Act 4.4 Ponikve Eco Krk Pilot

D 4.4.1 Comprehensive report with results achieved during pilot implementation local experience

WP4: Pilots: small technological investments, equipment installations and new services start-up

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Executive summary

This document represents D .1.1 Roadmap and evaluation report, setting the overall framework for DEEP-SEA pilot implementation, monitoring and evaluation. Coordinated by University of Split, this document presents a description of project pilots, provide the steps for pilot implementation and the KPIs useful for pilot monitoring and evaluation. It finally provides the structure of pilot reports, where results of pilot preparation, implementation, monitoring and closure should be reported periodically by partners responsible for each pilot, in order to compile a final list of lessons learnt and recommendations which will be used for service continuation and improvement in pilot areas and replication of experience outside DEEP-SEA sites.

1. Introduction

WP4 will develop and implement new sustainable mobility solutions in selected pilot sites to enhance the available services for passengers and tourists in Adriatic marinas. A new integrated approach for the inland, costal and maritime mobility services will be promoted during the project life and will continue after, thanks to its transferability actions. In order to achieve the highest impact on the marinas since the very beginning, partners will fine-tune their pilot actions according to the analysis performed in WP3, i.e. of best available solutions (Act.3.1), best practice in management and investment models (Act.3.2) and AS IS analysis of passengers' flows, needs and expectations, current mobility patterns, energy consumption and emissions (Act.3.3).

Marinas operators of DEEP-SEA pilot sites and relevant PAs are expected to keep the sustainable mobility services and energy efficiency solutions installed during the pilots fully operational in the coming years, as a starting point for further installations and increase of the range of e-sharing services, thanks to the investment plans defined for each pilot site in DEEP-SEA Act. 3.4.

The installation of the ECS for e-vehicles and e-boats will boost e-mobility in the marinas and in nautical sector in general: DEEP-SEA pilot sites will trigger further new installations along the Adriatic Sea considering the increasing demand of charging services for e-cars. The availability of e-charging stations for e-boats will support the increase of e-mobility, affecting also shipyards, operators involved in boat and yacht retrofitting and production of new boat models with electric engines.

The micro-grid installation will allow the production of energy from renewable sources and demonstrate the economic sustainability with reduction of costs in electric grid distribution and energy self-sustainability, particularly in sensitive island areas.

This document is intended to define a roadmap for the set-up of pilots, selection of results to implement in WP3 Investment Plans and to include in WP5 Guidelines, with particular attention

to terms of coherence with the overall programme and project objectives. It provides the monitoring framework for pilot evaluation through the KPIs here defined.

Pilots monitoring and measurement methodology will ensure coherence with project and Interreg Italia-Croatia Programme objectives as well, according to the agreed time plan and economic - financial sustainability. Designed as internal tool, this roadmap will ensure the correct monitoring and measurement of the new installations and e-services as well as action viability and transferability to other Adriatic Sea sites and beyond. Once the project is over, the monitoring system developed during the project life-time will be used as a tool for future monitoring of mobility services by MOs, defining KPIs for the evaluation of pilot impacts in terms of accessibility, quality of mobility services, eco-social sustainability, environmental impacts and energy efficiency. Stakeholders (MOs, PAs, end-users and others) will be called to validate the set of selected criteria and the pilot results.

Evaluation results will be collected by each pilot site every 6 months through specific pilot evaluation reports (D 4.1.2).

2. DEEP-SEA pilot description

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

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

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 4 e-scooter for sharing services and startup of 1 e-scooter sharing;
- Installation of 3 stations for e-cars
- Installation of 1 e-chargin station for e-boat
- Installation of 1 microgrid system.

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

- Installation of 2 e-charging station: 1 combined for e-cars and 1 mooring for e-boats (in Porat Marina), a and 1 e-charging station for e-cars in Malinska;
- Installation of 1 rack with electric and muscular bicycles for bike sharing services;
- Purchase of 4 muscular and 4 e-bikes;
- Charging system for e-bikes and software for rental;
- 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.

At the end of pilot implementation, each partner responsible will produce a final report with results achieved during pilot implementation such as local experience, findings and proposal for seamless integration (Act. 4.2.1, 4.3.1, 4.4.1, 4,5.1, 4.6.1).

2. Pilot phases

The implementation of pilots is divided into 3 individual phases:

- In the **preparatory phase** partners will have to deal with the concept design and its technical issues requirements, choose the location and arrange relations with the landowners in order to obtain permissions, if necessary, considering the related social aspects and the stakeholders involved. The partners, will then have to deal with the financial aspects, seeking negotiations with potential contractors and eventually preparing the technical specification and documentation required for the tender. Furthermore, partners will define the KPIs, the Key Performance Indicators needed to monitor and evaluate the implementation. Each partner should select the relevant KPIs and the method of measuring them, on the basis of

the type of pilot, local context, SHs involved, technical features and so on. In this phase partners should also define how the achievement of KPI targets will be measured and set the current situation for each KPI.

- In the **implementation and monitoring phase** partners will start to implement the pilot, including installation of equipment and small infrastructure, their testing, validation, service start up and operations. The progress will be closely monitored by each coordinating partner and KPIs measured periodically; progress should be reported back to the WP leader and reported into the 6-month evaluation report, one for each pilot. The pilot development will also involve local stakeholders, such as PAs responsible for local public transport, marinas operators, local and regional associations, tourism and promotion institutions. A direct action will be focused on the involvement of end-users testing the services quality and their usability. Pilots responsible will also provide feedbacks to both investment plans (Act. 3.4) and guidelines (Act. 5.1).

- In the **closure phase**, partners will compile the final documents with the results from the pilots, the lessons leant and recommendation for service continuation and replication. This information will be collected through the following documents:
  - A final 6-month evaluation report (D 4.1.2) in February 2021, delivered by University of Split;
  - The final Reports with pilot results, one for each pilot, by December 2022 (Act. 4.2.1, 4.3.1, 4.4.1, 4,5.1, 4.6.1);
  - The final results of KPIs measurements in the present Roadmap by December 2022.

  The documents above will be used for the transfer of results outside the project, as described in the Transferability Plan (D 5.4.1). The implemented services and installed equipment will remain on usage of the passengers and tourists for their inland and coastal mobility and will indirectly support the increase of e-boats in nautical mobility following project's closure.

3. Pilot monitoring and evaluation: KPIs

Below a list of KPIs is provided related to energy efficient and sustainable mobility and micro grids. Partners responsible for each pilot will select the more relevant KPIs for their sites and monitor them throughout the project.

3.1. Micro grid KPI

KPI Description		Values		
N.	KPI	Unit	Baseline (current sit.)	Target (to be achieved)

1	Energy produced using the photovoltaic system. This can be achieved using a meter at the DC MPPT output.	kWh (per month)	0	J F M A M J J A S O N D 420 6710 7730 7130 6340 3760 2600
2	Energy used for charging the e-cars should be logged. This can be achieved using a meter inside the CS.	kWh (per month)	0	J F M A M J J A S O N D 150 80 260 340 220 130 60
3	Energy from the grid used to fuel the car. When the car is charging, the difference between the CS energy and the ugrid energy (storage + PV).	kWh (per month)	0	J F M A M J J A S O N D 50 70 160 240 120 30 50
4	Charging station occupancy: the amount of time when e-cars are charging at the station should be logged.	hr (per month)	0	J F M A M J J A S O N D 11,28 32,26 1,316 72,67 0 0
5	CO_2 emissions reduction due to the use of an e-car instead of a conventional car. This value should be calculated by multiplying the e-car travelled distance per month by the average CO2 emission of a conventional vehicle (123.4 g CO2/km Source: www.eea.europa.eu)	CO2 kg./month	0	**J F M A M J J A S O N D** **123,4 65,81 213,5 279,8 181,0 107,0 49,36**
6	Number of users using the CS	# People	113	
7	Stakeholders / users satisfaction / benefits from DEEPSEA pilot(s) through interviews / questionnaires	%	100	
8	Number of e-car monitored	# Car	3	***E-cars of Ponikve purchased prior to DEEP SEA project**
9	Number of e-cars involved in the project	# Car	0	
10	Number of E-CS monitored	# E-CS	11	
11	Number of implemented E-CS by DEEPSEA	# E-CS	3	
12	Number of stakeholders involved (municipalities, regional authorities, investors, companies…)	SH	6	
13	Photovoltaic self-consumption energy, i.e. the percentage of energy locally consumed compared to that produced.	%	0	
14	Number of e-car charging profiles collected (e-car charging power vs. time)	# profiles/ year	0	
15	Number of e-car discharging profiles collected (e-car discharging power vs. time)	# profiles/ year	0	
16	Number of main battery charging profiles collected (charging power vs. time)	# profiles/ year	0	
17	Number of main battery discharging profiles collected (discharging power vs. time)	# profiles/ year	0	

3.2. E-sharing services KPI

KPI Description		Values		
N.	KPI	Unit	Baseline (current sit.)	Target (to be achieved)
1	Number of e-vehicles monitored	# Car	3	
2	Number of e-vehicles involved in the project	# Car	0	
3	Number of users using the e-sharing services	# People	0	
4	Number of charging hours	#Hours/ year	0	
5	Number of charging calls	#calls	0	
6	Stakeholders / users satisfaction / benefits from DEEPSEA pilot(s) through interviews / questionnaires	%	0	

3.3. ECS for e-vehicles KPI

KPI Description		Values		
N.	KPI	Unit	Baseline (current sit.)	Target (to be achieved)
1	Number of e-car monitored	# Car	0	0
2	Number of e-cars involved in the project	# Car	0	0
3	Number of E-CS monitored	# E-CS	3	3
4	Number of implemented E-CS by DEEPSEA	# E-CS	3	3
5	Number of stakeholders involved (municipalities, regional authorities, investors, companies…)	SH	0	
6	Number of users using the CS	# People	113	
7	Number of charging hours	#Hours/ year	385,85	
8	Number of charging calls	#calls	184	

3.4. ECS for e-boats KPI

KPI Description		Values		
N.	KPI	Unit	Baseline (current sit.)	Target (to be achieved)
1	Stakeholders / users satisfaction / benefits from DEEPSEA pilot(s) through interviews / questionnaires	%	0	
2	Number of e-boats monitored	# boats	0	
3	Number of e-boats involved in the project	# boats	0	
4	Number of E-CS monitored	# E-CS	1	
5	Number of implemented E-CS by DEEPSEA	# E-CS	1	1
6	Number of stakeholders involved (municipalities, regional authorities, investors, companies…)	SH	5	
7	Number of users using the CS	# People	0	
8				

3.5. Rack for bicycles and e-bikes

KPI Description	Values

N.	KPI	Unit	Baseline (current sit.)	Target (to be achieved)
1	Number of e-bikes monitored	# bike	88	
2	Number of e-bikes involved in the project	# bike	8	4 e-bike and 4 e-scooter
3	Number of E-CS monitored	# E-CS	11	
4	Number of implemented E-CS by DEEPSEA	# E-CS	1	
5	Number of users using the CS	# People	667	
6	Number of bicycles monitored	# bike	4	4 muscular bikes
7	Number of bicycles involved in the project	# bike	4	
8	Number of implemented E-CS by DEEPSEA	# E-CS	1	
9	Number of users using the CS	# People	76	
10	Stakeholders / users satisfaction / benefits from DEEPSEA pilot(s) through interviews / questionnaires	%	6	

4. The pilot report structure

4.1. Pilot description and selection of KPIs

4.1.1. Short Description

Pilot activities that are being carried out by Ponikve on Island of Krk are:

- Installation of a photovoltaic plant in the parking lot of the administrative building with a battery, a charging station for electric vehicles and a system for renting electric bicycles and scooters in the city of Krk, with 4 muscular bikes, 4 e-bicycles and 4 electric scooters (romobil)
- Installation of a charging station for electric vehicles and ships in municipality of Omišalj (Luka Njivice)
- Installation of a charging station for electric vehicles in Vrbnik.

4.1.2. Context analysis

In Croatia there are efforts to make touristic and sea-industrial sector more sustainable. E-mobility is a part of Krk's long-term strategy to become the first 'smart island' in Croatia.
"Zero Emission Development Strategy", pushing for the integrated and sustainable development of the island that goes far beyond in the context of energy. It introduces a long-term socio-economic development plan for the island, with special focus on energy savings through increasing energy efficiency and the share of renewable energy sources (wind, sun and biogas). As 53% of Krk's CO2 emissions come from transportation, the island installed 12 chargers for 24 electric vehicles and 8 chargers (prior to deep sea) for 80 e-bikes, the latter

being part of a bike-sharing system. The island of Krk stands out with numerous bike paths separated from traffic. Compatible with the idea of DEEP-SEA project, all the bike sharing stations on the island are located in the vicinity of electric cars charging station, offering mobility while charging e-vehicle.

4.1.3. The goal

The pilot installations carried out by PP12 aims at improving the multimodality in coastal transport, providing infrastructure for alternative transportation with zero CO2 emissions and promote e-mobility and e-bicycles while charging e-cars.Pilot's goal is compatible with Island Krk energy strategy.

4.1.4. Chosen key performance indicators

We are using rental application to monitor usage of CS and mobility system. On the Island of Krk, there are 11 mobility stations with 88 bicycles (muscular, electric).
During last season, total of 667 rents have been made in total of 634 hours (38.042 minutes).
Ponikve's e-bike system had 72 repeating customers, users to whom cards for free rental of DEEP SEA CS were distributed.

4.2. Preparation phase

As 53% of Krk's CO2 emissions come from transportation, the island installed 12 chargers for 24 electric vehicles and 8 chargers for 80 e-bikes, the latter being part of a bike-sharing system. All municipalities support energy strategy, and also all municipalities invested in compatible bike sharing stations. DEEP SEA widened the sharing network.

Ponikve has experience with PV installation on the waste management facility, and has access to experts as well as membership in local energy cooperative. Electricity produced is agreed not to be sold but used to charge Ponikve's 3 older EV-s and supply implemented charging stations.
Parcels of installation are owned by local municipalities and the Ponikve company itself. All mobility stations are located close but outside of old city center (in front of historical old town).

Tendering procedure was prolonged due to COVID-19 crisis. Negotiations with maintenance and mobility app provider, and development of application, have been challenging also on the topic of providing free-of-charge service.

Island has great network of multilevel stakeholder cooperation. Institutions, LR, businesses and NGO share the same vision of the island's future in the domain of sustainability. Krk has an energy cooperative since 2012, and the municipalities recently established two companies to manage the energy transition; Island Krk Energy will coordinate the energy transition process, and Smart Island Krk will focus on smart processes and the digitalization of the island's activities. Cooperation with NGO Moj otok (My Island) has been successful in organising e-bicycle race on multiple occasions, promoting e-mobility and DEEP-SEA project. Marina Punat, largest marina on north Adriatic and a signatory of MoU, offered its users as participants of the DEEP-SEA Marina users questionary.

4.3. Implementation and monitoring phase

Implementation phase

As predicted by SWOT analysis, COVID crisis had a negative impact both on implementation phase and monitoring results.
The installation of pilots had run into obstacles due to the COVID-19 pandemic. The price of materials has changed, especially steel prices increased on the market. No applicants submitted to the first announcement of the public tender, so we had to repeat the tender. In the second call, we contracted the procurement and installation of the necessary equipment. Factor for success is also collaboration with prior existing operator of bike sharing systems on the Island. The company offers sharing app in a number of Croatian cities. Under somewhat different conditions for customers, Ponikve's SC were added on map and Go2Bike app of UTE.

Monitoring phase

Baseline indicators have been met and investments implemented successfully.
Monitoring insight is achieved using e-mobility application connected to implemented CS installations (Go2Bike). Maintenance was somewhat obstructed (contractor's staff members got COVID in summer 2022) which as a consequence had made part of the bike fleet unavailable to clients during couple of weeks, leading to lower monitoring numbers.

Monitoring observations of installations and equipment:

→ e-vehicle charging station: functioning, in use on all locations

→ e-bike and e-scooters: permanent interest and many users

→ e-boat charging station: not used effectively - no demand

CS in front Ponikve building is not at the city center as most of the e-bike stations, but it has a lot of interested users among users of car charger and also among employees of Ponikve (over 140 employees).

4.4. Pilot closure

As for the general crisis of the worldwide economy, it seemed like the sector of e-mobility will slow down too. Contrary to Ponikve's SWOT analisys, the interest for renewable energy and electric cars actually increased. The crisis started with COVID, but continued with distortion in energy market influenced by Russian-Ukrainian conflict, which forced people to think of long-term investing in energy independence.

Although Krk is an easily accessible starting point and a content destination for yachting and small boat cruises, with the best marinas and seven local ports with developed nautical services, monitoring results show Krk did not attract e-boats with its DEEP-SEA charging station; electric boat fleet is non existant. On island Krk and its aquatorium there is no demand for e-boat charging station; installation implemented through deep sea project has no effective users.
Our recommendation for improvement and replication of similar projects would be to create a pilot for Conversion of motor boat to e-boat; promoting e-nautical travel.

As mentioned, Krk has compatible network of CS and rental bicycles on multiple locations, but they are mostly available to users during summer season. DEEP SEA project offered the use of EV and CS all year round, and noted existing interes for the infrastructure. With the idea to reach zero CO2 emition, a goal set by Island Krk's energy strategy, it would be desireable to secure access to existing CS and e-bicycle services on the island to residents in winter as well.

5. Final pilot evaluation and lessons learned with list of KPIs to be filled in by task leader

Pilot evaluation

All installations and investments were finalized successfully. Public interes for renting and sharing vehicles and KPI has already been greater than predicted by investment plan. Sustainability of the project and ongoing interes for e-mobility are expected to be strong, in accordance with mentioned goals of the whole island to be energy independent and carbon neutral by 2030. Project made e-mobility available to individual citizens, offering opportunity to meet new technologies and inspire lifestyle changes. Pilot supports the vision of Island Krk as a destination dedicated to green tourism; support of local community and civil society promises long term sustainability.

Lessons learned

We had the opportunity to test and improve our organizational knowledge, and we also improved in practice the technical knowledge related to photovoltaic cells, battery systems and the use of apps and new technologies.

During project implementation and monitoring, awareness of stakeholders rose on a matter of unused opportunity to implement electric boats to local fleets. KPI for e-boat charging were negligible, and electrification of nautical sector should be further stimulated.

Another lesson is improvement idea for future CS: Bicycle CS at Ponikve does not have a roof nor other cover, so e-vehicles are disposed to the weather conditions the whole year round. This will impact maintenance of the vehicles negatively. As a better example to follow, partners of Foggia province installed bicycle CS in shielded area under roof.

6. GANTT

activity	R = responsible P = partecipation					start	end	2020										2021												2022											
	Venezia Giulia	Prov. Foggia	Krk Island	Mun. Malinska	Maslinica - Solta			3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
KPI definition	P	P	P	P	P																																			
Preparatory phase	R	R	R	R	R									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
Implementation phase	R	R	R	R	R																								x	x	x	x	x								
Monitoring phase	R	R	R	R	R																													x	x	x	x	x	x		
Final Evaluation Report	R	R	R	R	R																																		x	x	