Guidelines for the integration of Blue Energy systems in coastal infrastructure

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GUIDELINES FOR BLUE ENERGY INTEGRATION

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Table of content

GUIDELINES FOR BLUE ENERGY INTEGRATION

The general goal of COASTENERGY is to encourage the creation of a favorable environment for business initiatives in the Blue Energy sector and promote the implementation of coastal blue energy systems in the program area, with special emphasis on wave and heat converters to be integrated into structures such as breakwaters, marinas etc. These initiatives must be informed and designed to ensure the full conservation of marine ecosystems and landscapes, and also in line with the needs of other maritime activities such as fishing, aquaculture, tourism and maritime affairs. The project will adopt a participatory approach, bringing together and involving

Quadruple Helix actors in a multi-level network to develop a common roadmap and implement coastal blue energy systems in pilot areas.

Project partners:

IRENA - Istrian Regional Energy Agency Ltd.

Development Agency of the City of Dubrovnik - DURA

International Center for Sustainable Development of Energy, Water and Environment (SDEWES CENTER)

University of Camerino (IT)

University of Udine (IT)

Community of Mediterranean Universities (IT)

Chamber of Commerce, Agriculture and Crafts Chieti Pescara (IT)

City of Ploče

General goal of the project:

New platforms, networks and auxiliary platforms to improve knowledge transfer and exploit the results achieved in the blue economy.

Analysis, assessment and promotion of energy potential and infrastructure in ports and coastal areas of the Mediterranean to facilitate business investment for companies, organizations and other stakeholders, focusing primarily on thermal energy and wave energy. The initiative will guarantee the sustainable development and conservation of the marine and terrestrial ecosystem and will be coordinated with other activities in the Mediterranean coastal area such as fishing, tourism and the maritime industry.

Project title: COASTENERGY- Blue energy in ports and coastal urban areas
Program: INTERREG V-A Italy - Croatia 2014 - 2020
Thematic area: Priority Axis 1- Blue Innovations
Main partner: IRENA- Istrian Regional Energy Agency
Proven time: 30 months (1.1.2019.-30.6.2021.)

Total project budget: 1,827,670 EUR

1. EXPERIENCES OF PROJECT PARTNERS – DURA

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.
Development Agency of the City of Dubrovnik - DURA
http://www.dura.hr/

DURA is a professional, non-profit organization founded by the City of Dubrovnik. It provides services for the preparation of project proposals to public institutions, small and medium enterprises, citizens' associations and all interested stakeholders. Through its activities, DURA acts as a liaison between the city, its institutions and other local stakeholders who can support local development and growth. All projects prepared by DURA are implemented in cooperation with the City of Dubrovnik.

Pilot project DURA:
DURA participates in leading and monitoring the project implementation, financial budget planning, communication activities, analysis of potentials for integration of Blue Energy production, mapping of target groups, creation of several central centers for defining joint strategies and local actions supporting coastal blue energy.
Guidelines for the integration of the blue energy system into coastal infrastructure should be derived from the analysis of the potential of blue energy and the data obtained.
The guidelines should include indications / instructions on how
- transform ports and other coastal structures of the Adriatic Sea into blue platforms for energy production,

- how to deal with environmental and landscape issues,
- how to implement the integration of energy production systems in the built environment,
- what are the criticisms that need to be taken into account.

The document represents the systematization of project partnership experiences and its main purpose is to define recommendations for future actions in the processes of integration of the system of using blue energy sources in the infrastructure of the Adriatic regions.

Figure 1: Port of the city of Dubrovnik existing situation

1.1. Transformation of ports and other coastal infrastructure

In the case of existing urban units, it is necessary to define an economically acceptable technical solution for the construction of central heating and cooling systems via a hot water network with central engine rooms through which the exchange of thermal energy with seawater would take place. Spatial plans do not provide for the installation of heating pipes, so it is necessary to make changes and additions to the spatial plans. It is necessary to create new maps for the management of hot water networks in existing urban units, respecting all possible technical

limitations of the micro-location through which the hot water network is intended to be implemented.

The city port in the city of Dubrovnik has been built and completed, which does not have the possibility of conducting new installations of central heating networks for heating and cooling of the entire city. The situation is the same in all city locations, so the transformation of the entire city zone would require extensive infrastructure works that would carry out all the necessary underground hot water installations. The situation is similar in all other cities on the Adriatic coast.

1.2. Environmental and landscape protection

The use of a central heating and cooling system would reduce the number of air-to-water and air-to-air heat pumps installed on the facades of buildings located in protected urban areas. The application of the proposed model would ensure the heating of buildings with an environmentally friendly system and at the same time would improve the urban architectural vision of the city.

Figure 2: Old town of Dubrovnik existing condition

The use of sea energy directly affects the CO2 emissions of the entire city, because many systems installed in the city of Dubrovnik have poorer technical properties than the proposed central heating and cooling system of the entire city. Air-to-water and air-to-air heat pumps have average seasonal efficiency factors of 3.5 while water-to-water heat pumps have seasonal factors of around 5.0. There are many old heating installations that use heating oil for heating and a large part of the buildings are still heated with wood. All these listed classic heating installations have higher CO2 emissions than the proposed central heating and cooling system.

The City of Dubrovnik is located in a protected cultural zone with a large number of buildings that are protected buildings, and for any construction work in the old city unit, a permit must be sought from the local conservation institute. The proposed central heating and cooling system using sea energy and underground heating systems has no impact on the appearance of buildings. Central heating pipes are installed underground and the pipes are run through the streets along with all other installations. The proposed installation requires extensive construction and infrastructure works, and the construction would solve all the problems with heating and cooling of the city of Dubrovnik in the long run.

1.3. Implementation of system integration in the built environment

Blue sea energy has great potential for the needs of heating and cooling of urban units. For each existing urban unit, it is necessary to find a specific technical solution that will ensure the use of sea energy in heating systems. Localized heating and cooling with sea water is not applicable, but the construction of central heating and cooling systems and a network of pipelines implemented through the urban zone is proposed. The advantage of this heating model is that a separate engine room with a local water-water heat pump is built in each building. This technical system has proven to be a good solution in large office buildings with much smaller functional units that have different modes of use.

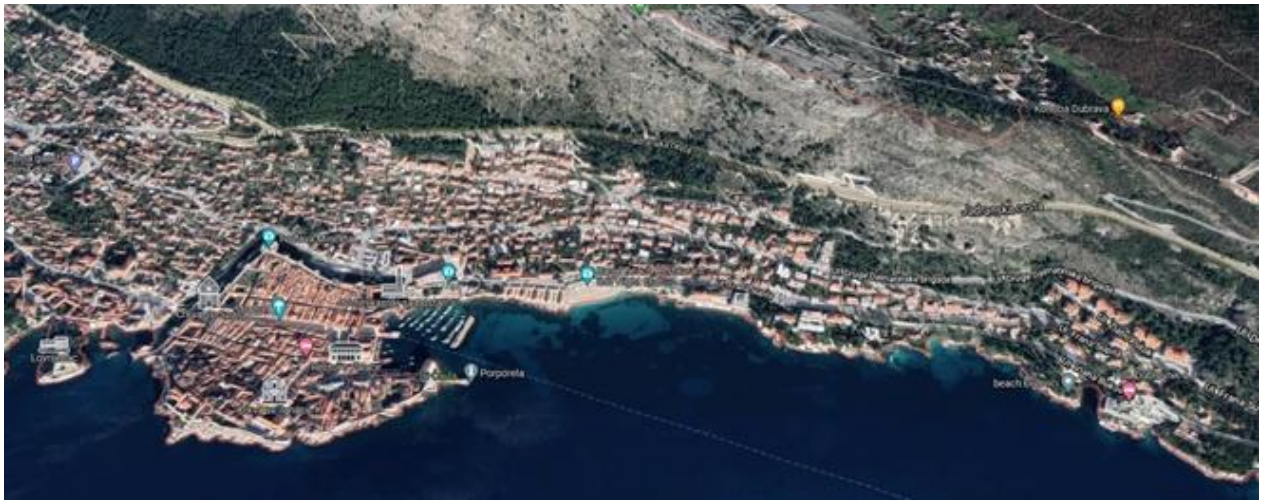

Figure 3: Old town of Dubrovnik existing condition

A small part of the city of Dubrovnik includes the old protected city center, while most of the city is located on the slopes of the mountain Srđ. In the new city urban units, it is possible to build central heating and cooling systems with underground heating pipes, but it is necessary to coordinate all other installations that have been carried out underground through the city.

With the existing technical solutions of central heating pipelines, it is possible to build the proposed installation of central heating and cooling of the entire city using sea energy and water-to-water heat pumps. All necessary equipment is available on the market, from central heating pipes, heating substations, control and balancing valves, measuring and control equipment, local water-to-water heat pumps for each building and central control and automatic control systems for the entire system to achieve maximum efficiency.

About 80% to 90% of the area of the city of Dubrovnik belongs to small family houses, apartment buildings and smaller apartment buildings that could all be connected to the proposed central system. When forming the price of heating and cooling, the price of kilowatt hours of thermal energy must be lower than the current amount of heating with which these buildings are heated. The price must be lower for potential customers to join the proposed system.

Figure 4: Central urban zone of the city of Dubrovnik [1]

1.4. Which critical factors should be taken into account

In the case of new urban units, it is necessary to introduce the concept of central hot water networks for heating and cooling of entire settlements with the help of sea water into the new spatial plans. Urban planning is necessary to envisage the heating pipeline zone along with all other classic plumbing, drainage, electrical and telecommunications installations. The number of underground installations would increase, but with the correct sizing of the entire network, it is possible to place all installations in the underground. In larger urban units, the practice is the construction of underground tunnels in which all city installations are located, so that the manipulation and control of all installations in service and repairs as well as in the construction of new connections to city networks is facilitated.

Distribution pipelines should be placed near buildings in such a way as to ensure that a local connection to the heating system is made. Each connection to the pipeline network is balanced via a local self-regulating valve that maintains the flow and pressure in the network. From the connection, the installation is then led to each individual building in such a way that it is connected to the local engine room of the building. It is proposed to install a water-water heat pump inside the engine room, while the heating and cooling network inside the building would be fan coil units.

With the design solution of the hot water network, it is necessary to envisage all possible connections and the necessary heat transfer power in all future expansions of urban units. The technical solution must ensure easy use of the hot water network with easy maintenance of the pipeline network. The technical solution of central heating pipelines can be performed as a central heating and cooling plant for the entire city of Dubrovnik or block engine rooms for heating and cooling can be constructed and exchangers would be installed in each engine room to transport seawater heat to city installations.

It is necessary to perform a detailed analysis of the construction of one central heating and cooling system or the construction of several block systems that would cover the heating and cooling of one city unit, depending on the local possibilities of building central networks. This technical analysis proposed a conceptual solution for the construction of a hot water network in the south-eastern block of the city of Dubrovnik, and local buildings would be connected to the installation. Regardless of the conceptual design, a similar experimental installation can be performed in any part of the city of Dubrovnik, even in the old town, which is protected as a cultural monument because it does not affect the view of the environment.

In the integration of renewable energy sources, long-term goals should be maintained until the final goal of using sea energy for heating and cooling using heat pumps is achieved. The process itself can be time consuming and requires the persistent work of a large team of people to ultimately implement the new technology.

Policy framework:

- it is necessary to avoid over-regulation of the application of new technologies with rigid regulations that do not allow large deviations of technical solutions
- implementation of marine energy technology in long-term strategic plans of the European Union such as the 2030 Clean Energy Package
- promotion of the use of marine energy and in general promotion of the use of heat pumps
- tendencies towards decarbonization of the energy sector for heating and cooling, which is mentioned in a large number of energy strategies such as the 2050 Green Deal
- development of national master plans for the use of renewable energy of each community
- monitoring and mapping of individual installed installations of heat pumps with the production of periodic promotional materials with indications of the benefits of using the technology

- financial incentives and programs between the countries located in the Adriatic region to increase mutual cooperation and exchange of experiences
- control fossil fuel tax policies and in this way regulate the situation on the energy market

Financial framework:
- identification of the heat pump market and what are the obstacles to further spread of the technology
- introduction of financial support or incentives for potential users to install heat pumps
- application of CO2 emission quotas to regulate the CO2 emissions of individual countries and communities in order to limit CO2 emissions as much as possible
- financial assistance in research works for the application of new models of marine energy use
- incentives for renewable energy investments depending on the overall efficiency of the system with higher incentives for the use of seawater energy in coastal areas
- tax reduction for energy efficiency measures related to the procurement of materials and equipment that are installed in installations and buildings and are related to renewable energy

Technical framework:
- development of materials needed for the construction of new devices and equipment
- use of hybrid energy systems that combine several technologies such as heat pumps, photovoltaic systems, wind energy
- development and installation of pilot projects for testing the work of technology
- promoting the use of seawater heat pumps and heat storage systems
- continuous education of installers, service technicians and designers of heat pumps

Social framework:
- increasing the level of awareness for the application of renewable energy
- implementation of new technologies in national strategies
- advertising and promoting new technologies to potential users of the system
- construction and monitoring of pilot projects and embedded technologies
- promoting heat pumps as an energy efficient technology that reduces heating and cooling bills
- production of various promotional materials, leaflets, brochures
- holding public forums, meetings and expert meetings on heat pumps

Table 1: Recapitulation of the pilot project for the installation of a water-to-water heat pump [11]

Rectors Palace, Dubrovnik, Croatia	
Group:	Thermal Energy
Name of project/plant	SEADRION pilot plant
Location	Rectors Palace Dubrovnik
Year of commissioning	2019
Name of used technology	Seawater heat pumps
Type of energy source	Seawater
Type of energy output	Thermal, Heating and cooling
Type of project	Implementation of technology
Plant status	The plant is operating in The City of Dubrovnik
Involved actors	DURA and The City of Dubrovnik
Nominal power	• Heating and cooling of four buildings (total heat load = 430 kW) • Heating capacity: 6 x 72 kW (50/45 °C) • Cooling capacity: 6 x 70 kW (30/35 °C)
Size	Not available
Annual productivity	Not available, the Pilot plant started to work in July 2019
Implementation cost	510,000.00 EUR with VAT for equipment and installation
Payback period	Not available
Operating cost	Maintenance cost approximately 20,000.00 EUR per year
Sources of financing	SEADRION project and the City of Dubrovnik
Reason for interest for COASTENERGY	• It is using seawater as a mediator for cooling and heating • An innovation system that uses the thermal energy contained in a reservoir (sea) to achieve the cooling and thermal energy in the buildings which are close to the sea • Renewable energy in public buildings near the sea • Making the building's energy self-sufficient and independent of fossil fuels
Problems and obstacles	• The problem of placing the heat pumps in the boiler room • The considered building is a monument of cultural heritage • A larger number of smaller power units had to be selected (6)
Assessment tools and methods	Although the plant is operational, there is still no data allowing to derive a cost/benefit analysis because the pilot plant was installed in July 2019. Soon we will start with a pilot plant monitoring system.
Environmental and landscape impacts	No impact.
Socio-economic impacts	Promote the use of seawater as a renewable energy source in the Old City of Dubrovnik.
Success factors	Not available
Transferability in the COASTENERGY area	SEADRION seawater technology could be available in all buildings located near the Adriatic Sea.
Keywords	Seawater, heat pump, thermal energy
Weblink	https://seadrion.adrioninterreg.eu/
Year of data collection	2019
Sources	https://seadrion.adrioninterreg.eu/

Pilot project of a heat pump in Dubrovnik

The experiences of project partners are presented in professional articles and presentations during the project implementation and are used as a basis for systematization of project experiences of Coastenergy project stakeholders.

An installation using sea energy for heating and cooling the building of the Rector's Palace Dubrovnik has been built in the City of Dubrovnik. The existing installation has been

reconstructed and a new water-to-water heat pump with a total heat output of 430 kW has been installed, which independently meets the heating and cooling needs of the building. During the reconstruction, the existing canals for receiving sea water were used, which facilitated the implementation of the project. The very core of the city of Dubrovnik is protected as a cultural monument, which significantly complicates the application of any installation that should connect the sea surface and individual buildings within the protected urban core. The total investment in this project was 510,000.00 EUR with the planned annual maintenance costs of the installation of 20,000.00 EUR. The built installation is a pilot example of the use of sea energy for heating and cooling and will be used in the future as a basis for gaining experience in building similar installations.

As part of DURA's "Seadrion" project, funded by the European Program for International Cooperation Interreg ADRION 2014-2020, the existing technical heating and cooling system in the Rector's Palace was replaced.

The new plant supplies the City Administration building, the Rector's Palace, the Sloboda Cinema and the Marin Držić Theater. The project has installed six heat pumps that use renewable energy sources as a working medium, in this case sea water, or cool / heat the complex of buildings with the help of sea water. The use of the sea as an inexhaustible heat source is ensured in an indirect way. The existing seawater manhole is located in the City Port, while the seawater recirculation pumps are located in the engine room. The price of works without VAT amounted to HRK 3,066,623.52, while the maximum amount of funds from EU funds used for the purchase of equipment for the new system is EUR 69,993.00. The pilot project of replacing the system in the Rector's Palace is of great importance because it is about the use of renewable energy sources in the cultural and historical center, or UNESCO protected area and will be a prime example for the ADRION region. The plant was put into operation in July 2019 and is used as a demonstration of the installation.

As part of the Coastenergy project, the first Local Conference and Founding Hub of Blue Energy Coastenergy DURA Dubrovnik was held on October 5, 2020, at the Hotel Adria, entitled "Challenges and opportunities for efficient blue energy management in Dubrovnik with practical examples"

The local conference was also the first gathering of local stakeholders interested in participating in the local Blue Energy Hub DURA Dubrovnik. The goals of the Coastenergy project were presented, as well as the expected results and examples of good practice of the City of Dubrovnik and the Dubrovnik-Neretva County.

At the conference, DURA employees, in cooperation with experts, identified opportunities for each stakeholder to use renewable energy sources for savings and sustainable development, emphasizing that increasing renewable energy production is key to reducing global greenhouse gas emissions.

During the meetings, they reflected on the position and usability of seawater as an energy medium, while the Port of Dubrovnik and other institutions within the walls in the immediate vicinity imposed themselves as a logical choice of key stakeholders for the construction of new installations. It was concluded that all public authorities, entrepreneurs and citizens themselves who are able to cooperate in order to establish a Blue Energy strategy and to increase the use of these forms of energy are indispensable.

The first meeting of the Blue Energy Hub DURA Dubrovnik and the first Coastenergy local conference in Dubrovnik "Challenges and opportunities for efficient management of blue energy in Dubrovnik with examples from practice" was held on October 5, 2020 at the Hotel Adria, Dubrovnik

DURA submitted "Guidelines for successful implementation of HUBs" to all partners, followed by local conferences and meetings, including for Dubrovnik. A local conference and the first meeting of the Hub was held in Dubrovnik, on October 5, 2020, in which project stakeholders and other stakeholders participated. The greatest interest was shown in the possibilities of using the sea for electricity production. At the joint workshop, the conference participants developed and defined potential pilot areas where new pilot projects could be developed. After gathering the stakeholders and the information needed about each of them, the participants created a document called “Stakeholders mapping” which includes all the necessary information about the selected stakeholders and possible projects.

It was defined at the conference that the main challenges are certainly the barriers that limit investments in blue energy in the Dubrovnik area, such as the sensitivity of the marine

ecosystem, technological readiness, but also the lack of legal frameworks. The participants of the conference believe that it is possible to realize as many such projects as possible through joint and improved cooperation and exchange of knowledge of the Coastenergy team, especially through feasibility studies, which is the main goal of the Coastenergy project.

The Coastenergy Dubrovnik team designated pilot areas, i.e., pilot actions and possible project stakeholders. As the final system for implementation, they chose the heating and cooling system, i.e., heat pumps using sea energy for heating and cooling. They opted for this system due to the environmentally friendly and sustainable nature of the planned installation.

2.EXPERIENCES OF PROJECT PARTNERS – IRENA

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.

Irena - Istrian Regional Energy Agency Ltd.
http://www.irena-istra.hr/

IRENA was founded in 2009 by the County of Istria as an independent, non-profit organization that provides advisory services to local decision makers, households and citizens on energy issues. IRENA's main activities include: promoting energy efficiency, using RES and cogeneration, implementing national and local energy programs and strategies, developing energy action plans, implementing and monitoring sustainable energy management in all public buildings.

The Coastenergy project defines the implementation of working meetings and presentations of the achieved effects of the project, so IRENA held a working meeting on November 16, 2020, February 17, 2021 and September 9, 2021, where they defined the introduction to the project. and the need to prepare a feasibility study for the whole project. Since this was an introductory meeting, the emphasis was on introducing stakeholders to the topic of the coastal energy project and showing examples of good practice from the previous Maestrale project.

The key stakeholders in the project are the City of Novigrad, the City of Poreč, the Municipality of Bale and the Municipality of Funtana. External collaborators in the implementation of the project are the Faculty of Mechanical Engineering and Naval Architecture from Zagreb and the Hrvoje Požar Energy Institute from Zagreb.

The first working meeting was held before the public call for analysis was announced. Mail was sent and all stakeholders from municipalities and cities were contacted by phone to encourage them to participate in the first introductory meeting and to present the objectives of the project.

The second local meeting was organized during the preparation of the study in order to discuss with the stakeholders' possible pilot locations and explain to them that the first procurement (within the terms of reference) contains two conceptual solutions. The first is the use of heat pumps in cultural heritage buildings, and the second is the conceptual use of wave energy in port infrastructure.

Regarding the first local meeting, the agenda was made according to the nature of the meeting, i.e., the presentation of the project and its objectives, a brief overview of the project and the presentation of the study author. Part of the meeting was reserved for open discussion and questions and answers. There was no agenda for the second local meeting as it was more focused on discussion and stakeholder and conservation proposals and explained to them what was being done through analysis and which method would be used to select a possible pilot site.

2.1. Transformation of ports and other coastal infrastructure

It was concluded that it is necessary to gain insight into a possible pilot location where the potential of blue energy could be implemented and used in the most appropriate way. Stakeholders were given the opportunity to suggest a possible location where the considered blue energy technology would be best used.

It can be said that in Croatia the use of marine heat is subject to general regulations relating to other renewable energy projects (including marine energy), and the administrative procedure for issuing permits for energy use should include a number of institutions at state and local level. The licensing process can be divided into interrelated, intertwined and agreed phases such as project planning and environmental project assessment, determining the spatial acceptability of the project and special conditions for connecting infrastructure, obtaining a concession for the use of maritime property, building and construction approval, issuing permits for performing energy activities, etc. Therefore, first of all, it is necessary to simplify the procedure for obtaining permits for the use of blue energy, which would be the first step in encouraging appropriate business services.

The working meetings were useful because the priorities or needs for blue energy were found out by the stakeholders involved. For example, the stakeholders of the City of Poreč were interested in drafting project documentation for the energy renovation of a protected city council building located on the coast and was a good candidate for the installation of a heat pump, but the final decision was made after analysis and after the building was reported. at the invitation of the Coastenergy project.

Stakeholders from the City of Novigrad were interested in installing a plant to convert wave energy into electricity in breakwaters, but given the results of the analysis showing that western Istria has a very low potential for wave energy, the cost-effectiveness of such energy is questionable. A later completed analysis confirmed this, but gave us some options and ideas for some other technologies that could be implemented through future projects. Also, with several local authorities involved, we have already collaborated on previous projects, and by re-cooperating through the Coastenergy project we are achieving one of our tasks, which is to promote energy efficiency and the use of renewable energy sources. Furthermore, the fact that a cultural heritage building is included in the project as a choice for a pilot site provides added value and benefit as this model can later be replicated to other similar buildings and sites.

During the second meeting held on February 17, 2021, potential problems in the implementation of the project were defined. In the second workshop, they tried to identify potential buildings that would be eligible to be a pilot project through cooperation with stakeholders. It was explained to the stakeholders that this first procurement (within the terms of reference) contains two conceptual solutions. The first is the use of heat pumps in cultural heritage buildings, and the second is the conceptual use of wave energy in port infrastructure. These two conceptual solutions provided inputs for the selection of 2-3 pilot projects. The final decision for the pilot construction was selected based on the results from the application form and the results of the analysis. Stakeholders were told that through the application they should report the building that is planned and renovated, and then the project will finance the preparation of project documentation for the energy renovation of the building. As these are protected facilities, the project documentation will have to comply with the guidelines of the conservation department. In order to get a better insight into the condition of the potential pilot building in Poreč, a meeting and a tour of the building has been agreed for March 1, which will be attended by representatives of IRENA, the City of Poreč, the conservation department in Pula and contractors.

Stakeholders from the City of Poreč were interested in drafting project documentation for energy renovation of the protected building of the City Council located on the coast and is a good candidate for the installation of a heat pump, but the final decision will be made after analysis and after receiving a template with potential other buildings which stakeholders will be able to report.

Stakeholders from the City of Novigrad were interested in installing a plant to convert wave energy into electricity in breakwaters, but given the results of the analysis showing that western Istria has a very low potential for wave energy, the cost-effectiveness of such energy was questionable.

Project participants were selected according to the location for which the analysis of blue energy potential was made. Since the analysis was made for the west coast of the Istrian region, all municipalities and cities whose coast is included in the analysis were invited to the first local meeting with other local authorities such as port authorities. The Conservation Department was invited as the pilot site for cultural heritage buildings was selected, and the authors of the study are the Faculty of Mechanical Engineering and Naval Architecture and the Hrvoje Požar Energy Institute.

2.2. Environmental and landscape protection

Blue energy has started to be used more intensively in Croatia only in the last 10 years, and from the technologies used we can single out the sea water / water heat pump as the one for which the interest has grown especially. Certainly, one of the good recommendations for the enhanced use of blue energy is to try to involve local authorities and other stakeholders as much as possible in various workshops (such as local hubs) through which new technologies can be presented easily and efficiently. There is certainly interest, but given that the use of marine heat does not have special treatment in Croatian legislation (special regulation, chapter or provision of environmental law) nor are special or simple approval procedures for such projects and there is no single point of charge for the issuance of all relevant information and the implementation or coordination of administrative procedures related to the use of marine energy, the implementation of such technologies in Croatia is still difficult, but is progressing. It was

concluded that no legal framework has yet been defined to protect the environment from this new technology.

The Fund for Environmental Protection and Energy Efficiency (EPEEF) is a central place for collecting and investing extra-budgetary funds in programs and projects for environmental and nature protection, energy efficiency and the use of renewable energy sources. Currently, the fund does not have a tender for co-financing such projects, but it will certainly have one in the future. Once the complete documentation for the pilot area is ready, the City of Poreč will be ready to apply for such a tender for the purpose of obtaining incentives or subsidies for the implementation of heat pump or district heating for selected buildings.

The City of Poreč, as the main stakeholder in the implementation of this project, is working intensively to reduce CO2 emissions, both in public transport and in buildings owned or under their jurisdiction. Through the previous project (ENERJ), the documentation of the energy renovation of the kindergarten building in Poreč, which is part of the cultural heritage, but also a large energy consumer due to its energy inefficiency, was successfully completed. Therefore, the focus of this project was to select, if possible, a protected building, given that energy renovation is demanding and poses a challenge given the administrative and bureaucratic difficulties it faces due to the vagueness of such renovations in Croatia. Therefore, the task of IRENA and the City of Poreč is to develop further models of renovation of such facilities through this project, which the City of Poreč and other local authorities could later use for the renovation of other protected facilities. The City of Poreč, as a stakeholder, has recognized the importance of such projects, and given its location, it certainly has the potential to harness the energy of the sea.

2.3. Implementation of system integration in the built environment

Through the meeting they concluded that it is necessary to involve all municipalities and cities and other local authorities in the introductory centre to present the objectives of the project and raise awareness of the potential of blue energy for future cooperation and possible investments.

IRENA is in constant contact with the competent bodies of the City of Poreč and the Conservation Department in Pula because they are key stakeholders. The City of Poreč is distributing the achieved results of the project with regard to the analysis and feasibility study for the installation of heat pumps in the selected building, i.e., the selected pilot location. They have already had a successful collaboration with them and the Conservation Department on one of the previous projects where the focus was on raising energy efficiency in cultural heritage sites. Any intervention on cultural heritage buildings is a complex process of maintaining the original appearance of the building, so such projects are particularly interesting and useful because they represent a kind of challenge, and later serve as an example of good practice in the restoration of such buildings.

As one of the problems, it was noticed that Istria and Croatia generally have the problem of fragmentation of local government in the form of a large number of small municipalities and cities that are sometimes difficult to include in a project and encourage cooperation on development projects. The City of Poreč was the first to apply for one of its buildings for the Coastenergy project and they showed the greatest desire to cooperate on the project.

On September 9, 2021, a working meeting of the Coastenergy project working group was held to present experiences in project implementation and construction possibilities in the existing environment. In Labin, the tenants were introduced to the Coastenergy project together with the Happen project, and a conversation was held with the contractor about the upcoming preparation of technical documentation for the selected pilot area, i.e., the Poreč City Hall. The meeting was also to be attended by representatives of the conservation department, who cancelled at the last minute. In Poreč, the focus was on visiting the selected building (pilot area) and talking to stakeholders about the upcoming preparation of technical documentation for the selected pilot area. Namely, after the analysis of the potential of blue energy for the area of western Istria and the building of the City Hall in Poreč was selected through a public call, the recently announced public call for technical documentation continued, i.e., for the project of mechanical engineering and electrical engineering for the selected building. This project envisages the installation of a heat pump, and a feasibility study will be prepared soon. It was necessary for the external contractor (in charge of drafting the project documentation) to inspect the building, especially the engine room, collect the necessary existing documentation (energy audit, sketches, etc.) and interview the representatives of IRENA and the City of Poreč. The

building is located by the sea and is an excellent candidate for the installation of seawater / water heat pump. Upon completion of the necessary project documentation, the City of Poreč intends to apply for subsidies for the installation of such a heat pump, given that the Ministry of Regional Development and EU Funds plans to issue the first call for incentives for offshore energy investment in production projects.

2.4. Which critical factors should be taken into account

From the previous experience in organizing meetings, it can be said that the biggest problem was to encourage and interest local governments to participate and be included in working groups, at least at the first one where they presented the project and its main goals and benefits. Given the low turnout at the first two meetings, and the selected pilot location in the city of Poreč, the remaining two meetings were focused on cooperation with other relevant institutions such as the Conservation Department.

During the implementation of the project, it was noticed that certain documentation (for example, architectural image of the existing condition, installation diagrams, etc.) does not exist, and certain documents will have to be re-created. The initial investment is (according to the first estimate) high, and the payback period is long (27 years) due to the relatively small area of the building. However, in the immediate vicinity there are two more buildings that are also owned by the City of Poreč, and the option of mini district heating that would be used by all three buildings, and with subsidies investments and a single return would be significantly reduced and the investment is acceptable.

For better dynamics of the project, there is currently a lack of certain documentation for a potential building in Poreč (e.g., energy certificate), but nothing that would be a problem when choosing that building for the pilot. Similar cooperation between stakeholders, the conservation department and IRENA has been successfully achieved over the past few projects, so no significant challenges or problems are expected.

A kind of problem could be the legal framework. Namely, the implementation of projects that use the sea as a source of renewable energy presupposes interventions in the sea and the coast, i.e., maritime assets, which in Croatian legislation have a special status in terms of ownership regime, conditions of use and environmental protection.

For such interventions it is necessary to obtain a concession for special purpose or economic exploitation of maritime property according to the Concessions Act (Official Gazette 69/17, 107/20), the Maritime Property and Seaports Act (hereinafter: MDSPA) (Official Gazette, Nos. 158/03, 100/04, 141/06, 38/09, 123/11, 56/16, 98/19) as a special law and the Decree on the granting of concessions on maritime domain (Official Gazette no. 23 / 04, 101/04, 39/06, 63/08, 125/10, 102/11, 83/12, 10/17).

The annual plan for the management of maritime assets in the County of Istria is adopted on the basis of the MDSPA, after a previous public consultation, which also determines the activities of granting concessions on maritime assets.

Feasibility study for the installation of a seawater heat pump in the Poreč City Hall building
To define the feasibility structure, three working local groups were defined which, in cooperation with external experts, defined potential problems in the implementation of the project objectives.

Local group 1.
City of Novigrad
City of Poreč
Municipality of Bale
Municipality
Funtana
Faculty of Mechanical Engineering and Naval Architecture
Hrvoje Požar Energy Institute

Main goal: Objectives of the analysis of the potential for the use of sea heat and wave energy in the area of western Istria

Main problem: Lack of interest in potential projects

Local group 2.
City of Novigrad
City of Poreč
City Umag
City of Rovinj
Conservation Department Pula
Main objective: to identify potential buildings that would qualify for the pilot project
- two conceptual solutions for the use of heat pumps in cultural heritage buildings and the use of wave energy in port infrastructure
- Stakeholders from the City of Novigrad were interested in the installation of a plant for converting wave energy into electricity in breakwaters

Local group 3.
City of Poreč
Arhinatura ltd. (as an external expert)
The main goal: a visit to the selected facility (pilot space) and a discussion on the upcoming preparation of technical documentation
- inspect the building, especially the engine room, collect the necessary existing documentation (energy audit, sketches, etc.) and conduct an information interview with representatives of IRENA and the City of Poreč
- Lack of certain documentation

Study analysis of thermal and wave energy potential of sea water in western Istria
Within its project, each working group defined several areas of activities and analyzes that need to be performed:
- Analysis of natural conditions in western Istria
- Bathymetric data for sea currents, wind, wave, sea temperature
- Analysis of available technology for the use of wave energy and thermal energy analysis of the potential of the application of certain technologies in western Istria
- Energy needs assessment of western Istria

- Estimation of the total potential of wave energy and sea heat energy and comparison with the energy needs of western Istria
- Plan for obtaining permits and approvals for projects using wave energy and marine heat
- Selection of pilot area proposals
- Techno-economic analysis of seawater heating energy and wave energy
- SWOT analysis

Study - bathymetric data

Through the study of bathymetric data, each local working group in the domain of its project defined the necessary parameters for making relevant decisions on the final selection of the project:

- Depth
- Sea currents
- Waves
- The wind
- Temperature

Depth

The greatest depth of the Adriatic in the western part of Istria does not exceed 50 m. The sea of the western part of Istria can be considered a very shallow sea with an altitude of between 2 m and 10 m.

Sea currents

In general, given the current readiness of tidal technology, investment costs and technical barriers, it is recognized that conditions conducive to tidal energy should reach current speeds at the peak of spring tides between 2 and 2.5 m / s. The power flow increases near the Istrian peninsula and reaches a maximum depth of an average speed of about 0.066 m / s, so the potential for use to generate energy is low.

Wind

For this study, nine points were selected, i.e., locations on the west coast of Istria according to individual cities or municipalities. These selected points, as future sites for the installation of

marine renewable energy devices, are located about 1.5 km from the coast near the given city or municipality.

Pilot project: defining technical conditions

- Fan convectors have already been installed in the City Palace building
- The reconstruction of the building envelope, which is protected as a cultural asset, is limited
- Distance from the sea is 20 m
- The sea in front of the City Palace is 5.8 m shallow and is a busy area near the port, which makes it impossible to lay pipes for direct water intake
- For the needs of underground intervention and obtaining a water permit, it is necessary to carry out the procedure in three phases:

achieving water conditions,
performing water research works,
obtaining a water permit

Pilot project: technical documentation Mechanical project

-Development of technical documentation for integrated energy recovery, which includes the following projects:

Mechanical project of thermotechnical installations
Electrical engineering project

-Mechanical project of thermotechnical installations includes the development of the engine room reconstruction project and the replacement of the existing energy source

The mechanical design of thermotechnical installations is made at the level of preliminary and main design. Preliminary design must contain 3 variants of the solution:

- Direct capture of seawater from a nearby port
- Coastal seawater abstraction by wells
- Indirect use of sea water via well exchangers (closed system)

Pilot project: technical documentation Electrical engineering project

- The electrical project will be made at the level of the main project

- The subject of the installation is necessary for the adequate functioning of the heating and cooling system of the building
- These installations also include a central monitoring and control system
- In the immediate vicinity of the shaft in which this system is installed, an information screen will be installed on which information on the functioning of the heating and cooling system in the building in question will be monitored.
- Technical documentation will be prepared with the objectives: Reduction of delivered energy in the included buildings by at least 20%

Pilot project: technical documentation of the feasibility study

- Preparation of a feasibility study and cost-benefit analysis based on input data from the preliminary design of the thermotechnical system.
- The preliminary design will envisage the replacement of the existing heating system that uses heating oil with a system of using a heat pump which, in addition to heating, also produces cooling energy for the needs of the building.
- The analysis will be conducted on the basis of a comparison of several offered variant solutions, which will be based on the comparison of:
- variant solutions proposed in the preliminary design with the existing thermotechnical system,
- mutual comparison of the offered variant solutions of the heat pump system.

Variant solutions are provided exclusively for the primary circuit, as follows:

- use of open seawater abstraction,
- use of seawater abstraction by the coastal well system
- closed primary circuit (closed well exchanger immersed in sea water)

EXPERIENCES OF PROJECT PARTNERS, POREČ

In the City of Poreč, an installation was built that uses sea energy for heating and cooling the building in question, the Parentium Hotel. For the heating and cooling of the hotel, sea water is used, which is directed towards the engine room of the building with a total installed thermal power of 2 x 692 kW, which is sufficient to heat the building area of 20,582 m^2. The total investment in this project amounted to EUR 2 million, while the estimated annual savings are

EUR 19,600.00 compared to conventional heating systems using natural gas. The project is being processed within the scope of the Coastenergy project, which would develop heating and cooling technologies using seawater. By applying this installation, the hotel has achieved a high level of CO2 reduction compared to other similar buildings.

Table 2: Recapitulation of the water-water heat pump installation project

Hotel Parentium, Poreč	
Group:	Thermal energy
Name of project/plant	Hotel Parentium
Location	13°35'18'' Longitude; 45°12'12'' Latitude
Year of commissioning	2014.
Name of used technology	Seawater heat pumps
Type of energy source	Thermal energy
Type of energy output	Thermal energy (heating/cooling)
Type of project	Full operating plant
Plant status	Operating
Involved actors	Owner of the Hotel complex and equipment producer CIAT Group
Nominal power	Cooling 692 kW x 2 Heating 795 kW x 2
Size	20 582 m^2
Annual productivity	723 MWh per annum
Implementation cost	2 mil. €
Payback period	6 years
Operating cost	Not available
Sources of financing	Private funding
Reason for interest for COASTENERGY	Project is in the scope of COASTENERGY project since it is related to the exploitation of seawater thermal energy by using heat pumps technology. As an example of good practice, the project is not only relevant but extremely important for COASTENERGY project, as well as for the programme area.
Problems and obstacles	Problems are related to spatial planning which is widely missing for such technology. Need for drilling to exploit the thermal potential.
Assessment tools and methods	Not available
Environmental and landscape impacts	At the end of the chalk is almost the entire Adriatic carbonate platform, so also the area of Istria. Under the influence of the regional phenomenon of locally very different duration. The waterfall is open to the sea which is 0 to 100 m away from the nearest the widest edge of the area.
Socio-economic impacts	The hotel achieved carbon-neutral production and consumption of energy, contributing to the sustainable development of the touristic offer. Simultaneously, the hotel ensured savings in energy consumption for a longer period.
Success factors	Annual savings for heating/cooling of the system of the heat pump water is approximately 19,600.00 EUR.
Transferability in the COASTENERGY area	Project is in the programme area.
Keywords	Seawater heat pumps, heating, cooling, hotel Parentium, Istria
Weblink	http://lagunaporec.com/hotel-laguna-parentium-porec
Year of data collection	2019
Sources	http://lagunaporec.com/hotel-laguna-parentium-porec

BLUE ENERGY HUB OF THE CITY OF PLOČE - IZVOR PLOČE d.o.o.

Source Ploče d.o.o. During the implementation of the project, he gave a statement on the experience gained and we are transmitting part of it here. Primary goal Izvor Ploče d.o.o. is to increase traffic, satisfaction and consumer confidence in the safety of drinking water and the preservation of healthy and quality water for generations to come.

Source Ploče d.o.o. carried out the project of reconstruction of the pressure pipeline from the Klokun water pumping station to the Ploče reservoir through the financing of EU funds. Also, the

projects of the Ploče Agglomeration are being implemented, which according to the budget and fi financing from EU funds is the largest project in the City of Ploče and the AdSwim project - Managed use of treated municipal wastewater for the quality of the Adriatic Sea. So, the company already has experience with the implementation of similar project tenders and is interested in the Coastenergy project.

For the inclusion in the Blue Energy Hub of the City of Ploče, they decided to get acquainted with the technologies of renewable energy sources and technologies for the use of water for energy production. The Klokun water pumping plant is a large consumer of electricity and is considering all available technologies to reduce electricity consumption, thus contributing to the preservation of the environment and the sustainable use of natural resources.

Their most interesting activity was a visit to the Rector's Palace in Dubrovnik, where they got acquainted with the technology of the heat pump. Apart from the technology itself, for Izvor Ploče d.o.o. this location is important due to the difficult conditions required for construction and they were able to obtain information on the procedures required to implement such technology. Also, at the third meeting of HUB, we got acquainted with the relevant data on blue energy technology and the experience gained will serve them well.

BLUE ENERGY HUB OF THE CITY OF PLOČE - PUBLICLY OPEN SCHOOL OF PLOČE

Ploče Public Open University is a public institution owned by the City of Ploče with the main activity of performing all forms of cultural and educational programs, and in accordance with the real needs of society organizes, conducts and cooperates in concerts, plays, film screenings, lectures, workshops, presentations and the like. During the implementation of the project, they gave a statement about the experience gained, and we are transmitting a part here.

They believe that through this project Coastenergy can greatly contribute to the local community from an environmental point of view. An increase in renewable energy production is necessary to reduce global greenhouse gas emissions. On the other hand, the building of the Ploče Cultural Center is in an ideal location for the application of Blue Energy through the production of electricity, which would greatly reduce the cost of electricity.

The third meeting of the local Blue Energy Hub of the City of Ploče is the most interesting because at that meeting the result of the analysis of the energy potential of the Ploče Cultural Center was presented as a preliminary phase of the feasibility study for the installation of a geothermal crane in the Ploče Cultural Center.
The study showed that the current level of energy efficiency of the Institution is satisfactory. However, there is room for improvement, especially in the segment of cooling energy, where the additional installation of a crane on seawater would achieve savings of 80 percent in summer and 30 percent in winter. It would also be useful to install photovoltaic systems and solar panels on the roof.

The College believes that it would be useful to educate users on the use of renewable energy sources in various ways, as well as to get acquainted with the benefits of using blue energy in order to improve the quality of life of the local community.

EXPERIENCES OF PROJECT PARTNERS, ROVINJ

An installation was built in the City of Rovinj that uses sea energy for heating and cooling the subject building of the Dr. Martin Horvat Hospital. For the heating and cooling of the hospital, sea water is used which is directed towards the engine room of the building with a total installed thermal power of 700 kW, which is sufficient to heat the building area of 167,312 m2. The total investment in this project amounted to EUR 1.2 million, while the estimated return on investment is 7 years compared to conventional heating systems using natural gas. The project is being processed within the scope of the Coastenergy project, which would develop heating and cooling technologies using seawater. By applying this installation, the hotel has achieved a high level of CO2 reduction compared to other similar buildings.

Table 3: Recapitulation of the water-water heat pump installation project

The Orthopaedic and Rehabilitation Hospital „Prim.dr. Martin Horvat"	
Group:	Thermal energy
Name of project/plant	The Orthopaedic and Rehabilitation Hospital „Prim.dr. Martin Horvat"
Location	13,64°; 45,10°
Year of commissioning	2016
Name of used technology	Seawater heat pump
Type of energy source	Thermal energy
Type of energy output	Thermal energy
Type of project	Fully operating plant
Plant status	Operating
Involved actors	The investor is named in the name of the project. The designer is GEO-5 d.o.o.
Nominal power	700 kW
Size	167,312 m^2
Annual productivity	800 MWh
Implementation cost	1,2 mil. €
Payback period	7 years
Operating cost	Not available
Sources of financing	EU funds and private equity
Reason for interest for COASTENERGY	The installed technology is directly related to the scope of project COASTENERGY. Thermal seawater heat pumps are the only mature and commercially viable technology for the installation in coastal and port areas. Since the COASTENERGY aims to improve and ease the procedure for deployment of blue energy (BE) devices, obtained knowledge from such project are very valuable and important for further actions.
Problems and obstacles	Problems are related to marine spatial planning which indicates the need for drilling. Moreover, the obstacle might be the lack of proper funding if EU funds cannot be used.
Assessment tools and methods	Not available
Environmental and landscape impacts	Probation work was carried out in the area where the terrain is lacking primary shoots of the rock from which the substrate was constructed. It was found that this rock layer is shallow and characterized by high primary porosity. The waterfall is opened to the sea which is to 100 m away from the nearest edge of the area. Pressures are higher in this area due to the tectonic activity.
Socio-economic impacts	Socio-economic impacts are focused on exploiting locally available renewable energy sources by improving the quality of life of locals. Benefits of this project are visible from the fact that the hospital is using renewable sources to accommodate users and achieve thermal comfort.
Success factors	Appropriate funding, regulatory framework,
Transferability in the COASTENERGY area	Project is in COASTENERGY area.
Keywords	Seawater, heat pumps, heating
Weblink	Not available
Year of data collection	2019
Sources	Various

3. EXPERIENCES OF PROJECT PARTNERS – SDEWES

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.

International Center for Sustainable Development of Energy, Water and Environment (SDEWES CENTER)
http://www.sdewes.org/

Nikola Matak, mag.ing.mech, is a doctoral student at the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb. He graduated from the FSB at the Department of Power Plants, Energy and the Environment. He is currently employed as a project manager at the International Center for Sustainable Energy, Water and Environment - SDEWES Center and works on projects YENESIS, COASTENERGY, JointSECAP and KeepWarm. He is an expert in energy planning and development of innovative business models for the implementation of RES projects who participates in the implementation of similar projects as Coastenergy and finds a lot of areas to implement the objectives of the Coastenergy project.

The "Clean Energy for EU Islands" initiative was launched after the signing of the Political Declaration on Clean Energy for EU Islands by the European Commission and 14 EU member states that have islands. The declaration says the islands face a number of energy challenges and opportunities given their specific geographical and climatic conditions. In 2018, based on the Declaration, the Commission, in cooperation with the EU Parliament, launched a Secretariat that should meet the goals of the Clean Energy for EU Islands initiative. The main goal is to ensure the energy transition of the islands, so that the inhabitants of the islands are a prerequisite for transition, and that the islands are the leading locations for innovation in the field of clean energy in the energy transition of Europe. The Secretariat should assist island institutions in transition by supporting them in developing and implementing plans for the transition to renewable energy

supply. The main topics to be covered in the plans are energy production, energy efficiency, heating and cooling, transport to islands and transport to islands.

From the beginning, the SDEWES Center has been actively involved in supporting the energy transition on the islands in Croatia. Activities in which SDEWES has participated include SEAP developments, decarbonization strategies, development of renewable energy sources and transport electrification projects, cost-effectiveness studies and education. SDEWES is currently supporting the Initiative and related members in Croatia in developing energy transition plans and finding pilot projects. One example is the cooperation with the towns of Mali Lošinj and Cres, OTRA (Island Development Agency) and the Island Movement in the Cres-Lošinj archipelago, which is the pilot island of the Initiative. The Cres-Lošinj archipelago is also a pilot site in the COASTENERGY project where the development of blue energy technology for the use of marine energy will be supported. SDEWES is also actively working on other projects on the islands involved in the Initiative, such as the YENESIS and JointSECAP projects, where there is also cooperation with the Island Movement and other island institutions.

The main benefit for the island community when joining the Initiative is the possibility of developing a plan for the transition to clean energy with the support of experts involved in the work of the Secretariat. The 6 islands (one of which is the Cres-Lošinj archipelago) selected as pilot islands received direct financial and technical support for the development of the aforementioned plans. 25 islands have been selected to support the Secretariat in the technical and financial planning of their energy projects.
In Croatia, these islands are Cres-Lošinj, Dugi Otok, Korčula and Žirje.

In addition to these islands, the Initiative supports the development of an energy transition plan for other Croatian islands, primarily Korčula, Brač and Hvar. The Cres-Lošinj archipelago has completed its plan and plans to decarbonize the island by 2040 with a focus on green electricity production, with new 22.5 MW photovoltaic installations, increasing energy efficiency of buildings, using renewable sources such as solar systems, heat pumps, and photovoltaic systems, electrification of transport on the island and electrification, i.e., gasification of ferry traffic from the island.

Involving the local community is one of the most important topics on which the Initiative is most focused. During previous developments of similar plans or strategies, one of the main shortcomings was that the plan was written by external experts and did not maintain specific conditions at the required location. In this case, this was avoided due to the development of the plan by local institutions that have professional support and bring together the wider community. The local community is involved through various workshops and conferences that are generally or specifically focused on a particular problem. Another option for involving the local community is through an iterative circle where the community makes suggestions on various versions of the plan, similar to a public consultation. The local community is divided into 4 main sectors - NGOs, business, public and academic, and in the case of the Cres-Lošinj archipelago, more than 30 interested institutions are involved.

Although the two initiatives seem very similar, due to the focus on local levels of decarbonization and CO2 emissions, they also have several important differences. The main thing is that the Agreement is mostly focused on cities and urban units. In contrast, the Clean Energy Initiative on Islands focuses on islands that are most often rural areas. Also, the Covenant of Mayors is focused on reducing CO2 emissions and adapting to climate change. Again, the Initiative is focused on island development through clean energy projects. The boundaries of the observed areas in the case of an initiative are the geographical boundaries of the island. At the same time, under the Covenant of Mayors, these are the administrative boundaries of municipalities. For the islands, this poses certain problems as many projects require the cooperation of several municipalities. The most significant difference observed in the pilot case is in the institutional, technical and financial support from the secretariat and related institutions and detailed instructions for involving the local community. This has significantly changed the process of developing island energy transition plans because it proposes a process that involves the wider local community.

TRANSNATIONAL COASTENERGY

The founding meeting of the Blue Energy Group was held on September 9, 2020 in the town of Cres, which was attended by local stakeholders from the observed area. The basis for planning was the Analysis of the potential of blue energy and the selection of pilot areas that they developed together with expert associates. These studies were presented to stakeholders who were presented with which blue energy technologies are most applicable in their area and which

pilot areas were proposed. It was necessary to find data on the legislation for the implementation of blue energy technologies, primarily seawater heat pumps.

The key stakeholders are representatives of cities and municipalities, research institutions, local associations and institutions, entrepreneurs, especially from the hotel sector where there is a significant need for heating and cooling in the coastal zone, then representatives of port authorities in the observed area who can give us first-hand information. for legislation for the use of marine property.

The mentioned analyzes of the Analysis of Blue Energy Potential and Selection of Pilot Areas were presented, as well as the issue of legislation. They received feedback from the port authority which are obstacles to obtaining a concession to use the marine property for the purpose of installing a heat pump. They also found out about additional buildings that are potential candidates for the installation of a heat pump, and requested information about these buildings (energy certificates).

The most interesting buildings for further consideration are the Kimen Hotel in the town of Cres, the town administration of Mali Lošinj, the primary and secondary school in Mali Lošinj, and the preliminary design for the building of the Blue World Institute. Stakeholders themselves were most interested in the issue of issuing concessions and any other necessary permits, as well as the price and cost-effectiveness of the proposed technology.

The first important conclusion is that the only commercially usable and cost-effective technology in the pilot area is the exploitation of marine thermal energy using heat pumps. Other technologies such as wave energy collection are not cost-effective, as periods of significant waves are too short in the Cres-Lošinj archipelago, as well as in most of the Adriatic.

They have designated a pilot study to work on a feasibility study. Their main goal was to agree with the stakeholders which of these buildings have the best potential for the implementation of heat pumps and for which building the implementation of the project is most feasible. After that meeting, they designated a pilot site for a feasibility study. They opted for heat pump technology as the most cost-effective technology for the exploitation of blue energy. Energy consumption

for heating and cooling is high in the observed area. Other technologies such as wave energy collection or tides are not cost-effective due to long periods without significant waves and relatively small tidal amplitudes.

They then analyzed the data for the proposed buildings from the first meeting, after which they discussed with stakeholders at the next meeting which buildings were potentially the most promising for the application of heat pumps. Based on all that, they decided which building to do a feasibility study for.

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the project's effects, so SDEWES held several working meetings to define the introduction to the project, selected locations for pilot projects and the need for a feasibility study of the entire project.

The first meeting of all stakeholders was held on September 9, 2020, after the completion of the analysis of blue energy potentials. They invited a wide range of stakeholders to share information and gain insight into potential locations. The second meeting was held on March 30, 2021 after selecting pilot sites to plan future actions. Representatives of project partners (SDEWES) and all stakeholders are involved in important activities in the target area, stakeholders with experience with similar projects and other experts involved in project development. The third meeting of the working group was held on October 4, 2021. A meeting was held at which the economic assessment of the installation of a seawater heat pump in the Mali Lošinj City Hall was presented and the possibilities of applying for project financing were examined.

They agreed on future co-operation to apply for EEA funding for SWHP grants in Croatia.

3.1. Transformation of ports and other coastal infrastructure

Local stakeholders are interested in seawater heat pump solutions. They analysed additional facilities that have great potential for the use of seawater heat pumps, after which they decided to develop a pilot project in the City Hall of Mali Lošinj.

The working group defined all the restrictions in the building and informed the city representatives along with the mayor. Stakeholders who developed similar projects shared their experiences. Representatives of the City shared their interests and demands regarding the pilot project that will be developed and decided on future steps.

After the meeting, the working group analysed all the sites that they considered had great potential. We requested additional information and documentation on their buildings, energy demand and existing heating and cooling systems. We agreed on potential solutions with the town of Mali Lošinj and arranged a meeting at the 2nd hub. After that, we hired an external expert and decided on the specifics of the pilot project. After that, together with an expert, we met with city representatives and audited the entire building.

3.2. Environmental and landscape protection

The installation of seawater heat pumps is feasible in the target areas and represents a great potential for reducing the carbon footprint, importing fossil fuels and reducing heating and cooling costs. The procedure for installing heat pumps needs to be simplified and defined from start to finish, including securing all necessary permits and concessions. Particular focus should be on constraints such as preserving architecture, the availability of the required power capacity, heating demand and energy efficiency throughout the urban zone.

The Fund for Environmental Protection and Energy Efficiency provides subsidies for the installation of heat pumps and the part of the investment covered, and the maximum amount depends on the location (the island gets a higher amount, 60% or 80% depending on location and conditions). There are other EU projects that finance the development of this type of project. The goal of subsidies on installations is to reduce carbon dioxide emissions.

3.3. Implementation of system integration in the built environment

Due to the architectural conservation of the promenade between the building and the seawater, but also the possible complications with the concession, it was difficult to design a project that would include direct input of seawater. So, they decided to indirectly engage and drill a well on the other side of the building. Obtaining the necessary certificate from the electricity operator will be necessary because it does not currently exist, and will be obtained during the development of the project.

3.4. Which critical factors should be taken into account?

Many stakeholders have taken an interest in the technology and are confident that there will be even more encouraged groups after the completion of a pilot project they are developing with external experts. Participation in the working meetings proved to be good and all new potential locations were defined.
It was necessary to hire a design office and a company that deals with the installation of heat pumps on sea water, and to hire a construction company that can build wells and channels for pipelines for water supply and drainage.

4. EXPERIENCES OF PROJECT PARTNERS – UNICAM

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.

University of Camerino (IT)
www.unicam.it

Maria Chiara Invernizzi is the scientific coordinator of the University of Camerino team for the COASTENERGY project. The University has so far carried out two important activities to involve local stakeholders and activate the participation process by encouraging the development of marine renewables in the Adriatic: the local conference "Energy from the Sea" (held on 11 February in San Benedetto del Tronto) and the first meeting of local Energy Group" (June 4), which was held online for health reasons.

The topic of the use of sea energy has aroused great interest, perhaps precisely because it is not yet well recognized, so local actors want to know more. This was also concluded during a well-attended local conference. From the beginning of the project, the university tried to arouse interest and convey clear information through preliminary interviews and the preparation of "targeted" brochures, which simply explained the possible benefits of Blue Energy for various user groups such as public bodies, businesses, associations and citizens.

The university concluded that there is a difficulty in involving some sectors of regional government. Representatives of the energy sector were immediately available and present for answers and advice. Other sectors that were able to provide important information on authorization procedures found it more difficult to get involved in project implementation. A considerable problem has been observed with the implementation of marine renewables. In any case, the observed problems in the implementation of the project indicated the usefulness of such a project, which can act as a "catalyst" for activating cross-sectoral cooperation within public administration and can encourage changes in regulations and laws.

The local conference organized by the University was attended by almost 50 people from different categories: local and regional authorities, companies, trade unions, environmental associations, schools, universities and research institutions, media and citizens. Some of them also participated in a local meeting, which was attended by several people and, more from a technical point of view, discussed the topic "Blue energy systems in the Marche region: authorization procedures and environmental impact assessment".

They focused on the energy that can be obtained by moving waves and selected several technologies that they consider appropriate for the specific characteristics of the local coast, in terms of potential production, visual impact and ease of installation. This refers primarily to surplus wave energy converters and attenuators, which have poor visual impact and help mitigate wave movement and thus coastal erosion, and systems that combine floating modules and hydraulic pistons specially developed for the Mediterranean and can be easily installed in existing port facilities.

Their analyzes led to the identification of two possible pilot areas: the port of Ancona (especially the north-eastern breakwater) and the part of the sea opposite the Sentina Reserve, in the municipality of San Benedetto del Tronto. For both areas, the wave energy potential was estimated to be around 43 GWh / year.

All working meetings were important in order to initiate a discussion and spread knowledge on the topic of Blue Energy, but also to increase the interest of the regional community in these technologies.
They realized that the Coastenergy project, by identifying areas suitable for the installation of systems for the production of energy from marine renewable sources, can make an important contribution to the development of the new regional energy plan that is currently underway. This will be crucial for the future capitalization of the project results.

In addition, problems with authorization procedures have been confirmed, especially for offshore facilities: insufficient clarity, skills overlap, but also a lack of technical knowledge by public authorities, making it difficult to evaluate innovative proposals. On the one hand, this suggests that we may need to work on a joint document to be submitted to the Region to simplify the procedure while, on the other hand, in cooperation with local environmental associations, we should continue to promote knowledge, especially towards public authorities and citizens.

The meetings also stressed the importance of focusing on pilot projects that can bring multiple environmental benefits: they are able to produce energy but also, for example, reduce coastal erosion.

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the project's effects, so UNICAM held several working meetings to define the introduction to the project, selected sites for pilot projects and the need to prepare a feasibility study for the entire project.

The first meeting of the local working group was held on July 6, 2021 and most meetings were conducted online using computer applications to reduce the direct contact between participants due to the spread of viral infections. The virtual meeting aimed to present the results of the COASTENERGY project that could be of interest to local stakeholders, including the Ancona wave energy pilot project, the Transboundary Coastal Energy Observatory web platform and related webGIS. The meeting was also conceived as an opportunity to plan future joint initiatives for the development of marine renewable energy along the Marche coast, in line with EU priorities for the 2021-2027 programming period. Due to the limitations caused by the COVID-19 pandemic, all meetings were held online on the Google Meet platform, which was chosen for its ease of use and the ability to send automatic reminders before meetings.

The first two meetings did not have a predefined agenda: only the main goal and theme of the meetings were defined and explained in the invitations. On the contrary, the third meeting was more capitalization oriented and was supposed to encourage future blue energy initiatives.

This required a different approach. Moreover, the organization was conducted a year after the previous meeting, and there was a need to attract the attention of stakeholders and stimulate their interest in participating.
Therefore, a detailed agenda was prepared and distributed together with a link to the online meeting, including a presentation on EU funding opportunities for blue energy, as well as a synergy with the Interreg IT-HR project JOINT_SECAP.

The invitees were selected on the basis of a contact list developed by UNICAM at the beginning of the project, which has already been used to organize the Local Conference. Along the way, additional contacts are included, based on further research on blue energy topics and professional staff contacts.

The selection criteria included the local / regional scope of the activities invited and the interest expressed in the project during previous contacts (LC, bilateral meetings, etc.).

Stakeholders were involved
- Ms. Laura Rotoloni, Mr. Guido Vettorel - Central Adriatic Port Authority
- Mr. Antonio Leone, Ms. Federica Allegrezza - Regional Environmental Protection Agency (ARPAM)
- Mr. Saimon Conti - CNT Technologies s.r.l. (local SMEs)
- Mr. Frank Bacher - Marel s.r.l. (local SMEs)
- Mr Pierluigi Penna - CNR-IRBIM (branch of the National Research Institute)
- Vice-Rector Graziano Leoni, prof. Carlo Bisci and prof. Luigi Maponi - UNICAM
- Prof. Maurizio Brocchini - Marche Polytechnic
- Mr. Sergio Trevisani - Municipality of San Benedetto del Tronto
- architect Federica Benelli - CRAS s.r.l. (company that helps the municipality of San Benedetto del Tronto within the Interreg IT-HR project JOINT_SECAP)
- Mr Andrea Stella - EcoPro s.r.l. (company contracted by UNICAM to prepare a feasibility study for a pilot project)
- Mr. Alberto Monachesi - Imagina s.r.l. (company that organizes the annual event "Tipicità in blu", presenting business innovations in the blue economy)
- Mr. Raffaele Macina, engineer

4.1. Transformation of ports and other coastal infrastructure

The presentations focused on the progress of the COASTENERGY project, the feasibility study prepared for the Ancona wave energy system (UNICAM pilot project), and the funding

opportunities offered by the EU in the new blue energy programming period, as well as synergies with Interreg IT -HR project JOINT_SECAP, which is developing SECAP in the area of San Benedetto del Tronto.

Coastenergy partner PP3 - UNICAM
Project location Port of Ancona (IT)
A kind of blue energy wave
Energy production 670 MWh / year
Investment price 1,000,000 EUR
Return period 11 years
Saved CO2 emissions 220 t / year

An agreement on the pilot area of the port of Ancona and the consolidation of relations with the Port Authority (data exchange) was drafted and the technologies for the pilot project were selected. A joint document containing 10 proposals for simplification of the procedure has been prepared and will be submitted to the Government of the region.

4.2. Environmental and landscape protection

The need to mobilize (also within local coastal energy hubs) universities, experts and environmental associations to promote the dissemination of science-based, up-to-date information on blue energy has been identified. Training / professional refreshment of civil servants on blue energy issues is needed, especially those who can be involved in the evaluation and authorization procedures of project proposals. It is necessary to establish assistance services to entities interested in applying for EU funds in connection with feasibility studies for the installation of blue energy systems.

The implemented activities included an analysis of the possibilities of project implementation in the existing infrastructure
- Inclusion of blue energy in the existing system of energy, innovation and spatial planning

- Identifying offshore areas for temporary installation and testing of new devices in a real environment
- Formalize local centers, including key stakeholders (bodies responsible for managing EU funds; entities in charge of environmental impact assessment, licensing procedures and spatial planning; decision makers; development technologies and / or manufacturing companies; coastal municipalities; universities and research institutions that work in relevant research domains; environmental associations)
- Creation of One stop shops for guiding proposers in the authorization procedure
- Overview of approval procedures, making them simpler, proportionate to the size, cost and possible impacts of the plant

4.3. Implementation of system integration in the built environment

Difficulties in the development of studies varied mainly depending on the type of technology selected for the pilot project (consolidated compared to new technologies. Lack of specific data on wave energy devices (production costs, energy yield, quantity and nature of materials used, required maintenance operations makes it difficult to quantify the costs and benefits of installation, and to consider life cycle assessment.

In both Italy and Croatia, regulatory aspects play a key role (complicated / unclear licensing procedures, overlapping competencies, lack of specific BE regulations, fragmentation of local authorities, maritime spatial planning process still ongoing (). This requires procedural restructuring and simplification, as well as stronger efforts to coordinate between the sector and the actors involved in the use and sustainable development of marine areas.

During the definition of the project, they indicated what financial possibilities the project has for co-financing from different funds:
- Creating economic and financial incentives at national or regional level.
- Inclusion of blue energy in new calls for ERDF and EMFF Operational Programs 2021. 2027.
- Support for research in the blue energy sector through ad hoc calls for research projects or prototypes

- Economic financial mechanisms that allow innovative companies to cover feasibility and design costs
- Use of innovative procurement to encourage the implementation of blue energy projects.

4.4. Which critical factors should be taken into account?

During the development of the project, they defined the following critical factors that should be considered in the further development of the project:
- Resource modeling (analysis of marine energy potential)
- Choosing a place
- Technical considerations
- Energy demand, production, demand coverage and consumption
- Life cycle considerations
- No technical limitations
- Impact on the environment and landscape
- Costs and socio-economic performance
- Licensing procedure
- Comparative grade.

The structuring of the permanent observatory supported by the internet web portal and its activity will focus on:
- providing harmonized and updated data and information,
- meeting of research and entrepreneurial initiatives
- networking with relevant macro-regional and EU projects, partnerships,
- institutions and thematic networks, as well as capacity building and training of key stakeholders

The Coastenergy project database webGIS page was created in which all project data were entered:
- Data collection
- Cataloging data

- Geographic data analysis
- Homogenization
- Upload online

Figure 5: Coastenergy project website [11]

WebGIS: coastenergy.unicam.it

5. EXPERIENCES OF PROJECT PARTNERS – UNIUD

Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.
University of Udine (IT)
https://www.uniud.it

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the project's effects, so UNIUD held several working meetings to define the introduction to the project, selected locations for pilot projects and the need for a feasibility study of the entire project.

5.1. Transformation of ports and other coastal infrastructure

An analysis is carried out to determine the shortcomings and advantages of the planned project, which assesses whether the project is worthwhile.

Obstacles needed to be defined in order to find possible solutions to ensure feasibility
- Bureaucratic barriers
- Plant implementation
- Stakeholder engagement and coordination
- Legal obstacles
- Environmental barriers

Preliminary activities needed to be developed as critical success factors
- Request for partnership with solid companies

- Request for state incentives and grants
- Request for permission
- Checking that the project complies with current and updated regulations
- Verification of environmental regulations
- Stakeholder engagement to ensure feasibility

Activities needed to be considered for executive planning needed to be developed
- Realization of the first prototype in scale (first phase TRL5, then TRL7)
- Site preparation
- Realization of the machine
- Preliminary and pilot tests, and installation
- Verification and standardization of use with consequential monitoring

5.2. Environmental and landscape protection

The project and the construction of a new installation are planned, so a feasibility study has been prepared at Piazza Unità d'Italia, Trieste. The historic center of Trieste is characterized by the proximity of the sea, a basin that is characterized by a depth of ten meters and temperatures with limited variations throughout the year 14 -16 C in summer and 9 -11 C in winter. The square has a rectangular floor plan with a total area of 12,280 m2. The square opens on one side towards the Gulf of Trieste and is surrounded by numerous palaces and public buildings.

It was necessary to request authorization for installation on the marine property
- Maritime good
- Port Authority Office
- Fvg region
- Municipality of Trieste

It was necessary to meet all regulations when implementing the project
- Withdrawal and use of water

- Master plan for using the site

Environmental regulations had to be complied with
- Environmental Protection Act 152/2006
- (Legislative Decree No 152 of 3 April 2006)

5.3. Implementation of system integration in the built environment

To assess the technical resources needed and available for the implementation of the project, analyzes of all technical equipment planned to be installed in the system were conducted:
- Heat pump
- Heat exchangers
- An annular circle with pipes connecting all the buildings
- Water intake filter
- Connection of maritime suction pipe works to the seabed
- Service facility where the sea heat exchanger is located
- Sensors for monitoring temperature, pressure, salinity flow rate, etc.
- Cleaning system
- Heating and cooling system connected to buildings
- Thermal power plant
- Monitoring sensors in buildings
- Difference between our source fluid, seawater), technical fluid energy conveyor from the sea side to the machine side and coolant

Defined shortcomings of planned technologies
- Noise
- Maintenance (cost and time)
- High installation costs
- Availability of a suitable place for the installation of the system and a suitable place in the buildings

Defining the advantages of planning technology

- Provide more energy
- CO2 reduction
- Energy from renewable energy sources
- High yield compared to other technologies
- Modular technology
- Possibility of hot and cold
- Possibility of making hybrid systems

5.4. Which critical factors should be taken into account?

The main criticism was to involve new stakeholders in the project. To mitigate this point, they also planned to organize dissemination and enrollment monitoring activities two months before the event. They also used this methodology for the third cross-border event (May 2021), and adopted the same strategy for the next three local meetings in September 2021.

Conclusions after defining the project itself are stated:

- The feasibility study of this technology should be assessed taking into account the five aspects presented. Therefore, a multidisciplinary project team is needed
- The feasibility study shows that the project is technically feasible, but large investments are needed
- Long payback periods require partnerships and national incentives
- Obstacles can be overcome first by scheduling and planning activities that are key to the success of the project
- From year to year, from the beginning, the following points need to be addressed
- Identification of energy needs of end users;
- Detailed economic assessment;
- Environmental impact analysis.

6. EXPERIENCES OF PROJECT PARTNERS – CMU

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.

Community of Mediterranean Universities (IT)
http://www.cmungo.eu/

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the achieved effects of the project, so CMU held several working meetings to define the introduction to the project, selected locations for pilot projects and the need for a feasibility study of the entire project.

Marine energy for the port of Mola di Bari

Architect Giovanni Manco is the external advisor of the Community of Mediterranean Universities (CMU) for the activities of the COASTENERGY project. He stated his experiences in a technical article and here are some of the conclusions.

The Community of Mediterranean Universities analyzed the potential of some Blue Energy technologies currently in technological development and checked their applicability in the Adriatic Sea and the port of Mola di Bari, selected as a pilot area within the project activities. It will be the subject of a feasibility study conducted in 2021 and will involve municipal governments and other relevant local actors.

Blue energy, and especially electricity produced by waves, was initially applied in the oceans, where the movement of waves is much greater than that in the Mediterranean. Blue energy is considered to be the largest untapped renewable energy source on the planet: it is estimated

that if used, it will produce 80 trillion kWh, five times more than the annual electricity demand of the world.

The application of Blue Energy is currently moving from the research phase to the industrialization phase, with prototypes already installed at sea. Only recently has the Mediterranean, with its mild climatic conditions, encouraged research into wave movements that is yielding significant results.

For the feasibility study, they started from the analysis of the regional legislation of the region of Apulia and numerous restrictions in its environment and landscape, such as the protection of the seabed and the migratory movement of birds. Therefore, the choice fell on those technologies that ensure both compatibility with spatial regulations and protection of biodiversity, avoiding those technologies that involve the construction of relevant facilities that would be set up on the coast or in the immediate hinterland.

They also took care to select the most developed technologies with the greatest production potential capable of reaching an energy cost that is competitive with the national electricity grid. Two important reasons influenced the selection of the Mola di Bari as a pilot area for the development of the feasibility project.

The first refers to the presence of piers and breakwaters, with the morphology of the seabed, where the depth required for the installation of selected coastal technology (between 25 and 50 meters) is achieved at a short distance from the shore.

Another reason is the numerous projects initiated by the local self-government, including the award of contracts for the construction of the second part of the coast, the construction of a series of floating residential buildings within the port area and general interest in improving the port and associated coastal zone.

Therefore, the Coastenergy Feasibility Project will support local government decisions and will in particular focus on producing clean energy from wave motion for floating units and piers.

In Italy, there is a growing interest in harnessing the energy of waves and tides. For the Mola di Bari project, the focus was exclusively on the energy produced by the movement of the waves, and they opted for two different Italian technologies, one installed on land and the other at sea.

The onshore system is called OBREC (Overtopping Breakwater for Conversion Energy), developed by the University of Campania: it is a device built into a breakwater tank, open to the sea and designed to capture waves that overflow a ramp located inside the tank potential energy. The water stored in the tank produces energy by flowing through hydraulic turbines, as a result of the difference in water level between the tank and the sea.

The second system selected for the project is the result of a spin-off of the Polytechnic of Turin: called ISWEC (Inertial Sea Wave Energy Converter), and consists of a sealed floating hull containing a pair of gyroscopic systems connected to generators. The first pilot plant is already active in Ravenna and is connected to the ENI PC80 platform.

In general, current obstacles to the implementation of such projects concern industrial technology development, sector investment, environmental issues and the availability of network infrastructure. It is also important to ensure access to funds that enable the full potential of the Blue Energy sector in terms of economic growth and the creation of highly skilled jobs.

In the case of Mola di Bari, the technologies chosen should not face many bureaucratic hurdles as they are based on compatibility with existing restrictions for the Naples Coast and on sharing the idea with local governments, associations and other local stakeholders.

It should also be emphasized that there is currently no precise framework of competences or regional legislation that clearly states what can and cannot be done outside the coastal zone in the area of Blue Energy. It is therefore desirable that through this pilot project the region of Apulia fills this regulatory gap to improve its coastline by promoting the use of Blue Energy compatible with the regional landscape and economy.

Conceived and designed for the Mediterranean, there is no doubt that ISWEC is currently the most promising system because it is based on the distance between the waves and not on their strength.

The system consists of a floating hull 8 x 15 m and an installed power of 130 kW; the waves cause the unit to tilt and oscillate freely because it lacks stable moorings to the seabed (and therefore does not significantly affect the marine flora). The energy produced will be distributed to the grid through a pipe connecting the hull to the mainland. The advantage of ISWEC is the absence of submerged moving parts because the entire conversion unit is located inside the hull. A simple

but high-tech solution. The first prototype achieved 105% energy production compared to a nominal power of 50 kW.

The industrialization of the system was made possible by a recent agreement between Eni, Cassa Depositi e Prestiti, Fincantieri and Terna, who are contributing to their sector.

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the achieved effects of the project, so CMU held several working meetings to define the introduction to the project, selected locations for pilot projects and the need for a feasibility study of the entire project.

The meetings were open to public bodies, businesses, experts, NGOs and universities, with the aim of presenting the Coastenergy project and the first results of a feasibility study in the Mola di Bari pilot area, and discussing procedural difficulties in obtaining authorization for such projects. One of the researchers who developed OBREC technology (from the University of Campania - Luigi Vanvitelli) also participated and presented its technical characteristics and state of development, expressing interest in collaborating with the project.

Those who have proven to be key stakeholders in this phase of project development are the Municipality of Mola di Bari (which provides the pilot area), the Port Authority (which has shown interest in supporting possible tests and even funding), Wave for Energy and the University of Campania developers of selected technologies).

Therefore, the goal of Hub's local events is to organize a limited meeting involving technology developers, the municipality, the Harbor Master's Office, the region and local manufacturing companies, to encourage possible actual implementation of the pilot project as a test in an operational environment for both selected technologies.

Most of the invitees were selected within the existing thematic networks and associations, with the intention of involving the widest possible representative of all stakeholders who could play a

role in defining blue energy projects: associations of experts, local, regional and national authorities, entrepreneurs, environmental associations.

CMU specifically hired a moderator as an expert in stakeholder communication and involvement, and as a provider of a professional webinar platform to be used for optimal results. In addition to CMU staff, who presented the project and its first findings at the local level, one speaker was selected from academia to learn about different blue energy technologies.

6.1. Transformation of ports and other coastal infrastructure

No specific results were produced (except for stakeholder information sheets). The goal of attracting technology development engineers has been partially met thanks to the participation of representatives of one company (Wave for Energy) which is currently in the process of developing a wave energy converter that is considered crucial for CMU's pilot project. On the other hand, despite the important role of the Port Authority in the process of approving any work located at sea, their involvement has proved quite difficult. The municipality has a strong interest in being a stakeholder in this project, given its commitment to rehabilitating the port area. Their participation went as expected.

Components

- deep dimension of the coastal territory, supported by a system of protected areas in different capacities, in order to activate functional and urban tasting projects that fully enhance the heritage, urban, infrastructural, rural and naturalistic coastal hinterland
- integrates all other territorial landscape projects on this coastal belt, through articulated interventions on urban waterfronts, dune systems, wetlands, agriculture, peripheral urbanizations, landscapes of high naturalistic value, infrastructural connections with the coastal hinterland, freshwater

Specific objectives for improving integrated coastal landscape restoration

- Do not lose pace: keep a history of alternating unarranged and built spaces at cost
- The sea as a large public park

- Preserve the diversity and variety of landscapes of historic coastal areas
- Ecological redevelopment of coastal tourist settlements
- Giving depth to the coast, creating synergy with the hinterland
- Decommissioning the coast through resettlement projects

Coastal Planning Regional Coastal Plan (PRC)

The PRC is an instrument that regulates the use of maritime property, in order to ensure the right balance between
- preservation of environmental and landscape aspects of the Apulian coast
- free use
- development of tourist and recreational activities.

The PRC is an instrument of knowledge of the coastal territory, especially geomorphological and meteorological morphological dynamics associated with the priority problem of coastal erosion, the evolution of which requires careful and constant monitoring and interventions to restore and rebalance the coast. In this context, the Plan defines the so-called physiographic wholes and subunits, understood as homogeneous and unique coastal marine areas.

The PRC is a planning tool, related to the transfer of administrative functions to local authorities (issuance of state maritime concessions), the efficient and effective use of which can be guaranteed only by coordinated and coherent action of the Region. In this regard, the PRC provides guidelines, addresses and criteria to be followed by Municipal Coastal Plans (PCCs).

Regional Coastal Plan (PRC) approved by DGR no. 2273 dated 13 October 2011
- analyses the coastal territory, and especially the geomorphological and meteorological dynamics related to the priority problem of coastal erosion
- regulates the use of maritime domain, in order to ensure the right balance between the preservation of environmental and landscape aspects of the Apulian coast, the free use and development of tourist and recreational activities
- provides guidelines, addresses and criteria to be followed by Municipal Coastal Plans (PCCs).

Municipal coastal plan
It is an instrument that defines the structure, management, control and monitoring of the coastal zone (maritime domain and territorial sea area).

6.2. Environmental and landscape protection

The metropolitan coastal space summarizes in an exemplary way the differences that characterize these areas with an unparalleled intensity, given the concentration, in such a distinctive space, of dynamics, pressures and flows. Therefore, the metropolitan coastal space is assumed to be an exemplary space for disciplinary reflection

Emerging criticism
- coastal erosion due to anthropogenic interventions, destruction of dunes, infrastructural interventions
- Salinization of coastal aquifers, due to excessive exploitation of groundwater aquifers
- Water pollution due to insufficient purification system

Coastal zones represent
- areas that are most vulnerable to climate change
- areas that are most susceptible to anthropogenic pressure
- places of greater economic profitability and welfare of the population

Access to coastal areas raises significant questions
- Cognitive, due to the peculiarities of environmental dynamics and the intertwining of natural and anthropogenic dimensions
- Interpretive, for difficult and ambiguous consideration of the scope and characteristics of this dynamic
- Management, for the multitude of actions and actors present and the need for a systematic and integrated approach

Discipline for the environmentally friendly use of the coastal zone must serve:

- protect the landscape, protect the environment,
- guarantee access to and free use of public natural heritage.

6.3. Implementation of system integration in the built environment

No specific funding mechanism has been identified. However, the Municipality of Mola di Bari is ready to assess the possibility of introducing the development of similar energy systems in existing plans and programs related to the rehabilitation of the port area.

They maintained contact with some of the stakeholders; in particular with Wave for Energy, ensuring their participation in the third meeting of the cross-border group; The municipality of Mola di Bari, which is currently involved in organizing the second meeting of the local group; and the Port Authority, whose involvement is considered central but is still progressing with some difficulties.

Involving key stakeholders is theoretically important for defining pilot projects. However, the reluctance of technology development engineers to uncover basic information such as the cost and productivity of their prototypes still does not allow for a deeper elaboration of these issues. On the other hand, the involvement of the Municipality is going as expected.

The involvement of the Port Authority is still proving difficult, but efforts have been made to focus activities on authorization procedures, hoping this will encourage some useful discussions and cooperation.

Coastal spatial planning tools:
- Landscape planning
- usually territorial and urban planning
- sectoral plans for the regulation of state-owned areas (coasts and smaller ports),
- port planning managed by 15 port system administrations
- planning of regional regulations of protected areas and plans for protection and use of the coastal system

- in the case of metropolitan cities, strategic planning and urban territorial planning.

In addition, Italy, although it has not yet ratified the EU Integrated Coastal Zone Management Directive, has in fact borrowed its principles and objectives by approving the Maritime Spatial Planning Guidelines (2017), in implementation of Legislative Decree 201/2016 (Implementing Directive 2014 / 89 / EU).

Among the fourteen Italian metropolitan cities (including, therefore, those designated by special statutory regions), eleven are coastal; among them only Rome does not have its capital directly facing the sea, although it is close to it. It has more than ten million inhabitants, almost half of the city's population.

Landscape Planning and Regional Landscape Plan
PPTR strives to promote and achieve self-sustainable and sustainable socio-economic development and conscious use of regional territory, also through the preservation and recovery of distinctive aspects and characters of social, cultural and ecological identity, protection of biodiversity, achieving new integrated landscape values, coherent and appropriate to quality criteria and sustainability.

Integrated improvement and redevelopment of coastal landscapes
It takes over the coastal system as an element of great heritage and strategic importance for the socio-economic future of the city

The goal is:
- block degradation processes due to the pressure of tourists concentrated near the coast
- Improve the still present heritage (natural, rural, landscape), both in the coastal system and in its hinterland

The public interest of the plan and the coastal zone is understood in various aspects, namely:
- encouraging the development of the tourism sector;
- in guaranteeing the right to enjoy property by the community;

- in an effort to protect the natural environment and recover coastal sections that are in a state of degradation.

Bari municipality plan

The specificity of the Bari coast is that it is almost entirely urban or suburban, while rare non-urban areas are mostly in a state of neglect and degradation similar to other peripheral areas surrounding the city.

The articulation of the Bari coast in the areas is implicitly related to the landscape approach and is methodologically analogous to what the PPTR implements in the regional territory. Identifying the areas or landscapes in which the state belt project will be articulated is the first step in avoiding considering the coast as a single belt more than 40 km long that approaches the city and is independent of it.

6.4. Which critical factors should be taken into account?

The challenges highlighted after all the meetings remain unchanged: both selected technologies are likely to need to be redesigned / adapted to the specific conditions of the southern Adriatic before being tested in a real environment.

An agreement with the municipality of Mola di Bari and other key stakeholders in this regard would therefore benefit everyone: a "green" investment for funding institutions and the municipality, a test field for development technologies and an economic opportunity for local manufacturing companies.

The main criticism relates to the lack of technologies that have a sufficient level of readiness: this makes any discussion of the issue too abstract and less attractive to stakeholders. The main aspect that appears as a bottleneck for the development of wave energy in the Adriatic Sea is related to the degree of technological readiness of existing prototypes, which does not yet allow their rapid implementation.

Moreover, there is clearly a certain reluctance of some technology companies to speak openly about their research and development processes. To overcome this problem, we are trying to

establish a process in which the municipality and businesses work together with the goal of achieving mutual benefits: energy savings for the former and the availability of a testing environment for the latter.

Project conclusions

In coastal areas, especially metropolises, in addition to anthropic pressures of various kinds, we can also note the number of general and sectoral planning tools, urban and landscape planning that insist on coastal space.
Moreover, coastal areas have been transformed by a number of projects that intervene accurately and for limited areas, which are not always coherent with each other and with planning instruments. In fact, such plans and projects do not always find coherence and synergy.
For any transformation intervention that wants to be sustainable, it is necessary to face this complexity of instruments and interventions.
In any case, the landscape plan, which is superior to all others because it deals with issues of constitutional importance, is a reference for all plans, policies and projects.

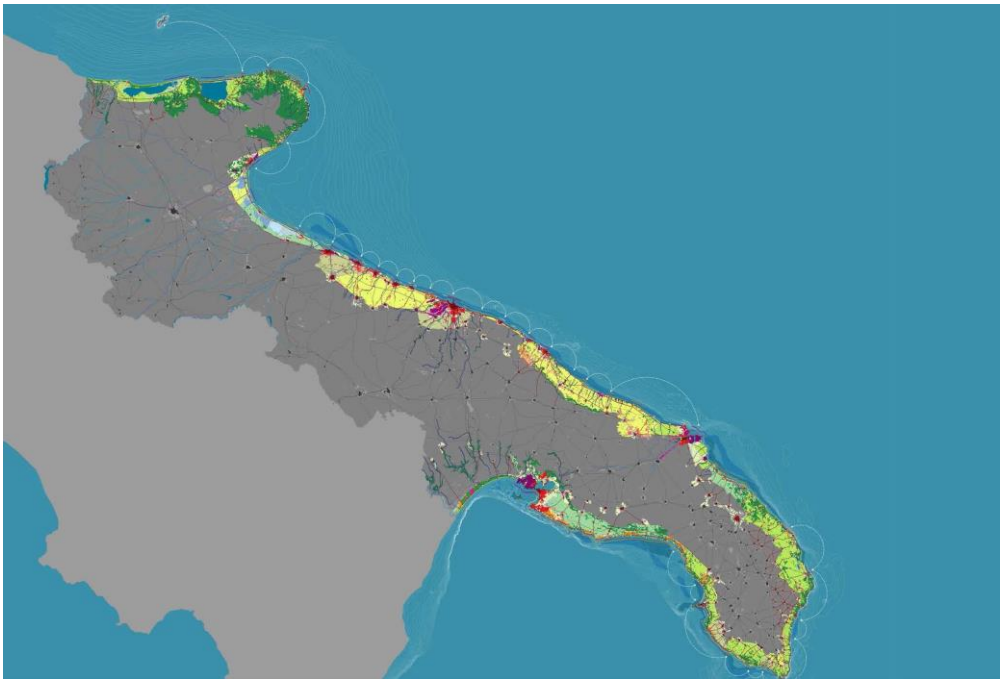

Figure 6: Strategic vision of the development of the coast of the city of Bari with new integrated elements [11]

7. EXPERIENCES OF PROJECT PARTNERS – PESCARA

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.

Chamber of Commerce Industry Agriculture and Craft Chieti Pescara (IT)
https://www.chpe.camcom.it/

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the project's effects, so PESCARA held several working meetings to define the introduction to the project, selected locations for pilot projects and the need for a feasibility study of the entire project.

7.1. Transformation of ports and other coastal infrastructure

The pilot projects of the Pescara and Vasto marinas have defined several technologies that are planned to be installed through the reconstruction of the existing coastal elements of that infrastructure.

SEA WATER - BASED HEAT PUMPS
120 MWh of heat
Pescara marina buildings

HOW DOES IT WORK?

A heat pump is a machine that extracts heat from an external natural source (air, water or earth) and introduces it into a building. By using the heat, they alternate with water, they can also be used for heating and cooling rooms.

OSCILLATING WATER PILLARS
250 - 500 MWh / year per 100 m pier

HOW DOES IT WORK?
Incoming waves allow seawater levels to move up and down and, like pistons, alternately compress and decompress the air inside the chambers. Air enters and exits through pipes and drives self-correcting turbines. Mechanical energy is converted into electrical energy by a power drainage system. Chambers can be installed in new or existing columns.

OSCILLATING FLOATERS
250 - 450 MWh / year per 100 m pier

HOW DOES IT WORK?
Floating bodies harness the energy generated by the motion of oncoming waves. Hydraulic pistons convert the movement of buoys into the rotation of generators to produce electricity. This technology can be installed in existing piers and docks.

7.2. Environmental and landscape protection

The planned installations and equipment are integrated into the existing coastal structures, which reduces the need to influence the landscape and the view of the coast. Heat pumps for heating and cooling have positive effects on reducing CO2 emissions compared to conventional energy sources.

7.3. Which critical factors should be taken into account?

Recommendations for ensuring the development of blue energy systems in coastal areas resulting from the meetings have been defined. It was concluded that more attention should be paid to regulatory aspects. There are still many shortcomings in regional laws and regulations.

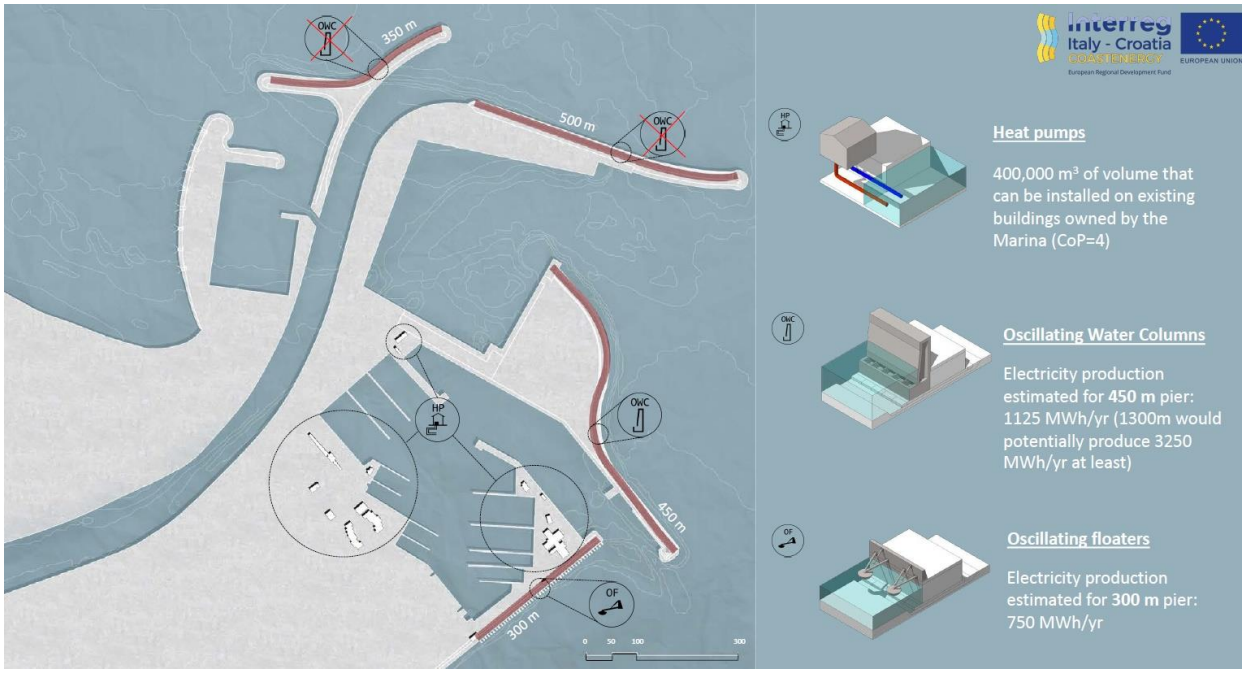

Figure 7: View of Marina Pescara with planned equipment [11]

8. EXPERIENCES OF PROJECT PARTNERS, CITY OF PLOČE

The Coastenergy project partners shared their experiences during the implementation of the Coastenergy project, and the experiences were systematized as a recommendation for future procedures and processes for the integration of the blue energy system. Some of the experiences are presented in professional articles, and the experiences related to the Coastenergy project are listed below.

City of Ploče
https://ploce.hr/

EXPERIENCES GAINED DURING THE COASTENERGY PROJECT

The Coastenergy project defines the implementation of working meetings and presentations of the project's effects, so PLOČE held several working meetings to define the introduction to the project, selected locations for pilot projects and the need for a feasibility study of the entire project.

As part of the project activities, the City of Ploče carried out a series of activities involving local stakeholders and encouraging a participatory process of strengthening the development of renewable energy sources in the Adriatic. Previous activities in the City of Ploče consisted of two meetings of the Local Blue Energy Group of the City of Ploče (one live and one online), study visits to the Rector's Palace in Dubrovnik and two workshops on the prospects of blue energy in urban areas in the Mediterranean and others on the presentation and discussion on the analysis of the energy potential of the House of Culture Ploče.

8.1. Transformation of ports and other coastal infrastructure

The Port of Ploče Port Authority, Luka Ploče dd, the Tourist Board of the City of Ploče, the Vladimir Nazor Primary School in Ploče, the Ploče Sports Center, the Izvor Public Institution, and the Fr. Andrija Kačić Miošić Secondary School expressed interest in participating in the activities of the

local Blue Energy group, Public Open University Ploče and Development Agency of the City of Ploče "Plora".

Response of local stakeholders to the initiative to establish a local blue energy group of the City of Ploče. The City of Ploče was the first to organize a meeting of the Coastenergy Group on June 19, 2019. where a large number of local stakeholders gathered. Although the field of blue energy is underdeveloped in the Mediterranean, there is great interest and potential in the City of Ploče to inform about trends in blue energy, and possibly apply to the EU tender to strengthen financial capacity for the use of heat pumps in seawater. There are examples of the application of heat pumps in the Ploče Port Authority and in the House of Culture, Ploče Public University.

Coastenergy Hub meetings were very useful for defining the pilot project and choosing the location of the sports port. Stakeholders were interested in participating and a representative was appointed for each of the nine Hub members to attend Hub meetings. Each of Hub's stakeholders found interest in applying to the upcoming EU tenders related to improving the energy efficiency of their facilities through the installation of heat pumps. All facilities are close to the sea so there is great potential for the application of blue energy in the future.

8.2. Environmental and landscape protection

At the first meeting of the City of Ploče, a dozen stakeholders, representatives of local self-government, companies, representatives of educational institutions and the tourist board of the City of Ploče gathered.

The first meeting of the group at which the initial conference was held aroused great interest of local community representatives with interest in the application of renewable energy solutions with emphasis on blue energy for tourism, port, aquaculture and housing solutions.

Feasibility study for the implementation of renewable energy sources in the sea sports port of Ploče brings the technical parameters that need to be met

Standard almost zero energy
- minimum 30% of delivered energy for on-site renewable energy technical systems

Maximum permissible values of annual heat required for heating
- new sports halls 48.60 kWh / m 2 and
- new hotels and restaurants 19.20 kWh / m 2

Maximum allowable values of primary energy
- new sports halls 150 kWh / m 2 and
- new hotels and restaurants 90 kWh / m 2

8.3. Implementation of system integration in a built environment

Heat pump technology has aroused the greatest interest of local stakeholders of the Coastenergy Group of the City of Ploče.

At the second meeting of the Coastenergy Group, the results of the analysis of the energy potential of the Ploče Cultural Center were presented. The study showed that the current level of energy efficiency of the institution is satisfactory. However, there is room for improvement, especially in the segment of cooling energy, where the additional installation of a geothermal crane on seawater would achieve savings of 80 percent in summer and 30 percent in winter. It would also be useful to install photovoltaic systems and solar panels on the roof.

During the presentation, the possibility of significantly improving the energy efficiency of the building by improving the thermal envelope of the House of Culture Ploče was highlighted because it would reduce electricity consumption and increase the comfort of staying in the building in the summer months.

In conclusion, it was pointed out that in the future, city-owned facilities have the capacity not only to be consumers, but also electricity producers in accordance with the strategic guidelines of the European Union.

During the first meetings, the Coastenergy Hub of the City of Ploče achieved some of the goals set for the local Coastenergy Hubs: exchange of knowledge and information among stakeholders, study visits to present examples of good practices in blue coastal areas and stakeholder networking.

nZEB technologies proposed for installation in the planned project

Ropes are easily associated with boats and sea life, so the idea of ropes as a second layer of the facade stems from the very future purpose of building sea sports combined in one building. In addition, this solution is perhaps one of the low-budget in terms of sun protection.

Ropes are placed on the protrusions of steel frames, later they are placed on a pre-prepared substructure of the facade of the building. Mounting frames are easy to transport and install on site in terms of size and shape. The ropes are processed so that they can easily withstand the weather. They are approximately 20 mm in diameter, placed vertically or horizontally, so they can be functional in terms of creating a large shaded area when placed in frames

Technical solutions for variant A (sport + hostel)

A1
151 kW th (W10 / W45) seawater heat pump with heat recovery, air conditioning (1500 m^3 / h) with 80% heat recovery, 13.9 kWp PV system

A2
151 kW th LPG condensing boiler, 80 kW refrigeration, air chamber with 80% heat recovery, 13.9 kWp PV system

A3
151 kW th LPG condensing boiler, 80 kW refrigeration, air conditioning (1500 m^3 / h) with 80% heat recovery, 382 m^2 solar collectors cannot be located on site

A4
104.8 kW th (A7 / W45) heat pump heat source with heat recovery, air conditioning (1500 m^3 / h) with 80% heat recovery, solar thermal collectors 43.2 m^2

Technical solutions for variant B (sport + coffee)

B1
104.7 kW th (W10 / W45) seawater heat pump with heat recovery, air conditioning (1500 m^3 / h) with 80% heat recovery, 13.9 kWp PV system

B2
90 kW th LPG condensing boiler, 70 kW refrigeration, air conditioning (1500 m^3 / h) with 80% heat recovery, 13.9 kWp PV system

B3
90 kW th LPG condensing boiler, 70 kW refrigeration, air conditioning (1500 m^3 / h) with 80% heat recovery, 43.2 m 2 solar thermal collectors

B4
104.8 kW th (A7 / W45) heat source air source heat pump, air conditioning (1500 m^3 / h) with 80% heat recovery, 13.9 kWp PV system

8.4. Which critical factors should be taken into account?

In the conditions of COVID-19 measures, they adjusted and organized the meeting of the Coastenergy Hub of the City of Ploče online. Also, with the support of representatives of Lead Partner and Communication Manager, they launched an initiative to publish a newsletter of the local Coastenergy Hub of the City of Ploče. In the first issue, in addition to the Coastenergy Hub of the City of Ploče, they also presented the local Coastenergy Hub of the Cres-Lošinj archipelago and the Declaration on Smart Islands.

They are satisfied with the first results of the project and are also interested in further involvement in similar initiatives that enable smaller cities and local governments to strengthen their competencies towards sustainable development of local communities in cooperation on international projects - platforms for research and knowledge exchange.

It is necessary to adopt a legal procedure regarding the execution of works on the installation of heat pumps - soil drilling.

It is necessary to establish a service center for entities interested in applying for EU funds in connection with feasibility studies for the installation of heat pumps.

Optimal financial cost analysis

In the analysis of financial costs optimal for variant A the most favorable solution is A1 (151 kW th (W10 / W45) heat pump seawater with heat recovery, air conditioning (1500 m^3 / h) with 80% heat recovery, 13.9 kWp PV system).

In the financial analysis for variant B, the most favorable solution is B1 104.7 kW th (W10 / W45) seawater heat pump with heat recovery, air conditioning unit (1500 m 3 / h) with 80% heat recovery, 13.9 kWp PV system

Macroeconomic cost optimal analysis

In the macroeconomic cost-optimal analysis for variant A, the most favorable solution is A1 (151 kW th (W10 / W45) seawater heat pump with heat recovery, air conditioning (1500 m^3 / h) with 80% heat recovery, 13.9 kWp PV system).

In the macroeconomic analysis for variant B, the most favorable solution is B1 104.7 kW th (W10 / W45) seawater heat pump with heat
recovery, air conditioning unit (1500 m 3 / h) with
80% heat recovery, 13.9 kWp PV system

Multicriteria analysis

The optimal technical solution for both variants is a seawater heat pump system, i.e., solution A1 and B1. These combinations have the lowest global price compared to other combinations, and significantly lower primary energy, CO 2 emissions and operating costs, with a predominant share of energy produced from RES on site.

LIST OF PICTURES:

9. LIST OF FIGURES AND TABLES

10. LIST OF SOURCES

[1] Google Earth maps, application
[3] Google maps www.google.com/maps
[4] DURA procurement documentation
[5] City of Dubrovnik wiki www.hr.wikipedia.org/wiki/Dubrovnik
[6] The Coastenergy WEB GIS project can be found at the following link:
http://192.167.120.31/lizmap-web-client-3.1.4/lizmap/www/index.php/view/map/?repository=maestrale&project=maestrale
[7] HUB Coastenergy Project Working Group Meetings
[8] Coastenergy newsletter No. 1 City of Ploče
[9] Coastenergy newsletter No. 1 City of Ploče
[10] Coastenergy newsletter No. 1 City of Ploče
[11] Closing Conference of the Coastenergy Project