offered

18) Are specific plugs available for charging e-boats? ☐ no ☐ yes if yes, how many _____ which is their nominal power _____

19) Are charging stations available for e-cars and e-motorbikes? ☐ no ☐ yes if yes, how many _____ what is their nominal power kW _____ historical data about the total absorbed energy (if available) _____ number of cars per year / month _____- the daily time profile of power absorption _____
20) Does the marina offer an e-bike rental service? ☐ no ☐ yes If yes, how many e-bikes are available? _____
21) Please list the other services offered by the marina and the equipment used in service provision:

E. Passenger flows and mobility pattern

22) How many passengers use the Marina daily? n passengers/day _____ n passengers/year _____
23) How many boats use the marina every year? n boats/year _____
24) From which Countries do passengers come from (on average)? 1. _____ % from _____ 2. _____ % from _____ 3. _____ % from _____ 4. _____ % from _____ 5. _____ % from _____
25) How far do they come from on average? Please provide a percentage below:

< 300 km	> 300 km
%	%

26) Which (public or private) means of transportation do they use to reach the marina? *(multiple choice possible)*

	%
Private car	
Public Bus	
Taxi	
Train	
Flight	
Boat	

27) Have you ever performed any Mobility Management survey and/or questionnaires or interviews for data collection about the mobility of your clients?
If yes, can you send us a copy?

8) Which one of these definitions describes better your marina (multiple choice allowed)?

1. ☐ **Departing Hub:** marina that users use to start their journey (renting or with their own boat), without stopping there
2. ☐ **Transit marinas:** mainly used for fuel supply or documents (customs passports, taxes, etc.) without staying or visiting
3. ☐ **Touristic marinas**: access points to tourist sites (historical or landscape) where the cruiser arrives for visiting
4. ☐ **Residence marinas**: Marinas with residences or flats where the tourist stops
5. ☐ **Camping marinas**: sleeping dock (houseboat, camping boats, boat & breakfast)
6. ☐ **Small cabotage marinas**: small/medium dockings area for small boats (day trip, especially outboards or sailing boats, fishing boats ,etc.)

29) If you selected marina 3, 4, 5: how long on average passengers remain at the Marina?

30) If you selected marina 3, 4, 5: which (public or private) means of transportation do they use to visit the site around the marina?

☐ Private/rented vehicle
☐ Public transport (bus)
☐ Taxi
☐ Train
☐ Bike
☐ Shared mobility

ANNEX II - 3.3.1 Questionnaire submitted to marinas' users

QUESTIONNAIRE FOR MARINA USERS

DEEP-SEA
Development of Energy Efficiency Planning and Services for the Mobility of Adriatic MARINAs

Dear guest, many thanks for your time and effort in filling in this questionnaire!

Your input will be really valuable within the scope of the Interreg Funded project DEEP-SEA which is supporting our marina to become more sustainable by offering electric mobility services to our guests in the future!

Privacy *– We hereby inform you that data provided in this questionnaire will be treated by DEEP-SEA project partners strictly confidentially according to the last EU General Data Protection Regulation (GDPR) and will not be made public individually. Collected responses will be processed in aggregated and anonymous form for the sole purpose of the project. By filling in this questionnaire you explicitly accept the diffusion of our survey results in an aggregated and anonymous way.*

If you like to receive our project newsletter, please leave your email: _____

1.1 JOURNEY TO REACH THE MARINA

	Private vehicle	Public transport - Bus	Taxi	Boat	Train	Flight
How did you reach the marina? (multiple choice possible)						

Where did you start your journey? (City & country)	
ONLY IF YOU USED ROAD TRANSPORT:	_____

select the type of vehicle and fuel that you used to reach the marina		Car	van (under 7-8 passengers)	Bus	Two wheelers (motorbike, scooter, etc)
	Gasoline/petrol				
	Diesel				
	Electric				

How many passengers in total/vehicle?	
Average fuel consumption [l/km]	
Total distance from the origin to the marina [km]	

1.2 ONSHORE (INLAND) SITE VISITING

Are you moving around the inland site during your stay at the marina?	**Yes**	**No**

If so, please indicate which transport you are using *(multiple options possible)*	**Private/rented vehicle**	**Public transport - BUS**	**Taxi**	**Train**	**Bike**	**Shared mobility**

ONLY IF YOU USE ROAD TRANSPORT:

select the type of vehicle and fuel		Car	van (under 7-8 passengers)	Bus	Two wheelers (motorbike, scooter, etc)
	Gasoline/petrol				
	Diesel				
	Electric				

Average fuel consumption [l/km]_____

Distance covered in total [km]_____

2. NAVIGATION

BOAT DATA

select the type of boat

Sailing	motor	motor sailing	house boat	

Own	Chartered

select the type of engine

FUEL TYPE	ENGINE TYPE		TICK THE BOX
Gasoline	outboard	2Stroke	
		4Stroke	
	in board	4Stroke	
Diesel	in board		
Electric			
other			

CONSUMPTION PROFILE

total fuel consumption/trip [l]			Average number of trips/year		

3. PERCEPTION ON EXISTING SERVICES AND INTEREST IN ADDITIONAL SERVICES

Are you satisfied with the services offered in this marina?	Completely satisfied	Fairly satisfied	Not satisfied
Service 1			
Service 2			
Service 3			

If you are not satisfied, please explain why	
Service 1	
Service 2	
Service 3	
Which services would you like us to add?	

Would you be interested in the following services (please check): *(tick the service you would like us to provide in the future)*	e-charging stations for e-cars	e-charging stations for e-boats	bike sharing service (e-bikes)	bike sharing (muscular bikes)	e-scooter sharing