Local action plan for the port of Rijeka

Final Version 30/06/2021

Deliverable Number D.3.3.8.

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Document Control Sheet

Project number:	
Project acronym	SUSPORT
Project Title	Sustainable Ports
Start of the project	July 2020
Duration	30 months

Related activity:	WP3 A 3.3. – Planning port environmental sustainability and energy efficiency
Deliverable name:	D.3.3.8 Local action plan for the port of Rijeka
Type of deliverable	Report
Language	English
Work Package Title	Cross-border planning of port environmental sustainability and energy efficiency
Work Package number	3
Work Package Leader	Intermodal Transport Cluster

Status	Final
Author (s)	Port of Rijeka Authority
Version	1
Due date of deliverable	03/2021
Delivery date	30/06/2021

Contents

Introduction

The Port of Rijeka, under the Maritime Domain and Seaports Act (OG 158/03, 100/04, 141/06, 38/09, 123/11, 56/16, 98/19), is classified as a port of international economic significance for the Republic of Croatia and has, as such, a number of positive effects for the national economy.

The vision of Port of Rijeka Authority until 2030 is that the port of Rijeka preserves the role of the most important intermodal hub and the main freight entry-exit port for Central and Eastern Europe in Croatia, as well as to use its potential and the advantages of its position in the Mediterranean and the Baltic-Adriatic TEN-T corridor. New opportunities for the gradual expansion and construction of a container terminal on the island of Krk, conservation and development of existing port infrastructure and the extension of port facilities for the construction of new infrastructure for the reception of large cruise ships is anticipated until 2030.

In the past but also the future development process, the Port Authority recognises the importance of all pillars of the sustainability of business management (environmental, economic, social). Consequently, it has also participated in a number of EU-funded projects dealing with a range of related topics.

SUSPORT ("Sustainable Ports") is an EU project funded by Interreg Italy-Croatia programme, with the main aim of increasing environmental sustainability and energy efficiency of ports in the programme area through increased institutional cooperation, in order to provide a basis for coordinated and sustained governance in the context of the environmental sustainability of the port environment and energy efficiency across borders. The project runs until the end of 2022 and Port of Rijeka Authority is one of the 16 project partners.

This action plan is one of the outcomes of the SUSPORT project for Port of Rijeka Authority. The aim of the Plan is to provide information on possible and advisable activities to reduce the environmental impact, increase energy efficiency and overall sustainable development of the port of Rijeka, in line with the Project's methodology (Methodology 3.3.1) and content.

Weaknesses and Threats following the SWOT Analysis

An extract of the SWOT analysis from the specific document also developed under the SUSPORT project ('Analysis of Environmental sustainability and energy efficiency of the port'), in relation to weaknesses and threats, is shown below. The SWOT analysis as a whole, and in particular these two domains, were an important starting point for the identification of possible measures.

WEAKNESSES	THREATS
o state of electricity and other infrastructure and the need for specific modifications, upgrading and renovation (due to a 50 Hz land network frequency, low transmission capacity of existing power lines) o possible questionable availability of space required for the necessary modifications/extensions, etc. o significant number of concessionaires and other stakeholders o a number of facilities in the status of protected cultural heritage (inability to implement measures and/or significant investment costs) o lack of a comprehensive, long-standing energy consumption monitoring system o possible insufficient general capacity to implement the port's complex development sustainability	o environment pollution o faster development of other ports o the slow pace of administrative processes required for the implementation of projects/measures o any conflicts with other users or pretendents for the same area and/or resources and/or infrastructure, etc. o general crises of diverse origins, in particular those which may have an impact on the development of demand in the transport sector

Measures on environmental sustainability and energy efficiency

Port of Rijeka Authority carries out a monitoring of the state of the environment, which includes, inter alia, testing air quality as well as measuring noise at specific locations in the port area. Monitoring is carried out on an annual basis and the results are publicly available (from 2015) in the form of a special report. Measurements of concentrations of pollutants in the area of measurement stations, relative to the legislation in force, indicate that, according to the concentrations SO2, NO2, and PM10, air quality is the quality of the category I (air is clean or slightly contaminated) and that no exceedance of daily or hourly limit value has been recorded. According to the reports, as a consequence, the health of the population is not expected to be adversely affected. Furthermore, on the basis of the evaluation of the estimated noise levels at the sites of measurement at the border of areas managed by the Port of Rijeka Authority, the reports show that the overall measured values are in compliance with the limits laid down in Rules on the maximum permissible sound levels in the area in which people work and reside (OG 145/04). Given the above, monitoring reports do not provide guidelines, recommendations or measures to further improve the state of the environment.

Nevertheless, the environmental sustainability domain and overall energy efficiency are very important themes for different business and other actors, including port authorities. In order to achieve these objectives, an efficient environmental management system is important, including the so-called carbon management, since a range of activities, products and services associated with the operation of port authorities has a certain environmental impact and generates greenhouse gas emissions, which should be avoided or at least minimised. In the context of sustainability and energy efficiency, the analysis of available literature, guidelines, good practices and the scope of the relevant regulatory framework makes it clear that the highest focus is on the air quality and climate change. Hence, the latter is also focus of this action plan for the port of Rijeka, encompassing also waste and noise domain.

An activity that is dominant in generating non-greenhouse and greenhouse gas emissions to air is the energy consumption, both in stationary and mobile sources (e.g. terminal, land transport, operation of onshore equipment, ships activities — manoeuvre, anchorage, berth, loading/unloading). Literature sources and examples of good practice indicate a set of possible measures to reduce emissions in ports without one single set of measures applicable to all ports as such. In the decision-making process on further sustainable development, and therefore on an appropriate set of measures, it is necessary to recognise the diversity of individual port areas in

terms of location characteristics, existing infrastructure, organisational arrangements with respective authorities, services/products/activities carried out, national/regional/local regulatory framework, etc., as well as to needs and objectives and financial opportunities. Cooperation from all stakeholders is important for successful implementation of measures.

In the context of the sustainability and energy efficiency of the port of Rijeka, the following is an overview of possible measures to achieve the stated objectives, which is also agreed with the representatives of Port of Rijeka Authority, as well as in compliance with the environmental guidance for visitors to the port area. Thus, the measures were focused on the options on the side of the port itself, not ships calling at a port. The identification of possible measures is based on SWOT analysis and good practice examples.

Acknowledging that the proposed measure cannot be defined at the level of a specific project without an additional, specific analysis and feasibility studies, which are not available for the time being, consequently, the avoided emissions could not be quantified. The assessment has been carried out, given the availability of more detailed information and the nature of the action itself, only for the socalled pilot measures proposed in this plan.

Name of action	Modernisation of lighting at the pier
Description of the measure	Many energy efficiency strategies rely on energy efficient lighting. According to some sources, LED lighting can reduce energy consumption to 60 %, and may also have a longer service life by up to 5 times. In addition, LED is more environmentally friendly as it does not contain mercury as is the case for neon lighting. The application of this technology is simple and implies mainly replacement of lamps/tubes. Modernization of public lighting shall be designed taking into account the following guidelines: o Construction of public lighting systems according to standard light technical values (HRN EN 13 201, HRN EN 12 464-2); o The improvement of conditions (transport) security; o Improvement of comfort due to public lighting; o Minimum electric energy consumption from the public lighting system; o Minimum maintenance costs for public lighting; o Minimum CO_2 emissions. This enables the introduction of energy-efficient and environmental public lighting by replacing pillars and lamps, for a total of about 1 700 m of the Rijeka pier.
Lead stakeholder/s for implementation	Port of Rijeka Authority

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Assessment of the avoided CO_2 emissions	5.52 t

Name of action	Purchase of an electric vehicle
Description of the measure	The electrification of land transport is one of the strategic measures for reducing pollutant and greenhouse gas emissions as well as noise in a given area. It is promoted at EU and national level. Electric vehicle shall be purchased for the purpose of serving the staff of the Port Authority. As the emission factor for the use of electricity as fuel (kg/kWh) is equal to 0, this vehicle will not generate CO_2 or other pollutant emissions (in the exhaust domain). A number of factors are affecting the noise emission of electric vehicles. The results depend on a research approach and goals. Nevertheless, in principle, the results indicate that the use of electric vehicles has a noise reduction potential where average speeds are below 30 km/h. In line with the latter, electric vehicles emit less noise by around 4-5 dB compared to internal combustion vehicles.
Lead stakeholder/s for implementation	Port of Rijeka Authority
Assessment of emissions avoided on an annual basis *	2.9-3.4 t CO2 per vehicle (petrol); 2.9-3.4 t CO2 per vehicle (diesel) 7.9-9.9 kg CO per vehicle (petrol); 4.1-5.5 kg CO per vehicle (diesel) 1.4-1.7 kg NOx per vehicle (gasoline); 20.9-27.9 kg NOx per vehicle (diesel) 0.02 kg PM per vehicle (petrol); 0.8-1.1 kg PM per vehicle (diesel)

* according to available data for LUCAS vehicles, only in case of replacement of one of the existing LNG vehicles

Name of action	Construction of a connection for the electrical charging stations
Description of the measure	Inland transport also contributes to emissions of pollutants and greenhouse gases, as well as to the noise of the port area and, by the very nature of the measures, which affect this segment, contribute to the port sustainability. A number of factors are affecting the noise emission of electric vehicles. The results depend on a research approach and goals. Nevertheless, in principle, the results indicate that the use of electric vehicles has a noise reduction potential where average speeds are below 30 km/h. In line with the latter, electric vehicles emit less noise by around 4-5 dB compared to internal combustion vehicles. Plan proposes construction of two new charging points for electric cars at the pier and in front of the administrative building of Port of Rijeka Authority. The latter represents an important infrastructure project as a contribution to the expected electrification of land transport and thereby to reducing air emissions as well as noise.
Lead stakeholder/s for implementation	Port of Rijeka Authority

Name of action	Energy consumption monitoring system
Description of the measure	Regular monitoring of energy consumption is a significant activity allowing efficient energy management as well as management of the accompanying air emissions. Smart grid systems represent an upgrade of the latter enabling energy supply and energy demand balancing. The implementation of this measure would improve the operation of the port, both in the context of overall sustainability and in terms of operating costs.
Lead stakeholder/s for implementation	Port of Rijeka Authority

Name of action	Construction of onshore power system (OPS system)
Description of the measure	High-voltage power supply (also called cold ironing) is considered to be one of the measures with the highest emission reduction potential. It is a land system that supplies ships with the necessary electricity (preferably from RES) and therefore supports all ship activities instead of auxiliary marine engines, thereby reducing emissions from ships during their stay in ports. The OPS therefore provides continuous energy supply for all systems (cooling, heating, lighting, etc.) while loading/unloading of cargo and/or passengers is carried out at the same time. However, this measure has a number of restrictive factors, of which the biggest one is the investment cost for the construction of the necessary electrical and other infrastructure in ports. Certain modifications are also needed for ships, with a more extensive implementation held back due to lack of standardisation and a complete regulatory framework even though there have been important shifts in this part. According to some sources, the emission reduction potential derived from the ship's diesel generator is significant and can be between 70-100 % of NOx, 50-70 % PM, 3060 % SOx, 40 % CO2 but also a noise reduction of up to 10 dB. The complexity of the OPS system implementation is reflected in the diversity of the electricity distribution system in the world, but also in the different voltage levels in ships. Application by the port itself places the ports in a special position, as it multiplies the requirements for electricity which can have a significant impact on the local electricity network. As a result of the 50 Hz land grid frequency, Croatian ports can generally be classified as ports with high installation costs. As the vast majority of ships use a frequency of 60 Hz, strong and therefore very expensive frequency converters must be installed. From the experience of ports having already introduced OPS, the price of the frequency converter and the transformer represents 50-65 % of the total implementation costs. Another very important factor that will surely have an impact on the possible deployment of OPS in Croatia is small capacity of existing supply voltage lines. The increase in

	their capacity will require substantial investment in the necessary infrastructure, notably in new lines and port substations.
Lead stakeholder/s for implementation	Port of Rijeka Authority/Energy suppliers/Croatian Transmission System Operator (HOPS)

Name of action	Onshore PV panels
Description of the measure	Onshore PV panels are very common energy efficiency and decarbonisation measure usually applied on roofs of buildings, storage facilities, parking areas, etc. Since there is a range of facilities and available roofing in the area considered, there is in principle a possibility for installation of integrated photovoltaic panels to produce electricity. However, data on specific potential are not available, where a significant factor is the age and status of the protected cultural heritage of many facilities. Therefore, this measure implies the installation of integrated PV panels on all facilities where it is technically doable and cost-wise justified. This can only be determined by further analyses and studies (e.g. feasibility).
Lead stakeholder/s for implementation	Port of Rijeka Authority /concessionaires

Name of action	Limitation of speed for ships in the port vicinity at a level of voluntary participation
Description of the measure	Limiting speed of ships in the vicinity of the port is very common in the domain of ensuring navigation safety. However, reducing emissions to air is based on reduced fuel consumption, which in turn is closely linked to the ship's speed. Consequently, the speed limit for ships close to the port represents a measure to reduce nongreenhouse and greenhouse gas emissions affecting both climate change and air quality as well as noise. Examples of practices show that there are ports that implement this even as a precondition for granting entry to port. Nevertheless, the effectiveness of speed limits depends largely on ship design, as ships are designed to operate at a particular speed, and the deviation from this can cause damage to
	the ship itself as well as negative environmental impacts. Therefore, this measure entails a voluntary speed restriction for ships close to Rijeka port.
Lead stakeholder/s for implementation	Port of Rijeka Authority

Name of action	Energy renovation of buildings
Description of the measure	The energy renovation of a building entails the application of energy efficiency measures to improve the energy performance of the building or part thereof and the basic application for building — energy management and heat retention. Hence, energy efficiency measures include: • energy auditing and energy performance certification of buildings for energy renovation purposes, • the development of a design documentation for energy renovation of a building demonstrating energy saving; • increase of the building thermal protection, • upgrading of technical building systems including technical equipment for heating, cooling, ventilation, air conditioning and domestic hot water generation, lighting systems and building automation and management, or part thereof, and deployment of renewable energy systems. The energy renovation of buildings contributes both to reducing energy consumption and thereby to reducing emissions which positions this measure also to decarbonisation domain. Given the complexity of the buildings in the area of Port of Rijeka Authority, in terms of their protection as cultural heritage (the conservation relevance), the presence and jurisdiction of the concession holder as well as future development plans, this activity entails the energy renovation of those buildings where and to what extent it is technically doable and cost-wise justified. This can only be determined by further analyses and studies (e.g. feasibility).
Lead stakeholder/s for implementation	Port of Rijeka Authority /concessionaires

Name of action	Use of alternative energy sources in land transport and machinery operation
Description of the measure	The EU policy, followed by national policies, encourages the uptake of alternative energy sources in all sectors, in particular energy and transport, with the aim of reducing emissions to air and increasing energy efficiency, but also reducing noise emissions. In addition to renewable sources of energy (RES), there is an increasing focus on electrification, hydrogen cells as well as liquefied natural gas (LNG).This measure implies the latter in land transport and machinery operation in the port area, either through direct energy production in the area considered or by purchase (e.g. energy from RES, vehicles and machinery driven by electricity, refrigerated storage trucks with cryogenic refrigeration units).With regard to the proximity of the Krk and LNG terminal, LNG as fuel is also interesting for the port of Rijeka. In case of electrification of equipment and mechanisation, the potential of NOx, SOx, PM and CO_2 emission reductions is practically 100 %.
Lead stakeholder/s for implementation	Port of Rijeka Authority

Name of action	Education for employees in the field of sustainability and energy efficiency
Description of the measure	Education of all employees operating in the port authority, irrespective of the segment (management, maintenance, loading/unloading, etc.), is necessary for the overall sustainable development. This action entails attending seminars, workshops, courses, study visits to other, international ports, etc. to increase internal capacity and knowledge levels on sustainable development, environmental protection, decarbonisation, energy efficiency, etc. Good practices include a so-called eco-driving for vehicle and mechanisation drivers aimed at reducing pollutant and greenhouse gas emissions as well as noise. According to some sources, such

	measures can contribute to reducing individual NOx, SOx, PM and CO2 emissions up to 10 %.
Lead stakeholder/s for implementation	Port of Rijeka Authority /concessionaires/ships

Name of action	Application of noise reduction technologies and principles
Description of the measure	The most common and most important sources of noise emission are equipment and machinery for loading/unloading cargo and passengers (e.g. forklifts, mobile cranes), ships at berth, inland connections (passenger transport, goods, freight) and HVAC (terminal) systems. Port of Rijeka includes all these elements with an additional circumstance having the built-up area in close proximity. Since future sustainable development of a port, in a narrower sense, can entail primarily activities on the land side, thus exempting ships themselves; * * consequently this measure relates to those port activities. Acknowledging that the port of Rijeka is a major port for freight traffic, equipment and machinery for loading/unloading is particularly significant in the context of noise. Sources of noise emissions are both driving and cargo manoeuvring. Research and good practice examples are mainly concerned with the issue of noise in the context of ships as sources of such emissions, while the scope of the possibilities on the port side is relatively limited. However, measures by which ports can reduce noise emissions may include: o noise mapping o setting noise barriers to suitable locations (according to some sources, these barriers can contribute to noise reduction of up to 25 dB), including green barriers as well . o changing the dynamics of individual activities in the port in order to avoid noisy works at certain times (e.g. night) or relocation of the noisiest activities o vehicle speed limitations from the land transport segment as well as the distance reduction o limitation of speed at which the container is dropped off

	o use of “soft” soils (e.g. “silent” asphalt) and utilisation of absorbing building materials o purchase of equipment with low operational noise o laser measuring system that permits the lifting of a container without collision and ‘soft’ launching o GPS containers to minimise noise peaks o sound insulation for noisy components o machinery silencers o appropriate use of the alarm system on the machinery o EKO driving A number of measures have a parallel positive effect on several domains, but they usually have primary and secondary focus. For example, the deployment of alternative energy sources will have a primary impact on climate change and air quality, while secondary contributions will result in reducing noise emissions. These measures are described separately taking into account their primary focus.
Lead stakeholder/s for implementation	Port of Rijeka Authority

* Heating, ventilation and air conditioning

* * Construction of high voltage connections on land (OPS) is a measure that covers ships and, inter alia, their impact on noise.

Name of action	Preparation of a Waste Management Plan for the whole area of Port of Rijeka Authority
Description of the measure	Currently, the waste management system works on the basis of two basic planning documents — the Waste Management Plan for the concession holder as well as the Plan for the Management of Waste from Ships under the responsibility of the Port Authority. The drafting and application of the Ship Waste Management Plan is an obligation stemming from maritime regulation (Shipping Code, Regulation on the conditions to be met by ports, Ordinance on the conditions and arrangements for maintaining order in ports and other parts of internal marine waters and the territorial sea of Croatia, Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues from ships and Regulation (EC) br.1069/2009 laying down health rules on animal by-products. The preparation of the Waste Management Plan by the concessionaire arises from the general regulatory framework on waste management. Aiming to improve the overall system of waste management for the whole area of the Port Authority, this measure entails the integration of those two planning documents into one single management plan, thus enabling a more complete picture of the status of the system and potentially new opportunities in the context of sustainable development.
Lead stakeholder/s for implementation	Port of Rijeka Authority

Below is a summary overview of the positive effects of the proposed measures on the environment and the port sustainability.

No	Proposed measures	Climate change and air quality	Waste	Noise	Light pollution
1	Modernisation of lighting at the pier				
2	Construction of the connection for the electrical charging stations				
3	Purchase of an electric vehicle				
4	Energy consumption monitoring system				
5	Onshore power system (OPS)				
6	Installation of onshore photovoltaic panels				
7	Limitation of speed for ships in the port vicinity at a level of voluntary participation				
8	Energy renovation of buildings				
9	Use of alternative energy sources in land transport and machinery operation				
10	Education for employees in the field of sustainability and energy efficiency				
11	Application of noise reduction technologies and principles				
12	Preparation of a Waste Management Plan for the whole area of Port of Rijeka Authority				

Implementation dynamics and potential sources of funding

Possible time frame for implementing suggested measures is referred to a period 2021 - 2030 following the vision of the Port of Rijeka Authority until 2030.

Detailed information about all the circumstances that have an impact on the definition of priorities, i.e. the distribution of the implementation of the proposed measures within that overall time frame, is not available and cannot be assessed in more detail. However, there are three measures whose implementation has already begun in part, and their implementation is planned for 2021 and 2022. The latter refers to the modernization of lighting on breakwaters, the construction of a connection for a charging station for electric vehicles and the purchase of an electric vehicle. Overall dynamics of the implementation of measures was discussed and agreed with the representatives of the Port of Rijeka Authority.

Furthermore, the implementation of the measures proposed by this Plan requires certain financial resources. An overview of possible sources of financing, in addition to the Port Authority's own resources, is given below. It includes sources at the national and EU level and some possible alternative forms that are increasingly used today.

SOURCE OF FUNDING	DESCRIPTION
The Environmental Protection and Energy Efficiency Fund (EPEEF)	The EPEEF is a central place for collecting and investing extrabudgetary funds in programs and projects for the protection of the environment and nature, energy efficiency and the use of renewable energy sources. In accordance with the commitments prescribed by the legislative framework of climate and energy policy and horizontal policy of environmental protection, energy efficiency and renewable energy sources, and systematic energy management, at regional, local and national level, EPEEF conducts activities for financing and implementation of programs and projects , education and training, cross-sectoral, and professional and technical cooperation with stakeholders in the field of energy efficiency through national and international activities. Therefore, in the field of energy efficiency, the EPEEF finances measures that expand the market and competitiveness of the Croatian economy and sustainable measures for environment, energy, and economy to prevent or reduce potential damage from the effects of climate change, in accordance with the Energy Efficiency Act and
	directives, regulations, decisions and EU strategies that have been transposed into Croatian legislation. Beneficiaries of the Fund's resources can be local and regional selfgovernment units, institutions, companies, civil society organizations and citizens. Their right to co-finance projects is exercised by applying to public tenders and calls with appropriate documentation.

Connecting Europe Facility - CEF	CEF is a sector-specific fund or financial instrument established for additional investments in the construction of new and improvement of existing transport, energy and telecommunications infrastructure from which Member States can finance projects on nine corridors of the Trans-European Transport Network (TEN-T) Core Network. The aim is to help create interconnected networks across Europe, which will be high-performance and environmentally sustainable, and contribute to economic growth, social and territorial cohesion within the European Union. CEF will contribute to the decarbonisation of the mobility sector, and thus to the goal of climate neutrality by 2050. The European Parliament and the Council reached an agreement on upgrading the CEF and releasing new funds for transport, digital and energy projects for the period 2021 - 2027. In addition to grants, CEF offers financial support for project implementation through innovative financial instruments such as warranties or bonds, usually in combination with European Investment Bank loans, which is then aimed to increasing private sector investment in infrastructure. With a total budget of around 30 billion euros, CEF will fund transport infrastructure modernization projects and cross-border projects with added value from EU. The program will ultimately aim to make energy networks more interoperable and ensure that funded projects comply with EU and national climate and energy plans. The amount of co-financing for port development projects is up to 85% for countries eligible for the Cohesion Fund, which includes Croatia (otherwise the rate is up to 20%).
Cohesion Fund - CF	CF serves for reducing economic and social disparities, as well as promoting sustainable development with an emphasis on transEuropean transport networks and the environment in which it supports

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	energy or transport projects, if they visibly contribute to environmental well-being in terms of energy efficiency, renewable energy use, rail transport development, supporting intramodality, strengthening public transport, etc. In a period 2021-2027 the amount of financial allocation for Croatia is 1.55 billion euros with the possibility of co-financing projects up to 85%. Applicants can be local self-government units, social, cultural and educational institutions, non-governmental organizations, small and medium-sized enterprises and associations. Projects aimed to promoting energy efficiency and renewable energy measures, environmental and transport infrastructure projects, development of smart energy systems, promoting climate change adaptation, risk prevention and disaster resilience, promoting sustainable water management and enhancing biodiversity, green infrastructure in urban areas, environment and pollution reduction can be funded through CF.
European Regional Development Fund - ERDF	The ERDF supports economic growth, employment creation and reducing disparities between regions. Key priority areas for investment are: • innovation and research, • information and communications technologies, • competitiveness of small and medium enterprises (SMEs), • low carbon economy. The Fund essentially finances the infrastructure projects of the Member States, which are defined through their national Operational Programs and need to be approved by the European Commission. Project co-financing can be up to 50%, indicating the need for additional contributions from other sources. However, relatively more modest funds have been allocated to development and investment in ports and port areas despite the long tradition of this Fund.

European Fund for Strategic Investment – EFSI	The EFSI provides financial support for projects of European interest through non-subsidy instruments, and the instrument itself is managed by the European Investment Bank (EIB). Namely, port projects that are not eligible for CEF or have not been funded still have the possibility of obtaining funding through the EFSI, which is expected to attract private capital and ensure a strong leverage (for example by giving a share through Special Purpose Vehicle access). So far this instrument has not achieved significant results in terms of financing port projects due to likely difficulties in closing the entire financial structure. However, projects focused on increasing resilience to climate change are becoming more important in the framework of 2021-2027.
European Investment Bank -EIB	The EIB also provides financial support through non-subsidy instruments for projects. Almost all port investments are eligible for EIB financing because they are compliant with EU policies. Ports that are a part of TEN-T network (which also includes Port of Rijeka Authority) are compliant by definition. The loan can be up to 50% of total investment cost.
European Energy Efficiency Fund - EEEF	The EEEF is a financial instrument that finances investments and projects in the field of energy efficiency (70%), renewable energy sources (20%) and clean urban transport (10%) through innovative instruments. In terms of technical support, the grant is available for development project services (technical, financial) related to investments financed by the Fund.
InvestEU	The InvestEU program is an extension of the European Fund for Strategic Investments (EFSI), which will support investments in a wider range of projects, including energy and transportation infrastructure projects.

European Economic Area Financial Mechanism (EEA)	The EEA Financial Mechanism and the Norwegian Financial Mechanism contribute to the reduction of social and economic inequalities in Europe and at the same time strengthen bilateral cooperation between donor countries (Iceland, Liechtenstein, and Norway) and beneficiary countries. For the period 2014-2021, donor countries have set aside a total of 2.8 billion euros for 15 European

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	countries: 1.5 billion euros under the EEA Financial Mechanism and 1.3 billion euros under the Norwegian Financial Mechanism. Financial allocation for the Republic of Croatia (2021 - 2030): 103.4 million euros. The funds are intended for a number of programs, including the Energy and Climate Change Program, which is 85% financed by the EEA financial mechanism. Program focus areas include renewable energy, energy efficiency, energy security, climate change mitigation, and adaptation to climate change. Through the implementation of the program in the Republic of Croatia special attention is on energy efficiency measures and support for the use of renewable energy sources, including geothermal energy, marine energy and solar energy.

INTERREG	INTERREG is a general term referring to European Territorial Cooperation (ETC). It is funded by the European Regional Development Fund and therefore provides support for projects with cohesion policy objectives. Eligible applicants are public and private entities established in the area of interest of the cross-border program. Specific features are applied in accordance with each program. INTERREG includes the following sub-programs: Cross-border cooperation (Interreg A): aims to address common challenges identified in border regions, such as poor accessibility, referring to information and communication technology connectivity and transportation infrastructure, declining local industries, inadequate business environment, lack of network connection between local and regional administrations, low levels of research and innovation and the takeover of information and communication technologies, environmental pollution, risk prevention and negative attitudes towards the citizens of bordering states. The goal should be using untapped growth potential in the border area (development of cross-border facilities and clusters for research and innovation, crossborder labour market integration, cooperation of educational institutions, including universities, or healthcare institutions), while strengthening cooperation for the purpose of overall harmonized EU development. Cross-border cooperation strengthening in border areas contributes to the overall development of territorial cooperation, increasing the

	international competitiveness of Croatian border regions, reducing social and economic inequality among Croatian regions and equalizing their development. Transnational cooperation (Interreg B): - strengthening of transnational and interregional cooperation contributes to the overall development of territorial cooperation, increasing the international competitiveness of Croatian regions, reducing social and economic inequality between Croatian regions and equalizing their development. Interregional cooperation (Interreg C) - includes these programs: Interreg EUROPE, Interact III, Espon and Urbact. • Interreg EUROPE promotes the exchange of experiences, identification and dissemination of good practice on thematic objectives of the EU with a goal of transferring to operational programs and European Territorial Cooperation programs in the field of: strengthening of infrastructure and capacity for RDI through regional innovation chains in selected areas, strengthening SMEs at all stages of their development cycle, achieving growth and innovation, transitioning to a low-carbon economy in all sectors through a policy of increasing the share of renewable energy sources and promoting sustainable multimodal transportation, protection and development of natural and cultural heritage and transition to a resource-efficient economy, promoting growth and eco-innovation. • INTERACT III is an interregional cooperation program within the European Territorial Cooperation Objective. It serves to strengthen the effectiveness of Cohesion Policy by promoting the exchange of experiences in identifying, transferring and disseminating good practice and innovative approaches to implementing territorial cooperation programs and activities related to territorial cooperation. • The Espon program is intended for the exchange of experiences in the field of spatial planning and general cooperation between universities or higher education and scientific institutions. • The Urbact is intended for cities experience exchange in making developing strategic documents as well as connecting with national priorities and strategies.

Local Energy e – ELENA	ELENA is a financial instrument intended for the development, structuring and launch of investments in energy efficiency and renewable energy sources. Implementation is enabled through four international financial institutions: the European Investment Bank (EIB), the Frankfurt Government Development Bank (KFW), the Council of Europe Development Bank (CEB) and the European Bank for Reconstruction and Development (EBRD). ELENA enables the financing of investments from both private and public sources and facilitates connections with other financial instruments. ELENA provides up to 90% of the costs of technical assistance for feasibility studies, energy analysis and preparation of tender documentation. Beneficiaries of these funds can be public authorities as well as private sector entities. Eligible projects include energy efficiency, renewable energy sources, public lighting, smart grids, promotion, and integration of the use of alternative fuels for the transportation sector, etc.
Joint Assistance in Supporting Projects in European Regions - JASPERS	JASPERS is a European Commission technical assistance instrument created in collaboration with the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) to support infrastructure projects. Consultation under the JASPERS instrument may include project preparation (cost-benefit analysis, environmental issues, procurement planning), documentation review (feasibility studies, grant applications), compliance with EU law (environmental protection, market competition) and other activities relevant to the preparation of such complex projects. The aim of the initiative is to provide technical and advisory assistance to Member States in the preparation of major infrastructure projects financed by the Cohesion Fund. The services are free of charge and are intended to accelerate the realization of available funds.

Energy Service Company - ESCO	Contracting energy services through the ESCO model is a recognizable name of the concept in the market of services in the field of energy. It includes development, implementation and financing of projects aimed at improving energy efficiency and reducing costs for operation and maintenance. ESCO company takes the risk of savings by providing warranties. Financial solutions for their implementation

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	are often offered in addition to innovative projects for improving energy efficiency and reducing energy consumption. Important fact about this model is after investment is paid off, ESCO company leaves the project, and all of the benefits transfers to the client.
Public-private partnership (PPP)	Public-private partnership (PPP) is a cooperation between public authorities and the private sector, including the non-profit private sector. Development and realization of commonly defined goals is possible through PPP which is very important in local initiatives. Relationship between public and private sector is accomplished through manufacturer and consumer cooperation – claimant cooperation. The Public-Private Partnership Act (NN 78/12, 152/14, 114/18) defines PPP models in the Republic of Croatia: • contractual form of PPP (concession model and PFI - privately funded initiative), • status form of PPP (company in mixed ownership of public and private sector). The advantage of this method of financing projects is in the fact that such an investment is not seen as an increase in public debt. The key condition is found in the classification of assets considered with the partnership agreement. Contract asset is considered an asset of local governments only if there is a firm proof that private partner takes most of the risk in a partnership.

Revolving funds	Revolving funds represent a financial mechanism specialized for financing clearly defined types of projects and are founded by multilateral agreement between national or international institutions and financial institutions. Revolving financing can provide loans for projects which do not have the right to access other loans of financial institutions or loans with an interest rate that is lower than the market (soft loans). The reason for its establishment is the mismatch between market supply and demand for financing energy efficient projects.
Crowdfunding	Crowdfunding gathers resources of all stakeholders through online platforms. Thanks to today's technologies through crowdfunding platforms, it is possible to attract the support of people from all over

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	the world, and it is based on fundraising through donations, mostly small amounts, from a large number of people. The goal is to include as many people as possible and with their small payments cumulatively make a significant amount sufficient for the realization of even large projects.
Energy cooperatives	Energy cooperatives are associations of individuals, companies, public institutions, local governments connected according to the location key, which develop renewable energy projects together. Joint investment reduces the risk of the investment and shares the profits from the project. The goal of such cooperatives is to promote renewable energy sources owned by local communities, which enables easier implementation of energy efficiency measures aimed at the local community, because cooperatives can achieve greater bargaining power. There are currently 8 energy cooperatives operating in Croatia.

Compatability of the measures with environmental sustainability and energy efficiency policies

The Republic of Croatia, as a full member of the EU, is harmonizing its regulatory framework with the EU acquis. Furthermore, the context of accepting the obligations arising from the membership contain the incorporation of guidelines adopted by the strategies of the European Union into their national policies. In this regard, we would like to single out the following.

GLOBAL AND EU POLICIES

EU Sustainable and Smart Mobility Strategy

The EU Strategy for Sustainable and Smart Mobility was adopted in 2020 together with an action plan and 82 initiatives to be implemented in the coming period. Total goal of emission reduction of 90% by 2050 is arranged in stages, therefore, in the context of ports and maritime transport the following is expected:

- by 2030, zero-emission vessels will be ready for the market
- by 2050, the Multimodal Trans-European Transport Network (TEN-T) for sustainable and smart transport with fast connectivity will be fully operational

82 initiatives mentioned above are divided into ten key areas of action ("flagship initiatives"), each of which contains concrete measures. The domain of sustainable transport is especially important for the subject of this Plan, where the Strategy plans the following measures:

- a significant increase in the number of zero-emission vehicles, vessels and aircraft, greater use of renewable energy sources and low-carbon fuels, and the introduction of connected infrastructure, for example by setting up three million public charging stations by 2030.
- creating zero-emission airports and seaports, for example by implementing new initiatives to promote sustainable aviation and marine fuels

EU Green Deal

A European Green Deal is a strategy to achieve the sustainability of the EU economy by turning climate and environmental challenges into opportunities in all policy areas and ensuring a fair and inclusive transition. It includes an action plan with measures for improving resource efficiency by moving to a clean circular economy and stopping climate change, as well as restoring biodiversity

and reducing pollution. It covers all economic sectors, especially transport, energy, agriculture, maintenance and construction of buildings and industries such as steel, cement, textiles, and chemicals. The only call so far under the auspices of the Green Deal included the domain of the socalled green ports as centres of sustainable and smart mobility where eligible projects were those related to the supply and production of low greenhouse gas energy, TSO systems, the use of alternative fuels in ships and other vehicles as well as the construction of associated infrastructure, energy renovation of buildings in ports, dynamic-logistical models to improve the routing system and retained ships in ports, etc.

Sustainable Development Goals - SDGs

The United Nations Program on Sustainable Development by 2030 (the so-called 2030 Agenda) was adopted in September 2015, as well as the corresponding UN General Assembly Resolution 70/1 entitled "Changing our world: Agenda 2030 for sustainable development". The main backbone of the development agenda is the 17 Sustainable Development Goals (SDGs), which are elaborated in 169 closely related sub-goals. From the list of goals below regarding to ports and proposed measures of this Plan, special emphasis is on goals 7. Affordable and Clean Energy, 12. Responsible Consumption and Production and 13. Climate Action.

UN Sustainable Development Goals (SDGs)

The International Association of Ports and Harbours (IAPH) has established the World Ports Sustainability Program (WPSP), which has developed a plan to integrate all 17 sustainable development goals into business strategies of port authorities. The Directive on Alternative Fuels Infrastructure (2014/94 / EU) This Directive determines:

- a common framework of measures to set up infrastructure for alternative fuels in the Union in order to minimize oil dependence and mitigate the negative impact of transport on the environment
- minimum requirements for the construction of infrastructure for alternative fuels, including filling stations for electric vehicles and natural gas (LNG and hydrogen) and hydrogen supply points, implemented through Member States' national policy frameworks, as well as common technical specifications for such filling points and supply and customer information requirements.

Member States are ensuring the assessment of onshore electricity supply for inland waterway vessels and seagoing vessels in seaports as well as inland ports in their national policy frameworks.

The establishment of such onshore electricity supply in ports that are a part of core TEN-T network and other ports by 31 December 2025 is a priority, unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits.

Furthermore, Member States, through their national policy frameworks, ensure that an adequate number of LNG supply points are set up in seaports by 31 December 2025 to allow inland waterway vessels or seagoing vessels to operate throughout the core TEN-T network. Member States, if needed, cooperate with bordering Member States to ensure adequate coverage of the TEN-T core network.

Directive 2012/33/EU amending Council Directive 1999/32/EC as regards the sulphur content of marine fuels

In addition to defining the sulphur content of marine fuels, this Directive is also important for port areas. Namely, in the context of reducing emissions, the Directive requires Member States to encourage mooring ships to use onshore power supply systems as an alternative solution to reduce emissions.

European Commission recommendations for the use of land-based power in EU ports (2006/339 EC)

The European Commission has issued recommendations for the use of electricity supply to ships from land in the ports of the European Union, according to which, inter alia:

- EU Member States should consider installing a system to power ships from the mainland, especially in ports where air quality indicators have been exceeded or where there are public concerns about high noise emissions, and especially in ports close to populated areas.
- the review process should cover all environmental benefits as well as cost-effectiveness
- Member States should consider introducing economic incentives for operators to use shore-side electricity supply to ships
- Member States should raise public awareness of this topic among local stakeholders.

NATIONAL POLICIES

Transport Development Strategy of the Republic of Croatia for the period from 2017 to 2030 (OG 84/17)

The strategy promotes activities to reduce CO2 emissions in all modes of transport that significantly relate to the replacement of conventional fuels with alternatives and the construction of the necessary infrastructure. In the context of maritime transport, it has defined the 2050 target as a 40% reduction in CO2 emissions from marine fuels.

Environmental protection, climate change and energy efficiency, as well as sustainability, are also the topics of this National Strategy. They are covered by general measures as follows:

• G.6 Improve energy efficiency of the transport system

Raising the energy efficiency of the transport system and determining low-carbon energy sources and propulsion systems have been set as a priority, and further studies will aim to analyse specific requirements.

• G.10 Increase administrative capacity / training

Lack of administrative capacity and properly trained staff are some of the key problems identified in the transport sector and one of the priorities of the European Union's cohesion policy. The introduction of new technologies and the increase in the requirements for the supervision of traffic and means of transport implies the necessity of training the existing staff and new employees in accordance with their specific needs.

• G.12 Reduce of negative environmental impacts of traffic

Mitigation of the negative impact of transport on the environment must be achieved through greater energy efficiency, especially through the use of energy sources with low or zero hydrocarbon emissions. It is therefore necessary to expedite the transition to low and zero emission vehicles.

• G.13 Adaptation and mitigation of climate change

The development of the transport sector in the Republic of Croatia should consider the need to reduce CO2 emissions, and thus mitigate the impact of transport on climate change. At the same time, transport infrastructure and business need to be built considering the possible consequences of climate change and the extreme weather conditions.

Energy Development Strategy of the Republic of Croatia until 2030 with a view to 2050 (OG 25/20)

The strategy defines the policy of decarbonisation of the energy sector, which includes the transport sector as a very significant source of emissions. The latter implies significant changes, primarily a reduction in the consumption of fossil fuels in transport while at the same time increasing the use of energy with zero or very low CO2 emissions. By 2030, the emphasis in the transport sector will be on the construction of new infrastructure for the use of alternative forms of energy in transport (LNG, electricity and hydrogen). It is foreseen to increase the share of alternative propulsion vehicles, especially electric ones, and electrification of urban and interurban traffic, as well as to increase the use of LNG in heavy freight, maritime and railway transport.

National Recovery and Resilience Plan 2021-2026 (Proposal from 29.4.2021.)

The Recovery and Resilience Facility (RRF) has been introduced under the instrument "Next Generation EU", which will allow Member States, through their own national recovery and resilience plans, to use grants and loans to finance reforms and related investments that accelerate recovery and increase the resilience of the economy and society.

In the context of maritime transport and ports, in the proposal of the National Recovery and Resilience Plan 2021-2026, goal C1.4 Development of a competitive, energy sustainable and efficient transport system, can be emphasized. The implementation of this goal is set on the basis of several reforms, including R3 Reform of maritime and inland navigation, which is expected to develop sustainable and efficient maritime and inland waterway transport which will increase navigation safety, ensure revitalization of inland waterways, improve transport connectivity of islands and improve port infrastructure in order to reduce the negative impact of the transport sector on the environment.

The new Law on Maritime Property and Seaports, which will be adopted at the end of 2022, will reorganize the structure of the port system of ports open to public traffic. The aim is to ensure uniformity in the implementation of legal obligations for managing public ports and streamline management costs. The Law will also issue the criteria which port must establish a system of sustainable waste management, and in accordance with the directives of Directive (EU) 2019/883 of the European Parliament and of the Council of 17 April 2019 on port facilities for receiving ship waste, amending Directive 2010/65 / EU and repealing Directive 2000/59 / EC.

REGIONAL POLICIES

Development strategy of Primorje-Gorski Kotar County 2016-2020 (SN PGŽ 22/20)

Development strategy of PG County 2016-2020 is the basic planning document for sustainable socio-economic development of the County, which defines a number of related measures. There are several measures related to the topic of this Plan:

- Measure 1.4.2. Supporting the move towards an economy based on low CO2 and greenhouse gas emissions in all sectors
- Measure 1.4.3. Encouraging the use of RES and energy efficiency (emphasis on the construction of ecological ports)
- Measure 1.5.1. Development of the transportation sector

Spatial plan of Primorje-Gorski Kotar County (SN 2013/32, 2018/41)

According to the County's Spatial Plan, the port of Rijeka with the basins Rijeka, Brajdica, Omišalj, Bakar, Raša - Bršica, the anchorage of ships and the separate port area Škrljevo belongs to ports open to public traffic of special international importance.

In the area of pools Rijeka west and Brajdica, the construction of a container terminal with a total capacity of around 1,400,000 TEU is planned. From the outside of the Rijeka breakwater, mooring of cruise ships is allowed. The construction of a unique maritime passenger terminal in the port of Rijeka for the transport of passengers by fast ships and coastal ships, state, county, and local traffic is planned by the Spatial Strategy. The passenger terminal should be connected to the main road, rail, and air transport terminals.

Furthermore, the Spatial Strategy states that the port area in Rijeka is a significant source of NOx emissions, and a smaller part of SO2 and particulate matter, with the main cause of emissions being transport, anchoring and mooring of the ship to / in the port, while the share of transhipment in the port is much lower. The port is therefore considered a planar source of emissions.

Sulphur dioxide emissions should be reduced:

- using a marine fuel at berth and in navigation with the prescribed minimum amount of sulphur,
- installing a connection for the supply of electricity to ships at rest during unloading/reloading of cargo.

The overall review of policies at all levels shows that the proposal of possible measures to increase the sustainability and energy efficiency of the port of Rijeka is very much consistent with the latest and valid strategic planning documents of the European Union, the Republic of Croatia and PrimorjeGorski Kotar County.

Conclusion

Port of Rijeka Authority is a project partner in the EU project “Sustainable Ports” (SUSPORT).The development of the Action Plan for the development of environmental sustainability and energy efficiency is one of the activities of the project carried out for the area of Port of Rijeka Authority (Rijeka and Sušak basin).The aim of the Plan is to provide information on possible and advisable activities to reduce the environmental impact, increase energy efficiency and overall sustainable development of the port of Rijeka according to the Project’s defined methodology and data/information availability.

The Port of Rijeka, under the Maritime Domain and Seaports Act (OG 158/03, 100/04, 141/06, 38/09,

123/11, 56/16, 98/19), is classified as a port of international economic significance for the Republic of Croatia and as such has a number of positive effects for the national economy. For sustainable development, as a fundamental determinant of today’s business of different actors, and also of port authorities, implementation of an efficient environmental management system, including the socalled carbon management, is important since a range of activities, products and services associated with the operation of port authorities has a certain environmental impact and generates greenhouse gas emissions, and the latter must be avoided or at least minimised. Sustainable development offers many opportunities, such as reducing operating costs (in particular considering reduced energy consumption), increasing the quality of supply, modern equipment of the entire port (machinery, infrastructure, etc.), promotion and development of the port as a sustainable and green one that advocates public interest and the common good, improving the state of the environment at site level and beyond (reducing noise, pollutant emissions and greenhouse gas emissions to air, light pollution, waste, etc.), which contributes to the satisfaction of local authorities and the population, etc.

Sustainable development can be implemented through a variety of measures to reduce nongreenhouse and greenhouse gas emissions, increase energy efficiency, etc. In the decision-making process on the appropriate set of measures, account must be taken of the specificities of the port area concerned (location features, existing infrastructure, organisational arrangements with respective competences, services/products/activities carried out, national/regional/local regulatory framework, etc.), as well as to the needs and objectives of, and financial opportunities. Cooperation from all stakeholders is also important for successful implementation of measures.

With this Action Plan on the development of environmental sustainability and energy efficiency, based on the SWOT analysis and the good practice examples 12 potential and advisable measures have been identified, with them having a positive impact on climate change, air quality, waste, noise and/or light pollution, and focused on the opportunities from the port side. Proposed measures and their possible implementation dynamics were agreed with the Port of Rijeka Authority.

The proposed measures include the following:

- Modernisation of lighting at the pier
- Construction of connection for electrical charging stations
- Purchase of electric vehicle
- Energy consumption monitoring system
- Onshore power system
- Installation of onshore photovoltaic panels
- Limitation of speed for ships in the port vicinity at a level of voluntary participation
- Energy renovation of buildings
- Use of alternative energy sources in land transport and machinery operation
- Education for employees in the field of sustainability and energy efficiency
- Application of noise reduction technologies and principles
- Preparation of a Waste Management Plan for the whole area of Port of Rijeka Authority

The possible timeline for the implementation of the proposed measures refers to the period 20212030 following the vision of Port of Rijeka Authority until 2030. However, there are three measures already in the process of implementation (modernisation of lighting at the pier, construction of connection for electrical charging stations and the purchase of electric vehicle) and their realisation is scheduled to take place in 2021 and 2022.

Since implementation of the proposed measures requires financial resources, the Plan provides an overview of potential sources of funding (national, international, alternative), in addition to the own resources of the Port Authority, from which it is clear that there are a number of possibilities in this segment.

A number of policies, both European and national, increasingly promote ports as so-called 'green ports' — centres of sustainable and smart mobility. The advancements are also reflected in the regulation that sets more specific requirements in this regard. All of the above points to a clear and already committed direction for the development of ports, and this Action Plan is certainly one of the initial contributions of such a development for the port of Rijeka.

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