

FEASIBILITY STUDY

FOR DUBROVNIK PORT AUTHORITY PILOT ACTION

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I. DOCUMENT CONTROL SHEET

Project acronym	ADRIGREEN
Project Title	Green and intermodal solutions for Adriatic airports and ports
Start of the project	01/01/2019
Duration	36 months

Work Package Title	Testing and evaluating innovative intermodal and low-carbon solutions
Related activity:	4.1 –Testing phase
Deliverable name:	Feasibility study for Dubrovnik Port Authority pilot action
Type of deliverable	Report
Language	English
Work Package Title	Testing and evaluating innovative intermodal and low-carbon solutions
Work Package number	4
Work Package Coordinator	Dubrovnik airport

Status	Final
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Version	1
Due date of deliverable	15 ^h February 2021

II. EXECUTIVE SUMMARY

According to application form of ADRIGREEN project, partners should implement its pilot action covering one of the four main pilot action goals identified:

- implementation of low-costs and smart solutions to better connect airports and ports with local public transportation system, such as railways and public bus lines;
- implementation of integrated timetabling and information for passengers that must continue their travel by other means of transportation;
- adoption of smart solutions to improve waste&water management and to reduce energy consumption in small-medium regional Airports;
- new protocols with public&private transportation providers to experiment new services to speed up the process of passengers from/to touristic destinations which are not well-connected.

Main deliverables of pilot action implementation should be Feasibility study of implemented action as well as testing report of implemented action, which will be basis for further project steps, especially in conducting Capitalisation manual on identified and tested solutions within ADRIGREEN projects.

Therefore, this document should evaluate pilot action implemented with clear conclusion regarding its feasibility and transferability to other regions or airports, contributing to project transnational approach conclusion which shall be summarized in Capitalisation manual.

The aim of this Feasibility Study (deliverable 4.1.) is to outline the reasons underpinning the pilot action choice, its benefits and the internal monitoring mechanism to ensure the efficient realisation of actions' output.

In addition, this document will underline the feasibility and transferability of the pilot action, contributing to project transnational approach.

Testing results of implemented pilot action in Dubrovnik Port Authority have demonstrated its advantages from process optimization point of view as well as from feasibility (cost-effectiveness) and environmental perspective.

In addition, Dubrovnik Port Authority has presented pilot action implementation plan covering all implementation process phases, from appointing project team, through identifying risks and risk mitigation procedures, conducting public procurement process and, in the end, implementation of equipment and monitoring of its performance.

Conclusion from this study represents recommendations to Dubrovnik Port Authority management board as well as to other interested parties on how benefits from green field process thinking and optimization may contribute to the organization.

Also, to have adequate knowledge on impact and in order to ensure durability of similar pilot actions implemented, it is essential that company implements environmental management system process in place, as an integrated tool for planning, implementation and monitoring of environmentally friendly activities.

III. BACKGROUND OF THE PROJECT

Green and intermodal solutions for Adriatic ports and airports - ADRIGREEN is a project approved under the INTERREG V-A Italy Croatia CBC Programme 2014- 2020. The programme is funded by the European Regional Development Fund under the European Territorial Cooperation objective during the programming period 2014- 2020.

The managing body of the Cooperation Program is the Veneto Region, Italy. The national body of the Republic of Croatia coordinating the implementation of the joint programme with other participating countries is the Ministry of Regional Development and European Union funds.

The project has started in January 2019 and it is expected to end by January 2022. The total budget approved for the project amounts to 2.104.217,00 EUR, 85% of which is co-financed through the ERDF fund (European Regional Development Fund). The project is implemented by 10 project partners (PULA AIRPORT Ltd., DUBROVNIK AIRPORT Ltd, AEROPORTI DI PUGLIA S.P.A., AIRIMINUM 2014 S.P.A., Rimini, ABRUZZO AIRPORT MANAGEMENT COMPANY Ltd., DUBROVNIK PORT AUTHORITY, CENTRAL ADRIATIC PORTS AUTHORITY, PULA PORT AUTHORITY SOUTHERN ADRIATIC SEA PORT AUTHORITY, UNIVERSITY POLITECHNIC OF MARCHE), the lead Partner is Pula Airport Ltd.

Project description:

The main objective of ADRIGREEN project is to improve the integration of Croatian and Italian ports and airports with other modes of transportation in order to enhance the processing of passengers during the summer seasons and to improve

environmental performances of the Adriatic maritime and aviation systems. To do that, the project will implement a set of structured activities based on transnational and cooperative approach.

One of the main problems that characterize the Adriatic coastal area is the imbalance in the development of infrastructures and modes of transport, caused by low level of investments and insufficient approach to innovation. In Italy and Croatia there are many maritime cities, which have to deal with a very high number of passengers, especially during the peak season. Even though the road transportation is still predominant, the number of people that are reaching Adriatic cities by ferries and airplanes is significantly increasing year by year. However, most of Adriatic ports and airports are suffering from lack of integration with various modes of transportation, causing serious traffic congestion problems during the summer season.

The main idea is to identify and analyse a few existing operational and technological solutions that can be easily transferred and adapted by involved ports and airports. The partners are not interested in inventing new solutions as there are a plenty successful models and schemes implemented in other parts of the world that can be replicable also in the Programme area. Once the solutions have been identified and analyses, the project partner will test the operational and technological models on their facilities so as to improve intermodal connections and to put in practices new schemes for a sustainable management of ports and airports. The objective of the testing phase will be to demonstrate the feasibility, the effectiveness, and the replicability of the identified solutions. Finally, intention of the project is to disseminate the results of tested solutions so as to explain also to other ports and airports how the operational procedures and technological innovation can be successfully transferred and used.

Also, it is very important to create more environmental-friendly and less polluting transport between ports (cities) and airports by reducing CO₂ emissions. This can be achieved by purchasing electric vehicles for transport routes between ports and airports, or for use in port/airport premises.

IV. PROJECT OBJECTIVES, PROJECT APPROACH, COOPERATION NEEDED

Project objectives

Low level of integration among different modes of transportation and insufficient investments in sustainable and low-carbon transportation technologies are characterizing several regions in the Adriatic area. The Croatian and Italian Adriatic coasts are rich of touristic destinations, which are reached by millions of tourists every year. Even though the road transportation is still predominant, the number of tourists that are reaching Adriatic towns and cities by ferries and airplanes is significantly increasing. Unfortunately, most of Adriatic ports and airports are suffering from lack of connections with other modes of transportation, causing serious traffic congestions problems, especially during the summer seasons. In addition, the majority of ports and airports facilities are lagging behind the EU average when it comes to sustainable environmental performances.

The main objective of ADRIGREEN project is to improve the integration of Croatian and Italian ports and airports with other modes of transportation in order to enhance the processing of passengers during the summer seasons and to improve environmental performances of the Adriatic maritime and aviation systems.

In order to do that, the project will implement a set of structured activities based on transnational and cooperative approach. The main idea is to identify and analyse a number of existing operational and technological solutions that can be easily transferred and adapted by involved ports and airports. The partners are not interested in inventing new solutions as there are a plenty successful models and schemes implemented in other parts of the world that can be replicable also in the Programme area. Once the solutions have been identified and analysed, the project partner will test the operational and technological models on their facilities so as to improve intermodal connections and to put in practices new schemes for a sustainable management of ports and airports. The objective of the testing phase will be to demonstrate the feasibility, the effectiveness and the replicability of the identified solutions. The last but not least intention of the project is to disseminate the results of tested solutions so as to explain also to other ports and airports how the operational procedures and technological innovation can be successfully transferred and used.

These objectives will be reached by producing several outputs:

- International investigation on best solutions to be transferred on Adriatic coasts;
- Environmental assessments of involved ports and airports;
- Joint Actions Plans: intermodal measures and green and sustainable actions to be implemented;
- Testing of innovative solutions in involved territories;
- Technical Manual on identified practices;
- Cross-Border Forum of Green and Intermodal Ports and Airports to present solutions, explain benefits and share recommendations for new strategies.

Project approach

Considering that all involved territories are facing similar problems (low integration between different modes of transportation and low environmental performances), the project will implement all activities with a participative and transnational approach.

The first step will be to perform a detailed and in-depth identification and analysis of existing solutions for lowering airports/ports environmental impacts and for intermodal connections of ports/airports with other modes of transportation and to identify a set of possible schemes to be easily adopted in territories involved in the project. It means that existing solutions, identified around the EU/world (mainly North Europe), will be the starting point of ADRIGREEN project. This activity will contribute to solve one of the main issues related to intermodal connections and low environmental performances: lack of knowledge regarding potential, smart and suitable solutions that could significantly improve the processing of passengers and decrease environmental impact of transport activities in Adriatic basin. The research will be followed by a deep environmental assessment and by realisation of specific Action Plans where all identified measures will be described.

The second step will be to test the adaptability and efficiency of identified solutions on ports and airports of ADRIGREEN project. Each partner already identified its major problems and a set of fields to be tackled by the testing phase: smart solutions to connect ports and airports to local public transportation systems; integrated timetabling and information for passengers; new services with public and private transportation services and reducing of energy consumption in airport/port facilities. E

Each testing phase will strictly pursue a transnational perspective since the final aim is to test solutions, which could be easily adapted in each area involved in the project. In fact, the project will organize also 4 transnational trainings targeted to staff working on ports and airports (not only those involved as partner) to improve their knowledge on technological solutions and procedures for both lowering the environmental impacts and planning new intermodal connections.

The final step of the project will be to disseminate as much as possible the tested solutions to all ports and airports located in Adriatic area. The dissemination will be based on demonstrations how the situation could be improved once the solutions are adapted.

Cooperation needed

Considering the specific objectives of the project (identification of innovative solutions to be adopted in all Adriatic area, testing of their replicability on ports/airports and spreading out of new tested technological solutions and procedures for improving intermodality and lowering environmental impacts), the cooperation among ports, airports, public authorities and research institutions is indispensable.

The project intends to support partners to test some innovative schemes to speed up the transit of passengers and to make their facilities environmentally friendly with the purpose to adapt and replicate them, not only within the partnership but also in other Adriatic regions not directly involved in the project. This is the main reason why the project goal cannot be efficiently reached at local/regional level. The local single action can be of course meaningful, but the challenge of the project is to contribute in the creation of convincing conditions for making entire Adriatic area better connected and its transport system more environmentally friendly. This challenge can be addressed only if existing practices, operational and technological solutions, and awareness raising campaigns melt together and produce a capitalization effect.

The testing phase (WP4) is a very important part of this project and its implementation will be done with highly transnational approach in order to give the possibility to each partner to benefit from results achieved by other partners. Following pilot actions are identified for the implementation:

- implementation of low-cost and smart solutions to better connect airports and ports with local public transportation system, such as railways and public bus lines;
- implementation of integrated timetabling and information for passengers that shall continue their travel by other means of transportation;
- adoption of smart solutions to improve waste & water management and to reduce energy consumption in small-medium regional ports (Dubrovnik- Port Authority

pilot action);

- new protocols with public and private transportation providers to experiment new services to speed up the process of passengers from/to touristic destinations which are not well-connected.

In WP4 the partners will have the possibility to identify some possible win-win solutions and to test concretely their efficiency. Each partner will consequently benefit from testing solutions carried out in other partners' areas. During the testing phase, the partners will have the opportunity to evaluate together the feasibility and effectiveness of identified solutions in order to know how to act in case of further investments to be done in this sector.

Through the transnational approach, the definition of both Joint Action Plans and of the Manual on identified solutions and practices will ensure the comparability of data and also the complementarity of the work.

V. NEEDS ANALYSIS DUBROVNIK PORT AUTHORITY

Dubrovnik Port Authority is located in the Dubrovnik-Neretva County. The Dubrovnik-Neretva County is the southernmost Croatian county. The main characteristic of this region is its transport isolation from the rest of Croatian territory and following that, from the rest of Europe, mostly as a result of physical separation from the rest of the state territory by the Bosnia and Herzegovina access corridor to the Adriatic. The region is also heavily lacking railway and highway infrastructures as the railway and highway links end at Ploče, a town located about 100 km North from the City of Dubrovnik.

The region's economy is mostly based on agriculture and tourism. Therefore, the traffic in Dubrovnik airport is mostly international traffic, including various destinations worldwide, especially during the summer season. This is why the area gravitating towards the Dubrovnik airport is much wider, including the Montenegrin territory and the territory of Bosnia and Herzegovina.

Dubrovnik is one of the most desirable tourist centers in Europe and every year it records an increase in the number of tourists. According to the data of the Tourist Board of the City of Dubrovnik, in 2019 Dubrovnik was visited by 1,443,971 tourists, most of them during the summer months. In 2020 tourism has been affected by the COVID-19 pandemic crisis. From the very number of tourist arrivals, one can see the importance of tourism for Dubrovnik and its surroundings.

Thanks to its favorable maritime position in the south of the Adriatic, Dubrovnik has a significant seaport whose primary function is receiving and supplying tourist boats.

Over the centuries Dubrovnik, with its long seafaring and merchant history, has been a relation between the two parts of the Mediterranean. It had a very significant position at the eastern Adriatic seafaring route. With the development of commerce and the arrival of railways to Dubrovnik, a need for a new sea port appeared, because the Old port couldn't fulfil the required standards of a cargo port neither by its position nor by its possibilities.

In the beginning the port was a cargo/passenger port and according to that there was one passenger quay, and the rest of the port was built as a sea port for cargo ships with lifts for loading and unloading of ship goods. Also there was a terminal for the loading and unloading of rail wagons with which they transported different goods throughout the whole region. The port was specialized for the reception and transportation of wooden materials, but with further development of the port they built a cold storage for the reception and storage of easy damageable alimentary products. Also there was built one terminal for the reception of passengers with restaurants and other facilities necessary for passenger transportation.



The Port of Dubrovnik is categorized as a passenger port open to public traffic, it is one of the six ports of international economic interest for the Republic of Croatia. The management of this port is directly the responsibility of the Ministry of the Sea, Transport and Infrastructure, the Maritime Transport Administration, the Maritime Property and the Port.

Due to the presence of certain types of traffic, the port of Dubrovnik stands out among the ports in the Croatian part of the Adriatic with its orientation to cruiser traffic.

In the last decade Dubrovnik has become a significant cruise ship destination in Adriatic Sea, namely the second one after Venice. The connectivity between Airport and Port is of major interest from environmental and industrial point of view. Also, it is important to highlight that there is only one route (a national road) between the Airport and the Port. This represents a significant infrastructural challenge to overcome, especially during tourist season. Dubrovnik Airport is in close relation with Dubrovnik Port, to monitor and organize transfers between the airport and port, and they are also collaborating on a number of projects. Such projects range from dedicated business projects such as Home Port for cruise ships, to more public ones such as projects supported by EU funding.

There are other emerging environmental challenges that were identified in recent years. Such new challenges are mostly due to the increase of traffic and the introduction of new port infrastructure. The additional maneuvering areas, buildings and facilities need to be integrated in existing systems and exploited in efficient way with lesser possible negative environmental effects.

In order to cope with new environmental challenges, Dubrovnik Port Authority has planned to increase the level of multimodality/ intermodality and environmental performance at the airport through number of dedicated projects.

Dubrovnik Port Authority pilot action includes purchasing of electric car and electric moped, covering the following pilot action field:

- adoption of smart solutions to reduce energy consumption
- implementation of integrated timetabling and information for passengers that must continue their travel by other means of transport

Gained experience and benchmark information will provide inputs for future sustainable development of the whole region.

VI. SAFETY AND INDUSTRY REGULATIONS

The new approach in managing the safety protection and security in the area in domain of the Port Authority of Dubrovnik is represented by the management of safety protection and dangers, and it has been developed with help of broad interests in the Port of Dubrovnik with goal to improve the safety of ships, passengers, cargo, environment, and all people using the port or working inside the port area. It is particularly focused on the people who have influence on human lives, property and environment inside the port area and its surroundings.

In order to ensure a satisfactory level of port security, the Dubrovnik Port Authority operates in accordance with the international ISPS Ordinance on the security of ships and ports. In accordance with international regulations, special attention is paid to the security protection of port operational areas open to international traffic in accordance with the SOLAS Convention and Part A of the ISPS Ordinance.

The security of the port is in line with Regulation (EC) No. 725/2004 regarding the application of special measures to improve the safety of seagoing ships and ports, and Directive 2005/65 / EC concerning the conditions and requirements of seagoing ships, shipping companies and port installations to which it applies. Special security measures and protocols have been introduced in accordance with the Assessment and Security Plan of the Dubrovnik Port Authority.

Compliance with international and national regulations for port security has been confirmed during the inspection of representatives of the EU Commission, EMSA, USCG and inspectors MMPI RH for security of the port of Dubrovnik-Gruž in the period from 18 to 22 June 2018.

In its daily work, the Dubrovnik Port Authority guarantees high standards of its business processes using the "Maritime Traffic Monitoring System" (VTMS), "Personnel and Vehicle Access Control and Control System, RFID (Radio Frequency Identification) Bus tracking system ", then the Croatian Integrated Maritime Information System, CIMIS (Croatian Integrated Maritime Information System)", under the constant supervision of the competent inspection body of the Port Authority of Dubrovnik.

Supervision over the handling of dangerous goods is performed in accordance with the IMDG Code, ie the "Ordinance on the handling of dangerous goods, conditions and manner of transport in maritime transport, loading and unloading of dangerous goods, bulk and other cargo in ports, and how to prevent the spread of spilled oils in ports" (NN 51/05, 127/10, 34/13 and 88/13), and internal acts of the Dubrovnik Port Authority "Ordinance determining special safety, protective and other measures when handling dangerous substances in the port area managed by the Dubrovnik Port Authority "and" Ordinance on order in the port of Dubrovnik-Gruž ".

VII. DESCRIPTION OF PILOT ACTION IMPLEMENTED

Dubrovnik Port Authority pilot action implemented is in compliance to pilot action field identified within the project: *“adoption of smart solutions to reduce energy consumption”*; and is divided into two main areas / types of vehicles purchased:

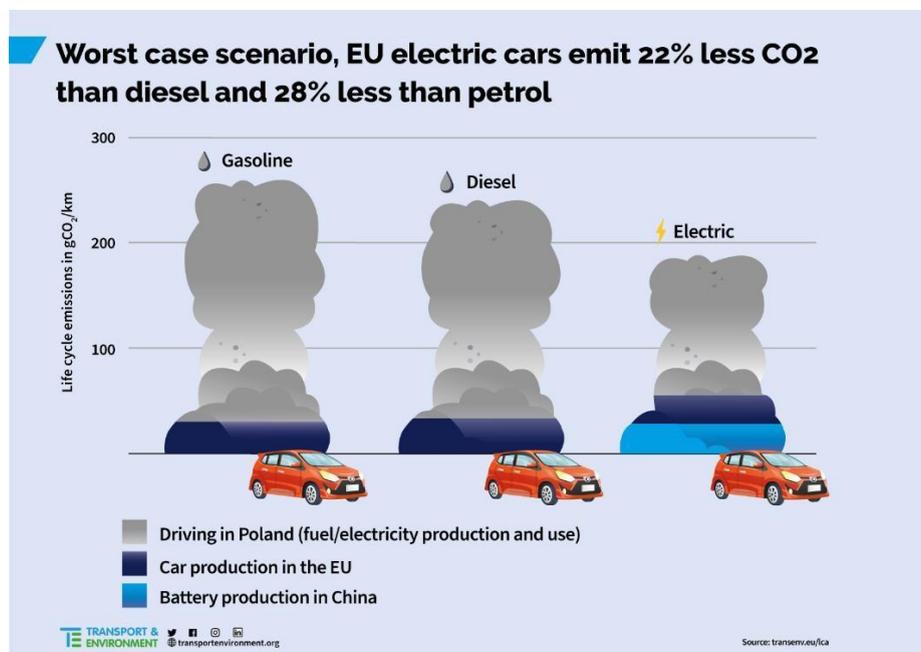
- electric car (smart EQ forfour)
- electric moped (SUNRA- Hawk)

According to the need’s analysis performed, Dubrovnik Port Authority has identified following fields for improvement in landside and airside area:

- energy efficiency improvements within ports processes,
- cost effective optimisation of business processes.

Purchase and implementation of the electric vehicle will significantly lower CO2 emission and it will reduce energy consumption in performing daily processes within Dubrovnik Port Authority. Also, since these vehicles is used on the landside area, it will be visible to the stakeholders and general public contributing to the ports green field policy and zero emission strategy.

Electric cars in Europe emit, on average, almost three times less CO2 than equivalent petrol or diesel cars. That’s according to a new online tool developed by T&E that allows the public to compare the lifecycle emissions of an EV to fossil-fueled vehicles. The tool draws on the most up-to-date data to allow users to compare the vehicles in several different scenarios based on vehicle segment, where the battery was produced, and in what country the car was driven. Even in the worst case scenario, an electric car with a battery produced in China and driven in Poland still emits 22% less CO2 than diesel and 28% less than petrol, the tool shows. In the best case scenario, an electric car with a battery produced in Sweden and driven in Sweden can emit 80% less CO2 than diesel and 81% less than petrol.



Additionally, daily operative activities performed by Dubrovnik Port Authority staff were supported mainly by several petrol vehicles.

Prior to ADRIGREEN project daily operative activities were performed by several vehicles on petrol fuel. Within ADRIGREEN project Dubrovnik Port Authority has purchased electric car and electric moped for day to day port staff activities, and with usage of these electric car and moped energy consumption and airborne pollutant emissions will be reduced.

One of the Adrigreen project priority is implementation of integrated timetabling and information for passengers that must continue their travel by other means of transportation. Each passenger should be able to:

- plan her/his trips by choosing the best travel option with regards to her/his needs;
- get real-time information about waiting times when accessing the service;
- get information about the trip and possible emergency events (delays, incidents, etc.) - including available transfer options - while travelling.

The Dubrovnik Port Authority intends to install variable message panels to give updated on-time information. The panel will be equipped with software able to guarantee an efficient and on-time information flow between different sources of information (ferry related information as well as local public transport).

VIII. FINANCIAL AND ENVIROMENTAL ANALYSIS

Financial analysis

Dubrovnik Port Authority has performed financial analysis of equipment purchased and used. In conducting financial analysis following assumptions were taken into the consideration:

- purchase price of new vehicle and old (replaced vehicle),
- additional yearly maintenance expenses,
- electric battery change each five years,
- discount interest rate of 3% (source: Croatia National Bank decision from September, 2017),
- economic life usage period of vehicles (8 years).

Other information:

- electric vehicle was purchased and put in use in August 2019.
- electric moped was purchased and put in use in June 2019.

1. WASTE MANAGEMENT VEHICLE ANALYSIS

FINANCIAL ANALYSIS OF EL.VEHICLE

VALUE IN CONSTANT PRICES						DISCOUNT VALUES (3%)						
	Year	Purchased price	Operating expenditures (service, fuel...)	Residual value	Net cash flow		Year	Purchased price	Discount values 3%	Operating expenditures (service, fuel...)	Residual value	Net cash flow
0	2019	181,625			181,625		2019	181,625				181,625
1	2020		3,800		185,425		2020		0.9709	3,689.42	0	185,314
2	2021		5,800		191,225		2021		0.9426	5,467.08	0	190,782
3	2022		3,800		195,025		2022		0.9151	3,477.38	0	194,259
4	2023		5,800		200,825		2023		0.8885	5,153.30	0	199,412
5	2024		32,300		233,125		2024		0.8375	27,051.25	0	226,463
6	2025		5,800		238,925		2025		0.8375	4,857.50	0	231,321
7	2026		3,800		242,725		2026		0.8131	3,089.78	0	234,411
8	2027		5,800	0	248,525		2027		0.7894	4,578.52	0	238,989

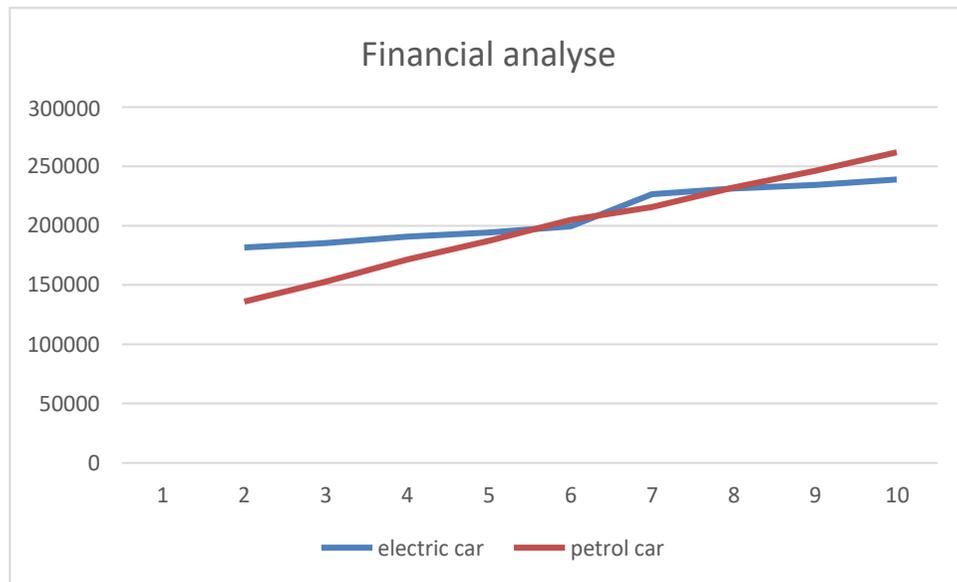
	SUM	181,625	66,900			SUM	181,625		57,364.23		
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FINANCIAL ANALYSIS OF PETROL VEHICLE

VALUE IN CONSTANT PRICES						DISCOUNT VALUES (3%)						
	Year	Purchased price	Operating expenditures (service, fuel....)	Residual value	Net cash flow		Year	Purchased price	Discount values 3%	Operating expenditures (service, fuel....)	Residual value	Net cash flow
0	2019	136,000			136,000		2019	136,000				136,000
1	2020		17,300		153,300		2020		0.9709	16,796.57	0	152,797
2	2021		19,800		173,100		2021		0.9426	18,663.48	0	171,460
3	2022		17,300		190,400		2022		0.9151	15,831.23	0	187,291
4	2023		19,800		210,200		2023		0.8885	17,592.30	0	204,884
5	2024		12,800		223,000		2024		0.8375	10,720.00	0	215,604
6	2025		19,800		242,800		2025		0.8375	16,582.50	0	232,186
7	2026		17,300		260,100		2026		0.8131	14,066.63	0	246,253

8	2027		19,800	0	279,900		2027		0.7894	15,630.12	0	261,883
	SUM	136,000	143,900				SUM	136,000		125,882.83		

According to financial analysis performed, electric vehicle costs for period of 8 years are 238.989 thousand HR compared to 261.883 thousand HRK for petrol vehicle, which makes it more feasible and cost effective for the company.

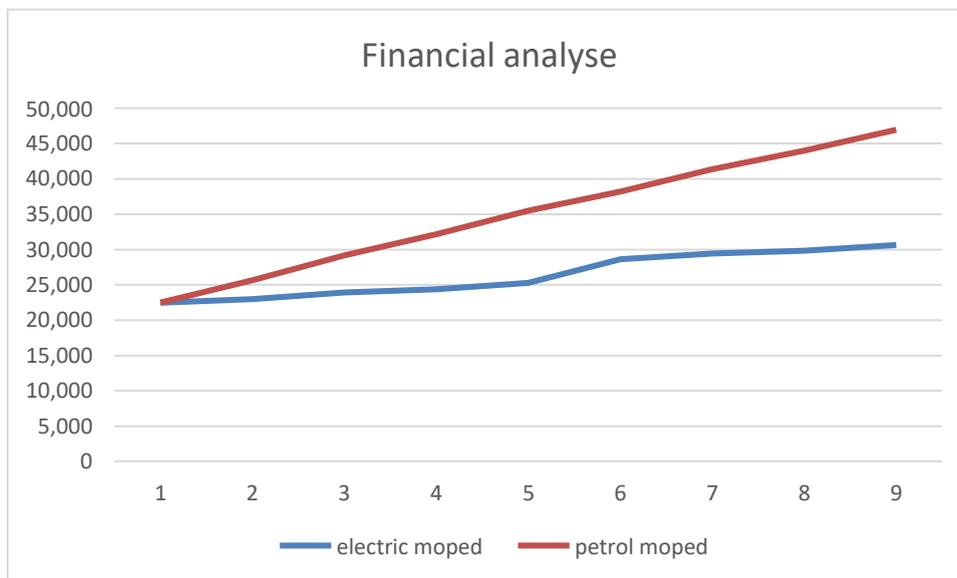


2. ELECTRIC MOPED

VALUE IN CONSTANT PRICES- electric moped						DISCOUNT VALUES (3%)							
	Year	Purchased price	Operating expenditures (service, fuel....)	Residual value	Net cash flow		Year	Purchased price	Discount values 3%	Operating expenditures (service, fuel....)	Residual value	Net cash flow	
	0	2019	22,488			22,488		2019	22,488			22,488	
	1	2020		500		22,988		2020		0.9709	485.45	0	22,973
	2	2021		1,000		23,988		2021		0.9426	942.60	0	23,916
	3	2022		500		24,488		2022		0.9151	457.55	0	24,374
	4	2023		1,000		25,488		2023		0.8885	888.50	0	25,262
	5	2024		4,000		29,488		2024		0.8375	3,350.00	0	28,612
	6	2025		1,000		30,488		2025		0.8375	837.50	0	29,450
	7	2026		500		30,988		2026		0.8131	406.55	0	29,856
	8	2027		1,000	0	31,988		2027		0.7894	789.40	0	30,646
		SUM	22,488	9,500				SUM	22,488		8,157.55		

VALUE IN CONSTANT PRICES – petrol moped						DISCOUNT VALUES (3%)						
	Year	Purchased price	Operating expenditures (service, fuel....)	Residual value	Net cash flow		Year	Purchased price	Discount values 3%	Operating expenditures (service, fuel....)	Residual value	Net cash flow
0	2019	19,000			22,488		2019	19,000				22,488
1	2020		3,250		25,738		2020		0.9709	3,155.43	0	25,643
2	2021		3,750		29,488		2021		0.9426	3,534.75	0	29,178
3	2022		3,250		32,738		2022		0.9151	2,974.08	0	32,152
4	2023		3,750		36,488		2023		0.8885	3,331.88	0	35,484
5	2024		3,250		39,738		2024		0.8375	2,721.88	0	38,206
6	2025		3,750		43,488		2025		0.8375	3,140.63	0	41,347
7	2026		3,250		46,738		2026		0.8131	2,642.58	0	43,989
8	2027		3,750	0	50,488		2027		0.7894	2,960.25	0	46,949
	SUM	22,488	28,000				SUM	22,488		24,461.45		

According to financial analysis performed, electric moped costs for period of 8 years are 30.646 thousand HR compared to 46.949 thousand HRK for petrol moped, which makes it more feasible and cost effective for the company.



Environmental analysis

At this stage, environmental analysis performed relates to basic calculation of CO2 emissions according to technical specifications of equipment purchased compared to the one replaced. In further steps of the pilot action testing, evaluation grid will be developed in order to assess action performance and to show how the environment and transit of passengers benefited from pilot actions. Also, it is important to specify that it is not yet fully investigated the impact of changing electric battery each five years on environment in respect of battery production and battery disposal.

Accordingly, listed below are technical specifications of pilot actions:

- Electric car – old petrol vehicle CO2 emission is 106 g / km, on a yearly basis, 30.000 km, it is 3.180.00 g. Electric vehicles emission factor was 234,81 g CO2 eq/kWh in Croatia in 2017;

IX. RISK ANALYSIS

Risk identification

Dubrovnik Port Authority has participated on several project meetings in order to discuss project implementation and to coordinate project activities.

In addition, Dubrovnik Port Authority has performed qualitative risk analysis for different stages of feasibility study (FS) and Action plan implementation as follows:

- Preparation phase – includes steps that are to be fulfilled prior to developing of FS and Action plan
- Implementation phase – includes steps that are to be taken for purchase of equipment or software necessary for testing pilot action
- Testing phase – includes steps that are to be undertaken during the testing phase of the Action plan and producing FS.

Per each phase of the Action plan lifecycle, engaged partners will perform following activities:

- Risk identification – all types of risks that can occur needs to be identified and addressed,
- Risk assessment – based on prescribed methodology, each risk shall be measured and assessed based on the probability of occurrence and impact on the project objectives achievement,
- Corrective measures and mitigation measures – measures prescribed by engaged parties in order to mitigate risk to acceptable level. Acceptable levels of risks are moderate or below, other risk levels should be addressed by appropriate measures.

Methodology for risk assessment

The qualitative risk analysis is based upon a combination of impact and probability and is evaluated according to the below risk matrix.

Impact/ Probability	I	II	III	IV	V
1	Low	Low	Low	Low	Moderate
2	Low	Low	Low	Moderate	High
3	Low	Moderate	Moderate	High	High
4	Low	Moderate	High	Very High	Very High
5	Moderate	High	High	Very High	Very High

Table: Qualitative risk analysis per FS and Action plan phases

PREPARATION PHASE						
Type of risk	Risk description / Effect on the project	Prob.	Impact	Risk	Measures implemented / mitigation measures	Status after measures on 28.10.2020. / new deadlines
Delay in start-up of project activities	Possible delays in signing of Subsidy contracts, Partnership agreement or delays in establishing internal project team could result in not achieving prescribed timeframe for deliverables nor spending forecast and consequently in project budget decommitment.	IV	V	Very high	According to internal rules and procedures of DPA internal project teams can be established from the official date of the project (1.1.2019) and prior to signing the SC and PA in order to start implementing activities on time.	Project has started in delay (AP in delay also), DPA team is established, procurements are done for the action plan implementation, risk is still on very high level. Corrective measures: FS needs to be adopted by end of October 2020.
Delay in adopting of Programme guidelines	Delay in adopting Implementation manual could severely influence partner's capability for preparing procurement procedures which can result in mistakes during procurement process and financial corrections.	IV	IV	Very high	Eventhough there was a delay in prescribing Implementation manual, DPA needs to follow National guidelines for procurement and establish adequate procurement plan in order to avoid possible financial corrections.	DPA has adopted procurement plan and performed all procurements. FLC has performed control of all procurements related to AP for DPA, no corrections were issued. Risk is mitigated to low level.

<p>Not adequate input / conclusion from International research performed and Environmental impact assessment</p>	<p>If best possible solutions from international research on number of low-impact intermodal solutions are not properly identified, then quality of Action plans as well as purchased equipment may not be in line with project objectives, which can result in project decommitment.</p>	<p>III</p>	<p>III</p>	<p>Moderate</p>	<p>International research for low-impact solutions, useful data on intermodality, best practices and operational and technical schemes to reduce environmental impact of ports and airports has to provide sufficient data for AP implementation.</p>	<p>There is a significant delay in finalising IIS. Risk has escalated to high level. Corrective measures: IIS together with Capitalisation report needs to be adopted by the end of the April 2020. However, due to the more delays in the project implementation, this risk has increased to very high level, new deadline April 2021.</p>
<p>Replacement of key personnel</p>	<p>Due to the envisioned timeframe of the project, key personnel may change positions within the Company or leave Company which can result in delays in closing the project. Information level of the person taking over the position will inevitably be lower than for the one leaving the position.</p>	<p>III</p>	<p>III</p>	<p>Moderate</p>	<p>Project procedures needs to include clear directions on what measures are to be taken to secure information hand-over when a key person is replaced. This includes e.g. a hand-over meeting and a hand-over memorandum. The hand-over process will be supervised to ensure that it is thoroughly executed.</p>	<p>Internal project procedures identifying hand over procedures are adopted. Internal project team has been named. Risk is mitigated to low level</p>

Lack of sufficient communication between WP coordinator and partners	Not adequate communication between WP coordinator and partners in producing FS and AP may result in unadequate FA and AP design especially regarding identifying testing phases and evaluation criteria.	III	IV	High	According to the result of Capitalisation report, FS for each territory should be created describing AP implementation and testing results achieved.	<p>There is significant delay in producing Capitalisation report, therefore input for FS at the moment is not adequate. Risk has escalated to the very high level.</p> <p>Corrective measures: IIS together with Capitalisation report needs to be adopted by the end of the April 2020.</p> <p>However, due to the more delays in the project implementation, this risk has increased to very high level, new deadline April 2021.</p>
IMPLEMENTATION PHASE						
Type of risk	Risk description / Effect on the project	Prob.	Impact	Risk	Measures implemented / mitigation measures	Status after measures on 28.10.2020. / new deadlines
Procurement plan not adopted	If all necessary procurements related to the project are not adopted and approved on time within the partners organization, equipment and related service may not be contracted and project objectives will not be met.	II	V	Moderate	Procurements related to the ADRIGREEN project should be adopted within the annual procurement plan of the Company in order to secure procurement funds.	<p>Procurement plans have been adopted and all procurements have been finished and contracts signed. Also, all equipment is delivered and put in function.</p> <p>Risk is mitigated to low</p>

Delays in public procurement publication	If public procurements are not published on time or delayed due to appeals, equipment will not be purchased on time to recover depreciation costs which may than be bared by the beneficiaries. Also, contracting of services related to performing testing actions may be delayed resulting in delay in achieving project objectives and outputs	III	IV	High	DPA has appointed public procurement expert and publish all procurements related to testing of pilot actions.	Procurement plans have been adopted and all procurements have been finished and contracts signed. Also, all equipment is delivered and put in function. Risk is mitigated to low level.

TESTING PHASES						
Type of risk	Risk description / Effect on the project	Prob.	Impact	Risk	Measures implemented / mitigation measures	Status after measures on 12.2.2020. /new deadlines
Not adequate testing plan	If testing plan does not include all necessary details and testing timeline, testing results may not be in accordance to project needs and project outputs underlined. Also, if Methodology for evaluating environmental impact is not described, results may be misinterpreted.	III	IV	High	DPA shall develop adequate testing plan and methodology for environmental impact solutions implemented on time.	

Testing procedures not performed according to plan	If testing procedures are not performed according to prescribed plan, testing results will not be in line with project objectives and project outputs which can result in project funds decommitment.	III	III	Moderate	Testing procedures should be performed according to methods agreed and on representative sample to ensure adequate testing results.	N/A
Not adequate actions implemented	If Dubrovnik Port Authority has not implemented adequate actions as prescribed by the AF, or actions are implemented in wrong manner, objectives and outputs of the project will not be reached.	III	III	Moderate	Dubrovnik Port Authority has purchased equipment according to specification in AF and has put them in use. Testing results should confirm improvement in environmental impact solutions	N/A

Identified risks shall be monitored and evaluated through entire Action plan and FS lifecycle.

X. CONCLUSION

Within WP4, the partnership will put into practice several solutions to test new mechanisms to speed up the passengers processing from/to airports and ports and as well as technological innovation to improve environmental performances of transportation facilities involved in the project.

Dubrovnik Port Authority pilot action includes purchasing of electric car and electric moped, covering the following pilot action field:

- adoption of smart solutions to reduce energy consumption
- implementation of integrated timetabling and information for passengers that must continue their travel by other means of transport

Research by the European Energy Agency found that, even with electricity generation, the carbon emissions of an electric car are around 17 – 30% lower than driving a petrol or diesel car. The emissions from electricity generation are also dramatically improved when low carbon electricity is used. Reusing and recycling batteries is also a growing market. Research into the use of second-hand batteries is looking at ways to reuse batteries in new technologies such as electricity storage.

Dubrovnik Port Authority has implemented process for monitoring and implementation of pilot action. Process consisted of following:

- identifying project team with clear responsibilities of each project team member,
- preparation of project implementation plan,
- identifying risks that can occur during pilot action implementation process with continuously monitoring and evaluation process,
- conducting timely public procurement processes for purchase of needed equipment,
- implementing purchased equipment in practice and measuring their performance,
- establishing monitoring system for environment analysis

The detailed risk analysis has identified events that may underpin activities realisation, providing mitigation measure to ensure the smooth development of the project and paving the ground to an effective testing phase.