Fostering diffusion of Heating & Cooling technologies using the seawater pump in the Adriatic-Ionian Region

Blue Growth Strategy for Ionian Adriatic Region

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Purpose of this document

Purpose of the D.T3.4.2 Blue Growth Strategy for Ionian Adriatic Region is the update of the Ionian Adriatic Macro-regional Strategy incorporating the most important results and recommendations linked to Blue Growth through seawater heat pumps.

The paper will give an overview of the EU Strategy for the Adriatic and Ionian region as well as the Blue Growth pillar. Blue Growth recommendations for the Adriatic-Ionian region through seawater heat pumps will be elaborated.

Introduction

Following the EU Green Deal initiative, and in order to achieve the decarbonisation of Europe's industry, heat pumps will play a key part in making Europe climate-neutral in the future.

In this context, heating and cooling buildings can be significantly reduced with technologies that use renewable energy sources and have high efficiency.

Taking this into consideration the SEADRION project aims to support the development of a regional innovation system for the Adriatic-Ionian area with the installation of **3 renewable energy facilities in public buildings located in Greece (Alexandroupolis) and the western and south part of Adriatic Croatia (Crikvenica and Dubrovnik)**. These facilities are seawater heat pumps, an innovative system that uses the thermal energy contained in a reservoir (sea) to achieve the cooling and thermal energy in the buildings close to the sea.

The main objective of the SEADRION is to identify benefits and barriers associated with the use of this technology and to find a system solution designed to improve the use of the seawater heat pump (SWHP) technology and to make the building's energy self-sufficient and independent of fossil fuels.

The main outputs of the SEADRION project are transnational seawater heat pump network

- to support sustainable development in ADRION region, science and technology cooperation between research institutions and enterprises,
- to enhance the innovation capacity of the heat pump sector; to enhance their innovation skills, capacities and competencies; and common strategy to enhance the use of seawater heat pump based heating and cooling in ADRION region.

In this Deliverable T3.4.2 Blue Growth Strategy for Ionian Adriatic Region, the following is elaborated:

- potential of seawater heat pumps in the Blue Growth Strategy for the Adriatic - Ionian Region,
- heat pump industry as an economic force and a provider of local labour,
- Blue Growth recommendations for the Adriatic-Ionian region through seawater heat pumps,
- occurred obstacles,
- possible interventions,
- relevant actors (stakeholder).

The main outputs of the SEADRION project are a transnational seawater heat pump network to support sustainable development in the ADRION region, a science and technology cooperation between research institutions and enterprises to enhance the innovation capacity of the heat pump sector and a common strategy to enhance the use of the seawater heat pump based heating and cooling.

Special attention was given on the policy roadmap, a reference framework for the promotion of the heating and cooling sector by the utilization of seawater heat pumps (SWHP). According to that, the SWHP is a technology that is still not widely used except in the hotel sector or public buildings on the

coast or some islands, and this applies to all partner countries of the project (Croatia, Slovenia, Italy, Greece and Albania).

Many barriers that hinder the increase in the implementation of (seawater) heat pumps are encountered in all partner countries and are mostly similar:

- lack of knowledge and experience in designing as installing and running such systems, lack of awareness form the policymakers, excessive bureaucratic obstacles, lack of public awareness and incentive subsidies.

On the other hand, some measures and activities proposed that could facilitate the implementation of such systems are inter alia:

- standardization of the seawater intake system installation, the involvement of heat pumps in energy strategies, the application of district heating and cooling systems, new corrosion and maintenance-friendly materials, and policymakers' engagement around structuring the process of implementation of heat pumps.

Many stakeholder target groups could be involved in implementing the suggested methodology activities, from the national public authority to enterprises.

Opportunities can be sought in other countries of the Mediterranean, such as Italy and France, where multipurpose complexes or district heating and cooling networks are considered in order to reduce heating and cooling costs along with:

- Training programmes for RES-installers, such as the EHPA EUCERT, a European training and certification program for heat pump installers, tax deductions offered by the Government for energy-saving measures and investment grants for renewable heating installations

The document's main focus is the improvement of the existing EU strategy for the Adriatic and Ionian Region (EUSAIR), with reference to the Blue Growth pillar. This will be achieved mainly by identifying reasons and possible interventions to promote seawater heat pumps in the Blue Growth Strategy, boosting this way the innovative marine and maritime growth by utilizing renewable heating and cooling and by promoting jobs and business opportunities in the Blue economy.

Recommendations and information from all partner countries (Slovenia, Greece, Albania, Croatia) were taken into account during the writing of the study.

Overall objective

On 17 June 2014, the Commission launched the EU Strategy for the Adriatic and Ionian Region (EUSAIR). It mainly revolves around the maritime economy's opportunities – Blue Growth, land-sea transport, energy connectivity, protecting the marine environment and **sustainable tourism**- sectors that are bound to play a crucial role in creating jobs and boosting economic growth in the region.

The **'EU Strategy for the Adriatic-Ionian Region'** is described in two documents: (1) a **Communication** from the European Commission to the other EU Institutions, and (2) an accompanying **Action Plan** which complements the Communication. The Action Plan is one of the outputs of the Strategy approach. It aims to go from 'words to actions' by identifying the concrete priorities for the macro-region. Once an action or project is selected, it should be implemented by the countries and stakeholders concerned.

Blue Growth is a concept which is used by the European Commission (DG MARE) to harness the untapped potential of Europe's ocean seas and coasts for jobs and growth. Blue Growth is seen as an innovative way to develop a range of maritime activities that are often dependent on each other, e.g. by relying on common skills and shared infrastructure. In the subsequent implementation of the Blue Growth concept, the importance of innovation across all blue economy sectors has been highlighted.

The overall objective of Pillar 1 "Blue Growth" is about driving innovative maritime and marine growth in the Adriatic-Ionian Region by promoting sustainable economic growth and jobs as well as business opportunities in the blue economy sectors.

This requires building on the regional diversity in the Adriatic-Ionian Region and taking into account that there are various pathways to innovative maritime and marine growth. At the same time, several challenges and development opportunities need to be approached through cooperation among the countries, regions and cities.

Blue Growth is the overarching objective of an EU initiative published in 2012. It is the maritime dimension of Europe 2020. The concept is connected to the Europe 2020 objectives of smart, sustainable, and inclusive growth and aims to unlock Europe's seas and coastal areas' untapped potential. The Blue Growth Strategy seeks to foster growth and job creation by capitalising upon the so-called blue economy. Its main focus is on blue energy, aquaculture, maritime, coastal and cruise tourism, marine mineral resources and blue biotechnology.

Specific objectives

The specific objectives of the “Blue Growth” pillar are:

(1) To promote research, innovation and business opportunities in blue economy sectors, by facilitating the brain circulation between research and business communities and increasing their networking and clustering capacity.
(2) To adapt to sustainable seafood production and consumption, by developing common standards and approaches for strengthening these two sectors and providing a level playing field in the macro-region.
(3) To improve sea basin governance, by enhancing administrative and institutional capacities in the area of maritime governance and services.

In line with the strategy's integrated approach, the three topics under Blue Growth must be brought together with objectives pursued under the other pillars. For example, while strengthening innovative marine and maritime growth positively impacts business development, it also improves environmental conditions (Pillar 3 – Environmental quality) through better coordinated and more sustainable use of marine and maritime resources. In this regard, marine biodiversity will be preserved by improving fisheries and aquaculture management and sustainability. Furthermore, this improves the tourist attractiveness of an area and stimulates cooperation between fisheries and tourism activities (Pillar 4 – Sustainable tourism). At the same time, increasing business activities will be closely linked to available transport connections for delivery of goods (Pillar 2 – Connecting the Region).

Blue Growth recommendations for the Adriatic-Ionian region

By implementing the SEADRION project, many difficulties have been identified that need to be overcome in order to reach the set goal (permits, pilot plant design, pilot plant installation, bureaucracy, etc.). Based on these difficulties, many recommendations have been proposed for further progress and understanding of the EU strategy for the Adriatic-Ionian region, and thus the Blue Growth pillar, as follows:

Policy field
Ensure data availability, especially regarding the four thematic areas of the strategy
Understand the factors which are limiting the development of all pillars, with a special focus on blue growth and sustainable tourism
Develop awareness and capacities through, e.g. knowledge-sharing platforms
Increase benefits for local communities (social, economic & environmental)
Build bridges and collaborations with and among involved stakeholders
Endow decision-making processes to promote substantial changes in the field
Ensure participation mechanisms for inclusive decision-making processes by proposing innovative decision-making mechanisms or tools
Special attention to the different level of development between EU and Non-EU countries by enhancing the exchange of expertise, knowledge and capacities

Operative field
Identify, share and replicate best practices in managing blue strategy scenarios through pilot projects/testing
Avoid or limit as much as possible administrative and bureaucratic burden when implementing projects (reduce paperwork, facilitate and favour the pilot project's investments)
Ensure local communities benefit when investing in blue growth projects
Endow decision-making processes to promote substantial changes in the field
Ensure participation mechanisms for inclusive decision-making processes by proposing innovative decision-making mechanisms or tools
Ensure all stakeholders' commitment through effective and assertive governance models (e.g. Memoranda of Understanding, Cooperation and Collaboration agreements etc.)
Propose monitoring and evaluation systems coordinated by independent bodies to ensure proper implementation of projects
Special attention to the different level of development between EU and Non-EU countries by enhancing the exchange of expertise, knowledge and capacities

Seawater heat pumps as part of the Blue Growth pillar

Seawater heat pumps are not considered Blue Growth, and thus part of the Blue Growth Strategy, although they use a renewable energy source (seawater) as a heat source. The reason for this is the electricity delivered to the heat pump for its operation, which does not necessarily have to be a product of renewable energy sources.

The current technology of seawater heat pumps is mature and advanced enough to be included in the Blue Growth Strategy. The efficiency and adjustment of such systems' operation at various loads are much more advanced than a couple of years ago, resulting in the production of a larger amount of heating / cooling energy for equal generation input. It is also a growing practice in coastal areas to perform a combination of seawater heat pump systems and offshore/onshore wind farms, which then generate electricity to power these heat pumps. As the use of renewable energy sources is increasingly encouraged, including the generation of electricity from RES, it is clear that in the near future seawater heat pumps, and heat pumps in general, will be powered only by electricity from RES.

The implementation of seawater heat pumps, as well as heat pumps in general, contributes to energy efficiency, quality of life, employment, etc. at the site of its application. Some of its benefits and opportunities are listed below:

- increase in high - skilled jobs and economic opportunities;
- connectivity with offshore and onshore wind farms for the purpose of closed-circuit energy production;
- energy independence;
- increasing the share of RES in the energy network;
    - there are no harmful emissions at the point of energy consumption;
    - reduction of local pollution;
    - positive effects on fisheries and aquaculture;
    - better seawater quality;
- possibility of exploiting wastewater that is being discharged into the sea;
    - decrease in the water temperature being discharged;
    - reduced development of microorganisms that reduce seawater quality.

The data gathered for buildings in partner countries of Adriatic - Ionian region where the seawater heat pumps can be implemented show that altogether estimated heating demand is 4736.08 GWh/year for hotels and 496.73 GWh/year for public buildings as shown in Figure 1.

Seawater heat pump high efficiency leads to primary energy reduction and CO2 emission savings, as shown in Figures 2 and 3.

The above results are all the benefits and opportunities mentioned in the previous section, i.e. the stimulus to Blue Growth.

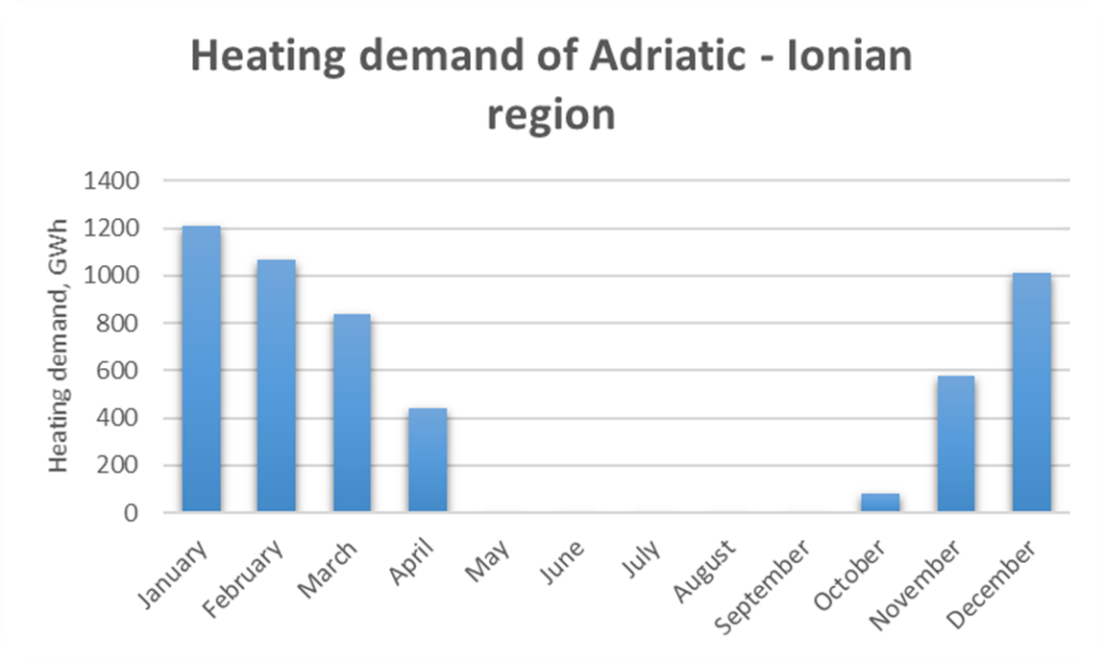

Figure 1: Estimated heating demand for public buildings and hotels in Adriatic – Ionian region per month

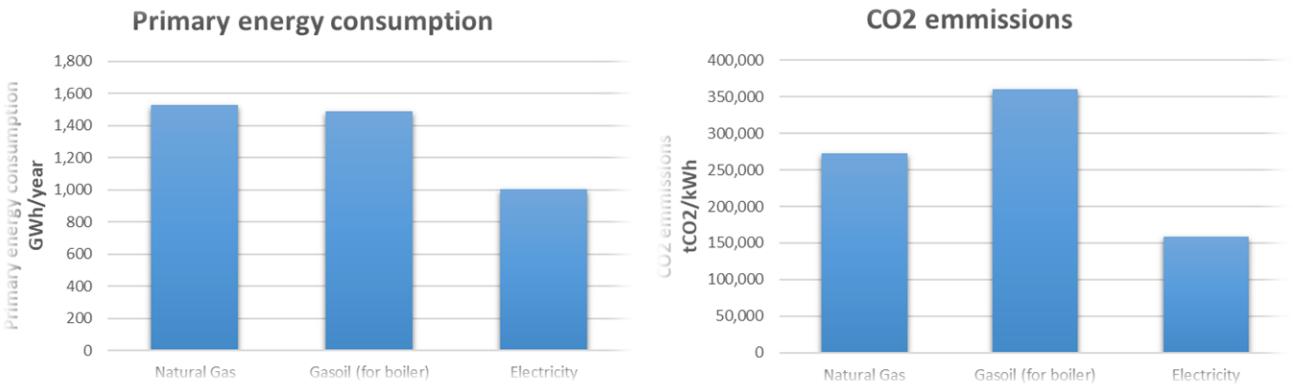

Figure 2: Primary energy consumption (left) and CO2 emissions (right) of public buildings close to the sea in Adriatic – Ionian Region if they would use natural gas boilers, fuel oil boiler or heat pumps for heating

Heat pump industry as an economic force and a provider of local labour

The European manufactures of heat pumps and components are world leaders in this technology.

From a labour perspective, the heat pump sector employs a well-educated workforce in the areas of R&D, components and heat pump manufacturing, installers (including drillers) and service & maintenance. Based on the number of working hours needed to install the different types of heat pumps and based on expert estimates on turn-over per employee, the total number of employees in the European heat pump industry is estimated 78 969 persons, approx. 36% of these being active in heat pump manufacturing.

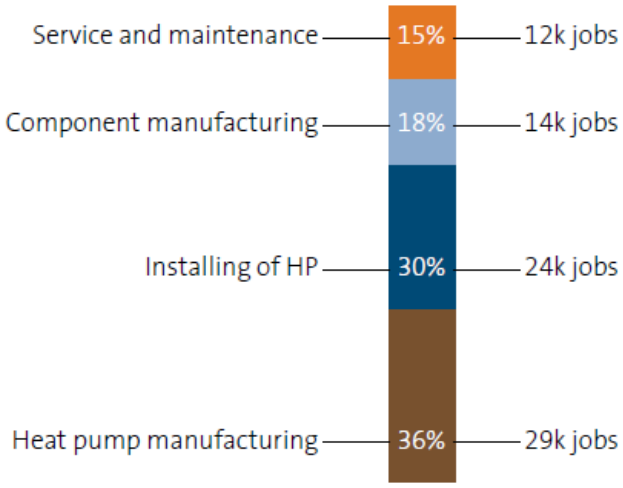

Figure 3: Employment in the heat pump sector 2019 [2]

Since seawater heat pumps' technology is marked by the use of special materials for important parts of the system, there is a need for constant research and development of the same, which also raises the need for educated workers. If research and development is carried out at or near the sites of implementation of seawater heat pumps (coastal area), jobs will also be created that need to be filled with local workers.

In order to conduct tests of developed materials and products, it is necessary to carry out pilot projects where they will be applied. In that case, many local installers, manufacturers and other workers will be hired.

Constant training and education can be carried out by local/regional/national energy agencies.

This is an example of the connection of different stakeholders who can work together to influence the development of the local/regional community.

On the other hand, historical buildings (defined as those built before 1945), which are usually low-performance buildings, represent almost 30–40% of the whole building stock in European countries. Historical buildings often contribute to townscape character. They create urban spaces that are enjoyed by residents and attract tourist visitors. They may be protected by law from alteration not only limited to their visual appearance preservation but also concerning materials and construction techniques to be integrated into original architectures.

In Italy, for instance, heritage buildings built before 1919 are around 19% of the total, and buildings built between 1919 and 1945 are about 12% of the total. In the EU27, 14% of buildings were erected before 1919, and 26% has been built before 1945.

Heat pumps and other HVAC systems seem to be one of the most popular systems to improve energy efficiency in historical buildings without compromising its architecture. Examples can be found in Trieste or Dubrovnik.

A **possible application** in Trieste's city refers to exploit this energy source to serve buildings characterized by high historical and architectural values. The plant provided for this goal consists of three main parts: an open-loop system that picks up seawater through the main heat exchanger and then restores it to sea; a closed-loop ring in which a heat transfer fluid brings sea - recovered energy to final users' derivations; installations inside buildings, consisting in water - to - water heat pumps in order to meet the energy needs of those buildings.

Particular attention has to be paid to the positioning of heat pumps in historical buildings: complying rules on safety during operation, there should be considered settings for exclusive use, suitably located and partitioned form the remaining part of the asset. **Similar importance is due to replacements and integration of the technical distribution facilities in historical buildings**. The proposed system must then interface with architectural features, distribution network and plant of each building.

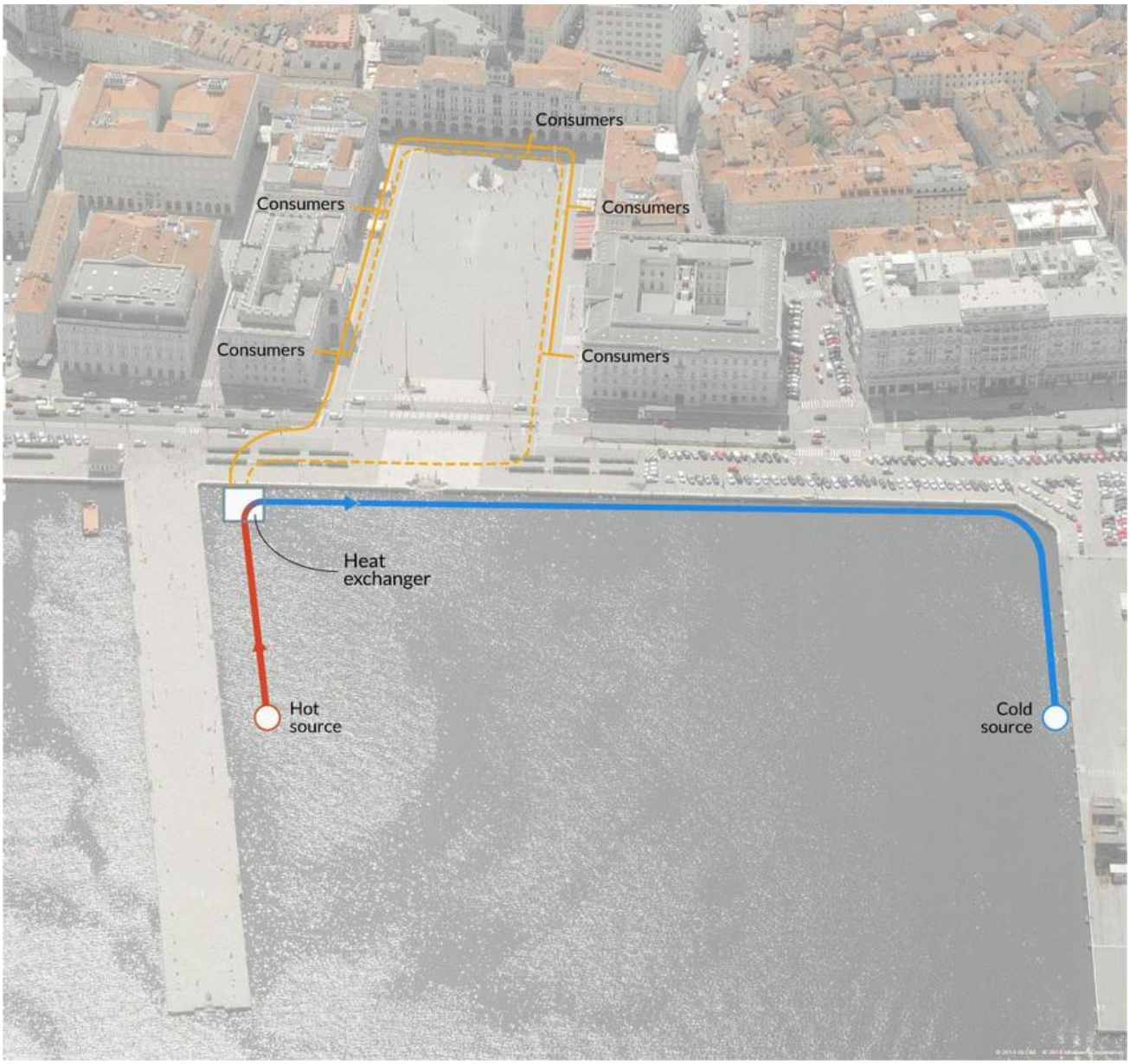

Figure 4: Design concept for an open-loop ring for seawater sampling and secondary closed -loop ring in Piazza dell'Unità d'Italia in Trieste old town [3]

Another application of the seawater heating and cooling technology was applied in the historic town of Dubrovnik.

Works were financed from the SEADRION project, in which Dubrovnik Development Agency, DURA, participated. The European Union supported it, and six heat pumps were installed to exchange energy with seawater and enable heating and cooling. The intake is in the old port, and the recirculation is conducted in the station. The substations are in the Rector's palace, the city hall and the theatre.

The endeavour cost HRK 3.19 million (EUR 428,100) before value-added tax.

The local authority stressed the pilot project was executed in a protected area, designated by Unesco.

The Croatian city in the far south was independent until 1808 when Napoleon's forces dismantled the Republic of Ragusa.

Figure 5: Seawater heat pump system in the historical town of Dubrovnik

In the table below, **Blue Growth recommendations** for the Adriatic-Ionian region, mostly based on the inclusion of seawater heat pumps in the Blue Growth Strategy, are outlined. Thematic areas have been identified for which encountered obstacles have been listed and possible interventions formulated (relevant actors involved).

Thematic area	Obstacles	Possible interventions	Relevant actors involved
Investments/access to finance	• Absence of economic advantages and motivations for implementing systems in buildings. Moreover, the investment cost is still high both for commercial and domestic use. • Lack of incentive subsidies for SWHP systems and heat pump systems in general. • Absence of financial advantages and measures to support RES projects, especially concerning the creation, operation and manufacturing units for equipment as well as the promotion of research, the development of technology and the concretization for commercial applications of local importance. • The price difference between the electricity produced with renewable energy sources and that obtained with traditional fossil sources is still the biggest obstacle for further diffusion of the technology in question.	• Inclusion of seawater heat pumps in ROPs, national funding programmes and RIS3 or inclusion in Green Public Procurement. • Financial tools as a decision aid (e.g. warranty for studies, test drilling) to cover the risk in case the implementation is not possible.	• National / regional public authority, • Chambers of commerce, • Business support organisations (national banks, banks for reconstruction and development, etc.).

Technological infrastructure	• Lack of knowledge and experience in designing as installing and running SWHP systems. • Lack of knowledge and experience in the construction of boreholes and wells for the needs of heat pumps (seawater intake). • Lack of instructions for installing the seawater intake (it should be standardized). • Superficial system design (oversizing) modelled on the design of conventional heating systems (fossil fuels) which leads to a decrease in system efficiency (system sensitivity). • Poor maintenance of such systems which leads to a decrease in system efficiency. • Non-existing certification or control scheme for installers or installed systems. • Varying approaches are taken by DNOs / possible future challenges	• Standardization of the seawater intake system installation. • Design of central heating/cooling systems with seawater heat pumps (possibility of connection to the associated onshore/offshore wind farm). • Development of special materials to increase system efficiency and reduce problems in the operation of the system. • Designing and installation of pilot projects to develop and test new solutions. • Introduction of multi-source energy systems, especially the photovoltaic/thermal cogeneration in order to utilize the same area both for producing electricity and heat.	• National / regional public authority, • SMEs (producers of related equipment and designs, design offices), • Enterprises (hotels, private companies, apartment complexes).

	(i.e. reinforcement of electricity grid) as a number of heat pumps increases.		
Labour market and employment	• Lack of professional staff in the involved institutions. • Lack of skilled workers in the labour market (designers, contractors, maintainers). • Lack of additional training to upgrade the knowledge of existing workers.	• Capacity building activities to address market needs for qualified professionals. • Support for education and training for new job's opportunities • Creation of specific professional qualifications.	• National / regional public authority, • SMEs (producers of related equipment and designs, design offices), • National / regional public energy agencies.
Awareness and knowledge	• The lack of environmental education in the community leads to an unfavourable reaction to plants' construction. When the latter is combined with contradictory political interests, the procedure may present serious delays. • Lack of public awareness, both about technology and about subsidies. • Potential of heat pumps is not sufficiently exploited in the Energy	• Promotion of heat pump technology through brochures, pilot plants and media attention. • Involvement of heat pumps in the energy strategies (Blue Growth Strategy). • Promotion and diffusion of technology to targeted end-users (medium to large consumers, preferably hotel complexes and public administration buildings).	• National / regional / local public authority, • National / regional public energy agencies, • Education centres and schools.

	and Climate Plan of the Republic of Croatia until 2030 (SWHP are not mentioned at all). • Heat pumps do not have a reputation as a reliable and good solution due to poorly installed systems. • Lack of awareness about sustainable energy management.		
Cooperation among stakeholders	• Lack of trust among actors. • Lack of cooperation among involved stakeholders.	• Provision of greater support to already existing clusters and promotion of their cooperation. • Promotion of small scale eco-industrial parks. • Establishment of an open network of technological infrastructures for SMEs at the EU level to promote advanced manufacturing integration.	• SMEs (producers of related equipment and designs, design offices), • National / regional public energy agencies, • National / regional / local public authority, • Enterprises (hotels, private companies, apartment complexes).
Legal framework	• Lack of a national spatial master plan for RES (seawater heat pump potential).	• Implementation of national strategies to support project actions and outcomes	• National / regional / local public authority.

	• Bureaucracy. • Lack of both specialized and administration data (land registry, property and use, and management of protected areas).	• Counteract both overregulation and the lack of specific policies in the field • Technical guidelines to applicants/investors. • Simplify the procedures of permitting without reducing environmental protection and other important factors. • Increase awareness and knowledge on existing regulatory frameworks impacting the development.	

Conclusion

Mid-2014 the Commission launched the EU Strategy for the Adriatic and Ionian Region (EUSAIR). It mainly revolves around the maritime economy's opportunities – Blue Growth, land-sea transport, energy connectivity, protecting the marine environment and sustainable tourism- sectors that are bound to play a crucial role in creating jobs and boosting economic growth in the region.

“Blue Growth” is one of the pillars elaborated in the Strategy, some of which are the objectives to promote research, innovation and business opportunities in blue economy sectors, by facilitating the brain circulation between research and business communities and increasing their networking and clustering capacity as well as to improve sea basin governance, by enhancing administrative and institutional capacities in the area of maritime governance and services.

Based on difficulties encountered during the implementation of the SEADRION project, many recommendations have been proposed for further progress and understanding of the EU strategy for the Adriatic-Ionian region, and thus the Blue Growth pillar, such as developing awareness and capacities through, e.g. knowledge-sharing platforms, building bridges and collaborations with and among involved stakeholders, etc.

It has been recognized that seawater heat pumps are not part of the Blue Growth pillar, and thus not part of the Strategy, although their implementation contributes to energy efficiency, quality of life, employment, etc., most importantly, builds bridges and collaborations with and among involved stakeholders as previously mentioned.

The document elaborates the potential of seawater heat pumps as part of the Blue Growth pillar and identifies areas (access to finance, technological infrastructure, labour market and employment, awareness and knowledge, cooperation among stakeholders, legal framework) where there is potential for increased Blue Growth, including obstacles that may be encountered as well as possible interventions to solve them.

Seawater heat pumps are not considered Blue Growth although they use a renewable energy source (seawater) as a heat source; however, the current technology of seawater heat pumps is mature and advanced enough to be included in it and contribute to it in various areas from local employment, stakeholder cooperation, education and training to energy efficiency, environmental protection and life quality.

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