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

Policy Roadmap for the enhancement of H&C technologies through innovative seawater heat pump technologies

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Architecture and SEADRION project partners *and can under no circumstances be regarded as reflecting the position of the European Union and/or ADRION programme authorities.*

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Purpose of this document

Purpose of the D.T3.4.1 Policy Roadmap is the enhancement of H&C technologies through innovative SWHP technologies. The roadmap is providing guidance to regional governments, industry and other elements on the potential of seawater heat pumps and applications in ADRION area focusing on technology, markets and institutional issues.

A methodology for the enhancement of H&C technologies through innovative SWHP technologies is elaborated for each partner country of the Seadrion project.

1 Introduction

The recent Heating and Cooling Strategy from Commission indicated that emissions related to energy used for heating and cooling of buildings could be significantly reduced with technologies which 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 the public buildings located in Greece and western and south part of Adriatic Croatia.

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 Activity T3.4 Policy recommendation, each partner will collect and analyse data and information about:

- regional/national strategy goals that are relevant to the use of renewable technologies in heating and cooling sector, as well as overall, particularly focused on the implementation of SWHP as well as heat pumps in general,
- milestones (activities) to achieve strategy goals
- frequent barriers that investors and designers encounter during SWHP implementation as well as heat pump implementation in general (technological, environment, social and political, economic and funding, legislative and administrative, etc.),
- proposed measures (roadmap) that would encourage an increase in the implementation of SWHP (technological, industrial, social and policy change,
- stakeholder target groups which could be involved in implementing the proposed measures,
- international good practice applicable to each partner country,
- currently running activities relevant to the use of renewable technologies in heating and cooling sector, particularly SWHP and heat pumps in general.

Due to diverse legislation and development, four partner countries were involved in this activity:

CROATIA – UNIZAG
GREECE - CERTH
ALBANIA - AKBN
SLOVENIA - GOLEA

The main focus of the study are the obstacles that investors and designers face in the implementation of seawater heat pumps and the measures and activities for each partner country that would contribute to increasing the application of such systems.

2 Methodology

The table bellow elaborates methodology for the enhancement of H&C technologies through innovative SWHP technologies for each partner country of the SEADRION project.

2.1 CROATIA

1 Country	Croatia
Partner institution/company name	UNIZAG FSB
Address	Ivana Lučića 5, 10002 Zagreb
e-mail	iva.bertovic@fsb.hr

2 Summary
Summary on national legislation on RES (specifically SWHPs) Croatia has several documents that represent national legislation on RES, specifically heating and cooling, and they are: • Energy Act (Official Gazette 120/12, 14/14, 95/15, 102/15) • Regulation of Energy Activities Act (Official Gazette 120/12) • The renewable energy sources and high-efficiency cogeneration Act (Official Gazette 100/15) • Thermal Energy Market Act (Official Gazette 80/13, 14/14, 102/14, 95/15) • Rules on conditions and measurements for the establishment of quality systems and proceedings for certification of installers of renewable energy sources (Official Gazette 56/15) • Technical Rules on heating and cooling systems of buildings (Official Gazette 110/08) Seawater heat pumps (SWHPs) are not included in any national legislation documents. Croatia has a more generic reference to the heat pump technology. National legislation on RES in Croatia is elaborated in more detail in DT1.1.2 National legislation report. **Current share of RES in the final energy supply** The latest official energy data for the Republic of Croatia can be found for the year 2017 when the renewable energy source in final gross consumption was 27.28 % according to the European Energy Agency (EEA) data provided by Statistical Office of the European Union (Eurostat). Figure 1 presents the share of renewable electricity, renewable energy for heating and cooling, and renewable energy for transport in Croatia through the years. In 2017, renewable electricity (RES-E) accounted for 38 % of gross final renewable energy consumption in the Republic of Croatia, while renewable energy for heating and cooling (RES-H&C) accounted for 62 %, and renewable energy in transport (RES-T) was negligible. In absolute terms, **RES-H&C** remains the dominant RES market sector in Croatia due to the still large number of households heating with biomass. Heat pumps, multi-split systems and solar

systems make up a smaller share.

RES-E accounts for the second-largest RES market sector in Croatia consisting mostly of large hydropower plants, onshore wind farms and solar power plants.

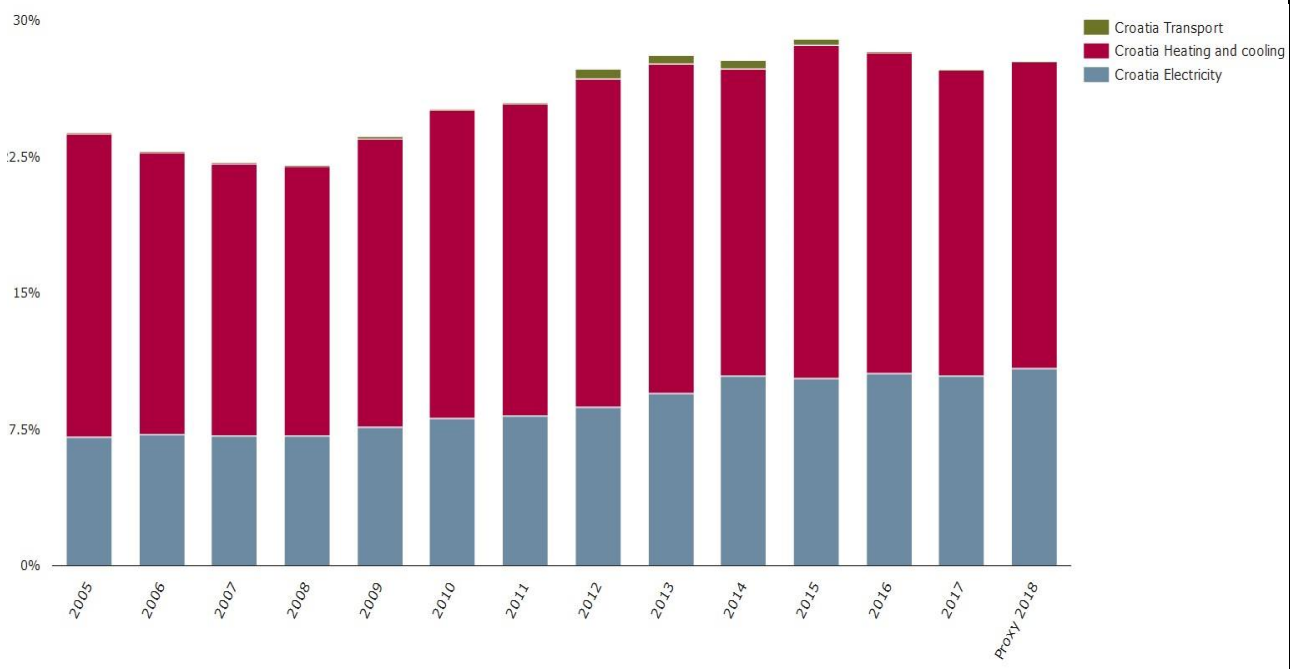
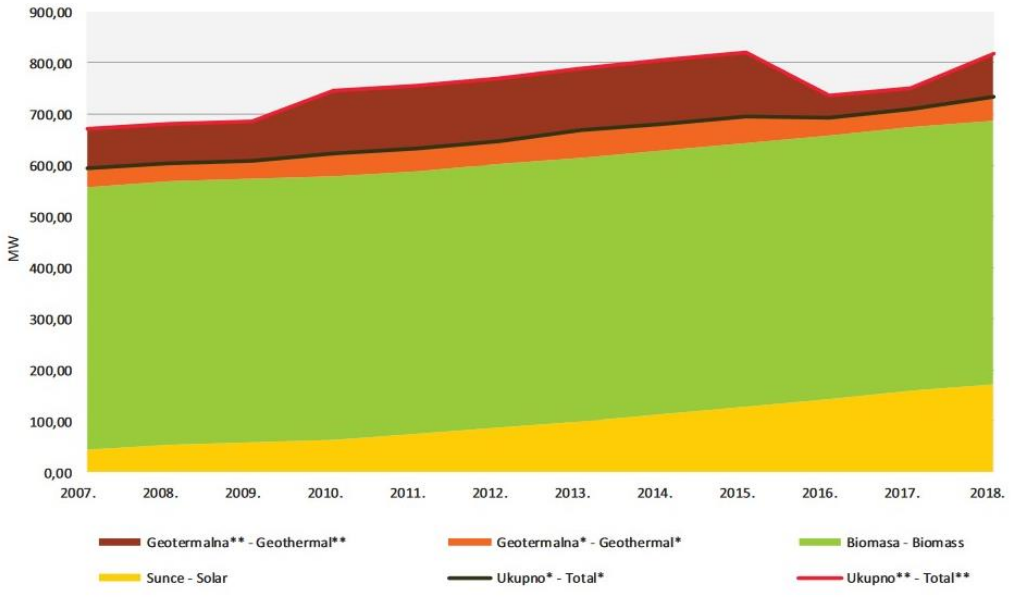


Figure 1: Share of renewable energy in gross final energy consumption

Figure 2 presents installed capacities for RES-H generation in Croatia, which proves that the largest share in RES-H, as already said, is biomass.



* geotermalna toplinska energija za grijanje prostora / geothermal heat for space heating

**uključujući i geotermalnu toplinsku energiju za grijanje tople vode za kupanje / including geothermal heat for hot water and bathing

Figure 2: Installed capacities for RES-H generation in Croatia

3 Regional/national strategy objectives and targets

The Republic of Croatia will fulfil its obligations under the proposal of the European Union Directive considering the promotion of renewable energy sources, including large hydropower plants, aiming to the share of renewable energy sources in gross energy consumption of 20%. Furthermore, Croatia sets the target of maintaining a share of electricity generation from renewable energy sources, including large hydropower plants, up to 35% in total electricity consumption by 2020.

In order to meet the following goals, the Republic of Croatia has adopted an *Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030*, which is based on existing national strategies and plans. It provides an overview of the current energy system and the energy and climate policy. It also provides an overview of the national targets for each of the five key dimensions of the Energy Union and the appropriate policies and measures to achieve those targets.

The table below includes the most important targets that the Plan sets by 2030.

Table 1: The most important targets set by *Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030*

Indicator	Target
Reduction in greenhouse gas emissions for the ETS sector, compared to 2005	at least 43%
Reduction in greenhouse gas emissions for non-ETS sectors, compared to 2005	at least 7%
Share of RES in gross final energy consumption	36.4%
Share of RES in final energy consumption in transport	13.2%
Primary energy consumption (total energy consumption without non-energy consumption)	344.38 PJ (8.23 ktoe)
Final energy consumption	286.91 PJ (6.85 ktoe)

Decarbonisation dimension

The European Union has ratified the Paris Agreement and has committed itself to reduce greenhouse gas emissions by at least 40% by 2030, compared to 1990 emissions. Croatia ratified the Paris Agreement in May 2017 and shared a common EU goal. This common EU target is divided into two parts, the first of which covers large sources of greenhouse gas emissions that are subject to the European Emissions Trading System (ETS sector), and the second for non-ETS sectors, which include other, relatively smaller emission sources, such as: road and off-road transport (except air transport included in the ETS sector), small energy and industrial plants not included in the ETS sector, households, services, agriculture, waste management, land-use change and forestry.

The following goals for reducing greenhouse gas emissions by 2030 have been set for the Republic of Croatia according to the *Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030*:

- in the ETS sector: at least 43% compared to the 2005 level,
- for sectors outside the ETS: at least 7% compared to the 2005 level.

Indicative national targets for RES shares by 2030 are shown in the following table:

Table 2: Indicative national targets for RES shares by 2030

RES share	2020 projections, %	2030 targets, %
In gross final energy consumption	28.6	36.4
In gross final electrical energy consumption	47.0	63.8
In gross final energy consumption for heating and cooling	33.3	36.6
In the final energy consumption in transport	5.2	13.2

Figure 3 presents the trajectory of the share of RES in gross direct consumption by 2030.

As can be seen from the table, the smallest increase in the share of RES will be in the heating and cooling sector, as shown in Figure 4, while in the electricity sector this increase will be the largest. This is because, by 2030, the construction of two to three large hydropower plants, several low-power hydropower plants (on watercourses and in water supply systems) and one pumping hydropower plant is expected. The revitalization of existing plants is expected to extend their lifespan with a slight increase in the capacity of hydropower plants.

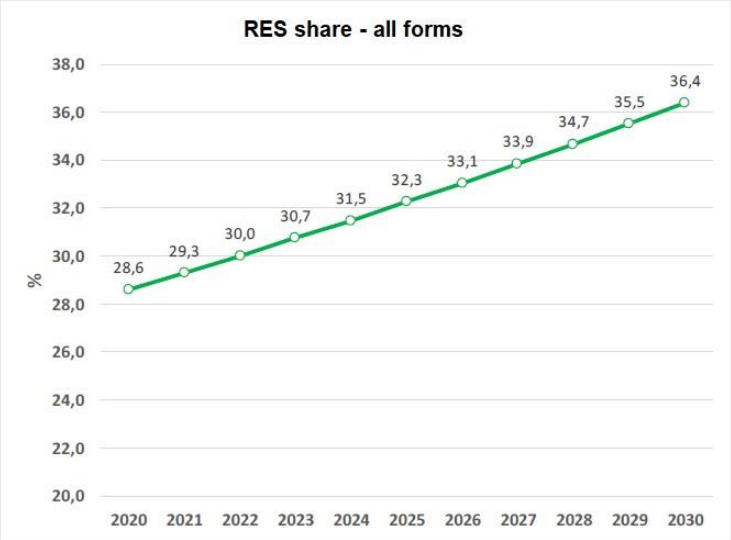


Figure 3: Indicative trajectory of the share of RES in gross final energy consumption

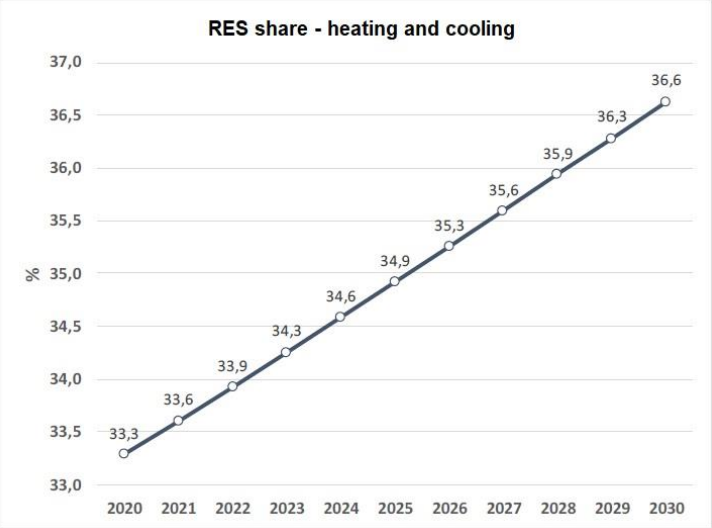


Figure 4: Indicative trajectories of RES share in heating and cooling

According to the new Directive on the promotion of the use of energy from renewable sources 2018/2001 of 11 December 2018, all Member States undertake to increase the share of RES for heating and cooling by 1.3 percentage points per year, or 1.1 percentage points per year if not uses waste heat, as an annual average for the period from 2021 to 2025 and the period from 2026 to 2030, in relation to this share in 2020, expressed as a share of final consumption and according to the methodology prescribed in the same document.

Focusing on the district heating and cooling sector, an increase in the share of RES is required at the level of 1.0 percentage points per year in the period from 2021 to 2025 and the period from 2026 to 2030, compared to this share in 2020. But this condition is also considered to be met if the production of thermal energy in cogeneration production is more than 60%. As the projected share of cogeneration production in Croatian district heating and cooling systems is 79%, Croatia meets the condition of Article 24 of the Directive on the promotion of the use of energy from renewable sources.

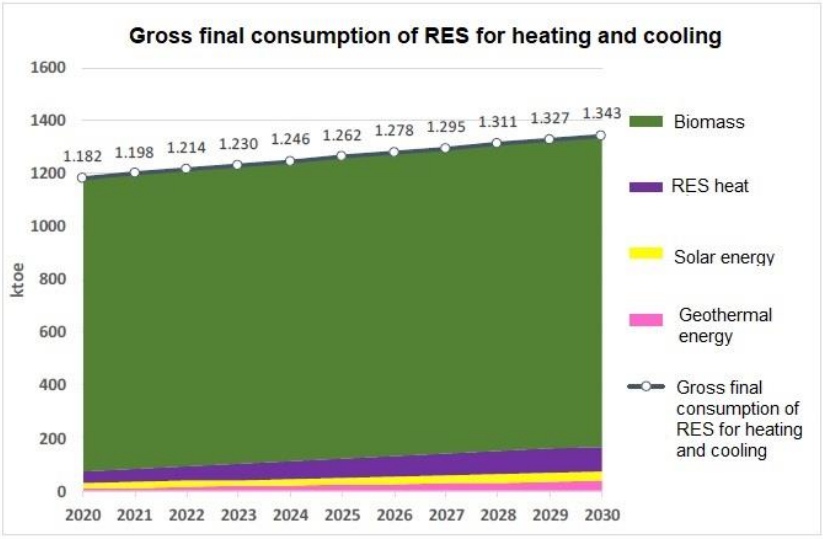


Figure 5: Gross final consumption of RES for heating and cooling

Except for district heating and cooling systems with cogeneration, the share of biomass as RES is leading and will lead in the heating and cooling sector as it is shown in Figure 5.

With this national energy plan, the increase in the implementation of heat pumps as a technology that would greatly increase the use of RES in the heating and cooling sector is neglected. Seawater heat pumps are not mentioned in the document.

On the other hand, Croatia has taken on a role in exploring options for further work on the Clean Energy Declaration on EU Islands, which has recognized the importance of European islands on the road to decarbonising the economy and the role they could play under the Paris Agreement during the EU presidency in the first half of 2020. The main goal will be to define the needs related to the energy transition and the transition to clean energy, taking into account that self-sufficiency is promoted on the islands (both for individuals and larger projects) as well as solutions that will not further burden the transmission system. Ensure electricity supply in every situation. This provides an opportunity to implement seawater heat pumps that would allow households on the islands complete energy independence in the heating and cooling sector, and combination with other technologies such as photovoltaic systems, energy independence in general.

Energy efficiency dimension

Indicative national targets of an increase in energy efficiency by 2030 according to Article 3 of Directive 2012/27/EU are shown in Table 3

Table 3: Indicative national energy efficiency targets by2030

Targets 2030	PJ	ktoe
Primary energy consumption	344.38	8.23
Final energy consumption	268.91	6.85

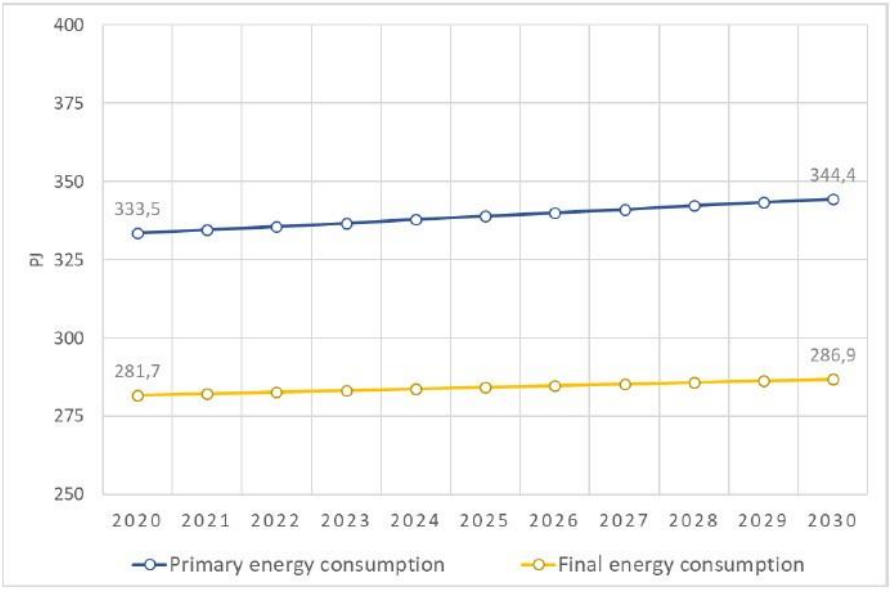


Figure 6: Energy consumption trends in the period from 2020 to 2030

Figure 6 shows energy consumption trends by years in the period from 2020 to 2030.

After 2020, following the Technical Regulation on Rational Use of Energy and Thermal Insulation in Buildings, all newly constructed buildings will be nearly-zero energy (nZEB). It is expected that the total residential stock will grow at an average rate of approximately 6,600 residential units from 2021 to 2030, 6,300 from 2031 to 2040 and 6,050 units from 2041 to 2050. In order to achieve this growth of the total stock, 10,930,698 m² of new buildings and 8,630,863 m² of renovated buildings are expected in the period from 2021 to 2030 (around 30,000 new and renovated housing units per year, with a very high rate of abandonment and demolition of old poor-quality units of about 11,200 units per year).
The average final energy consumption in the residential sector will be 30 kWh/m²a for newly-built and renovated buildings, and it is expected that there will be no significant variations for the non-residential sector.

Pursuant to Article 2a of Directive 2018/844 amending Directive 2010/31/EU on the energy performance of buildings, the Republic of Croatia will adopt a new Long-term strategy for the promotion of investments in the renovation of the national building stock with a plan of measures and indicators for 2030, 2040 and 2050, which will be aligned with the Energy Development Strategy and Low-Carbon Strategy of the Republic of Croatia.

4 Milestones to achieve strategy goals

Several key strategies describe the activities of the Republic of Croatia in the following periods to achieve the set decarbonisation and energy efficiency goals.

The Energy Development Strategy of the Republic of Croatia until 2030 with an outlook to 2050 (hereinafter referred to as the *Energy Development Strategy*) is an obligation under the Energy Act (OG Nos. 120/12, 14/14, 95/15, 102/15, 68/18). To develop the *Energy Development Strategy*, analytical backgrounds have been prepared (the so-called Green Paper and White Paper)

presented to the professional and interested public at the end of 2018 and the beginning of 2019. The analytical backgrounds contain elaborated targets for the use of renewable energy sources (RES), energy efficiency, the internal energy market and energy security. The *Energy Development Strategy* defines the optimal energy mix and development projects intending to ensure the energy independence of the Republic of Croatia, with particular emphasis on strengthening the production of energy from renewable sources. Also, special attention is paid to the security of supply, sustainability and competitiveness of the energy system. All of the above is in line with the objectives of the EU Directives in terms of reducing consumption, reducing greenhouse gas emissions, the sustainability of energy development, the competitiveness of the energy system and a positive investment environment.

The Long-Term Strategy to Encourage Investment in the Renovation of the National Building Stock of the Republic of Croatia by 2050 is crucial for the use of renewable energy sources in building construction, which, through the nZEB request for new buildings and the renovation of existing buildings, includes the obligation to cover a substantial portion of primary energy for the building by using renewable energy sources at the location of the building or in its immediate vicinity.

The third strategic decarbonisation document is **the Draft of the Low-Carbon Development Strategy of the Republic of Croatia until 2030 with an outlook to 2050** (hereinafter referred to as the *Low-Carbon Development Strategy*). The preparation of the *Low-Carbon Development Strategy* and the *Action Plan for the Implementation of the Low-Carbon Development Strategy for a period of five years* is an obligation under the Air Protection Act (OG Nos. 130/11, 47/14, 61/17 and 118/18). The *Draft of the Low-Carbon Development Strategy* was prepared during 2017, when it was submitted for public debate, and refers to the sectors of energy, industry, transport, general consumption, agriculture, waste and land use. The final adoption of the *Draft of the Low-Carbon Development Strategy* has been postponed in order to align it with the *Energy Development Strategy*.

One of the objectives within the decarbonisation dimension is also adaptation to climate change, which is elaborated in **the Draft of the Climate Change Adaptation Strategy in the Republic of Croatia until 2040 with an outlook to 2070** with the action plan (hereinafter referred to as the *Adaptation Strategy*. The *Draft of the Strategy* has been subject to consultation with competent bodies and institutions and with the interested public, and the adoption of the document is expected upon the adoption of the *Low-Carbon Development Strategy*.

The key document for the energy efficiency dimension is **the Long-Term Strategy to Encourage Investment in the Renovation of the National Building Stock of the Republic of Croatia by 2050**, which promotes the need to invest in the building stock. The current energy renovation rate of 0.7% per year will gradually rise to 3% over the 2021-2030 period, with a 10-year average rate of 1.6%. An important element is the introduction of additional measurable indicators of energy renovation of buildings, which will strengthen the process of conversion of the stock into nearly zero-energy buildings, i.e. climate neutral.

Some of the measures relevant to the decarbonisation and energy efficiency of the Republic of Croatia that are planned to be implemented in order to meet the set objectives are shown in Table 4.

Table 4: Overview of measures relevant to the decarbonisation and energy efficiency of the Republic of Croatia

Number	Name
1	Supporting the establishment and capacity building of regional energy and climate agencies
2	The EU Emissions Trading System
3	Charter of Cooperation for the Decarbonisation of Buildings by 2050
4	Establishing of Platform for Hydrogen Technologies
5	Limiting fluorinated greenhouse gas emissions
6	Measures to increase energy efficiency by improving processes and process units
7	Information, education and capacity building for RES use
8	Spatial planning requirements for using RES
9	Promoting the RES use for the production of electricity and thermal energy
10	Development of the regulatory framework for RES use
11	Energy efficiency obligation scheme for suppliers
12	Promoting nearly-zero energy standard in buildings construction and refurbishment
13	Energy renovation programme for multi-apartment buildings
14	Energy renovation programme for single-family houses
15	Energy renovation programme for public sector buildings
16	Energy renovation program for heritage buildings
17	Energy management system in the public sector
18	Energy renovation programme for public lighting
19	Green public procurement
20	Energy management system in business (service & production) sector
21	Providing information on energy efficiency
22	Energy efficiency education
23	Integrated information system for monitoring energy efficiency
24	Energy efficiency of the electricity transmission network
25	Reduction of losses in the distribution network and introduction of smart grids
26	Increasing efficiency of district heating systems
27	Increasing efficiency of the gas transport network

Measures related to the heating and cooling sector are based on high-efficiency cogeneration and efficient district heating and cooling taken from the document *Programme for the use of efficiency potential in heating and cooling for the period 2016-2030*.

Heat pumps are barely mentioned in several parts (measures) of the energy strategy of the

Republic of Croatia as:

- New technology applicable in energy transformations as part of revitalization and increase of energy efficiency in existing thermal and hydropower plants,
- Technology that must be promoted to increase the use of such systems in buildings,
- Technology that can be used in terms of greater integration of RES into district heating systems and possible development of district cooling systems,
- Technology to increase the efficiency of district heating system,
- Technology that can be used for construction and renovation according to the nZEB standard.

Heat pumps have not been given sufficient importance in the energy strategy of the Republic of Croatia, while seawater heat pumps are not mentioned at all.

5 Barriers

In the Republic of Croatia, heat pump technology is still not sufficiently known, and a very small number of users decide to implement such systems, especially large systems. Air-to-air and air-to-water heat pump systems are most commonly used in both residential and non-residential buildings, while water-to-water heat pump systems, including seawater heat pumps, are used at higher building loads but not to the same extent as systems with air as a heat source. The reason for this is the more demanding design of the system (drilling of pumping and sinking wells), which entails a larger required investment. Also, seawater heat pump systems, as well all heat pump systems, require knowledge and experience in designing as well as installing and running systems for the system to work properly and successfully. Some administrative barriers cause fewer and fewer users to opt for such systems. Due to all the above and similar situations, water-to-water and seawater heat pumps do not have a reputation as a reliable and good solution in Croatia.

In order to try to increase the use of heat pumps in general and seawater heat pumps in particular, because Croatia is a country with a large coastal area and many islands, it is necessary to identify all possible barriers. Part of the policy roadmap is to identify barriers and to suggest the best steps to overcome them. Below is a list of common and possible barriers that occur when implementing seawater heat pumps and heat pumps in general in the Republic of Croatia.

Technological barriers

- Lack of knowledge and experience in designing as installing and running such systems.
- A small number of companies professionally engaged in the construction of boreholes and wells for the needs of heat pumps (seawater intake).
- 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)
- System modifications during installation by the contractor, which may lead to poorer system performance.
- 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.
- Lack of advanced control and management systems in practice which leads to low

efficiency (pumps work 24 hours, bivalent drives are not harmonized,...).

Legislative and administrative barriers

- Lack of both specialized and administration data (land registry, property and use, and management of protected areas).
- Lack of legislation governing the installation of seawater intake.
- Undefined from which authorities (local, city, county, state) to request a concession for special use of the marine domain (direct seawater intake).
- Undefined whether the use of seawater from coastal wells is equal to the use of groundwater from wells.
- Lack of a national spatial master plan for RES (seawater heat pump potential).
- SWHP developments may require several planning permissions. The process can be complex and time-consuming.
- Bureaucracy continues to create major obstacles.

Social and political barriers

- Lack of public awareness, both about technology and about subsidies.
- Potential of heat pumps is not sufficiently exploited in the Energy 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.
- Scepticism towards central heating and cooling systems.
- Citizens still rely on conventional heating systems.
- Lack of awareness about sustainable energy management.
- Lack of professional staff in the involved institutions.
- Investor fear of system malfunction with such a large required investment (easier to install a conventional system with less necessary maintenance and control).

Economic and funding barriers

- 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.
- Electricity and gas price ratio are not encouraging.

Environment barriers

- Public concern about the impact of SWHP on marine pollution.
- Seawater intake at shallow depths (recommendations are 15 - 20 m), and there are systems where water is taken from the port or a few meters depth.

6 Key focus areas

In order to increase the implementation of seawater heat pumps, it is necessary to remove as many of the obstacles mentioned in the previous section as possible. Simplified, the question is how to apply heat pumps, i.e. seawater heat pumps more easily.

The key areas where changes are needed are listed below. For each area, suggestions are made that could facilitate the implementation of such systems.

SECTOR	STEPS
Technological change	a) <u>Standardisation of the seawater intake system installation</u> The primary purpose of the seawater intake system is to provide a reliable source of seawater in the proper quantity and at the proper quality and temperature to ensure satisfactory operation of the heat pump system. At first, glance, supplying seawater from the sea to a heat pump room along the coastline appears to be a relatively simple task. The sea, however, is a dynamic entity which is constantly in motion and, therefore, constantly changing the shoreline and the nearshore bottom profile. These changes are the result of the action of waves and currents which are capable of moving large amounts of sand and sediments. The sea is extremely powerful and can create devastating forces in short periods. Seawater also acts slowly to cause the incipient corrosion of submerged structures. Also, the sea is alive with marine organisms which can rapidly attack or foul submerged objects. All of these factors combine to complicate the installation of equipment in the sea or subsurface and make the design of seawater intakes a task which requires careful attention and planning Because the design of seawater intake systems superficially appears simple, often the data used is insufficient to evaluate the many parameters that can adversely affect the performance of a seawater intake properly. For this reason, problems often develop in the operation of seawater intakes. Consequently, problems with seawater intakes and corrosion are the two primary causes for unscheduled downtime in seawater heat pump systems. It is important to standardize the materials that can be used in seawater intake systems since contractors, as well as designers, are not aware of the impact of marine water on the material of such systems (corrosion). Also, it is important to define the necessary protection (protection grid) against the entry of biological contaminants (larger organisms such as fish and molluscs and the withdrawal of sand from the seabed) into the system, especially in the case of direct seawater intake. If the sea is shallow at the site of direct seawater intake, it is important to position the suction port at a certain height above the seabed to prevent sand from entering from the seabed. Also, depending on the depth of water intake, the change in water temperature as well as the influence of sea currents and waves depends. In the case of subsurface seawater intake from coastal wells, it is important to properly drill the borehole and the well from which the seawater will be pumped. Also, it is recommended to test the soil at the site of the seawater heat pump implementation in order to determine the sufficient water supply

of the wells for the successful operation of the heat pump.

The above are just some of the recommendations that would need to be standardized to facilitate seawater intake system implementation as well as seawater heat pump systems in general. With proper implementation of the system, the operation of the system would also be successful, allowing users to opt more for such systems.

b) Encouraging the construction of coastal wells

The subsurface seawater intake form coastal wells imply that this water contains fewer admixtures, oils and debris and biological micro - and macro - organisms, resulting in less biological contamination of pipelines and heat exchanger of the seawater intake system, and thus a more stable operation of the system. Also, such water has less salinity, which reduces the possibility of corrosion occurrence and development. The application of pump, piping and heat exchanger material is the same as for direct seawater intake. The measuring results of pilot plants with subsurface seawater intake show that such seawater intake enables more efficient operation of the seawater heat pump system since the temperature changes of such water are less than in the direct operation which, also, has a major impact on the system operation efficiency.

Moreover, usage of seawater through a coastal well is under the direct jurisdiction of Hrvatske vode (Croatian legal entity for water management established by the Water Act) while for the usage of seawater through direct intake a concession approval for special use of the marine domain needs to be asked from the authorities. The afore-mentioned greatly facilitates and speeds up seawater heat pump system installation.

c) Providing heating and cooling together

Since heat pumps have the ability to both heats and cool the space, when installing a new heating system or replacing an existing one with a seawater heat pump, it is advisable to provide both if possible.

The implementation of a seawater heat pump system requires a large initial investment (seawater intake, titanium heat exchanger, heat pump) so it is pointless to invest so much if what is invested is not used to the maximum. The relatively high sea temperature in winter and low in summer compared to the outside air temperature makes seawater a very favourable heat source or sink. Due to the lack of knowledge of designers of thermos-technical systems, the possibility of cooling with heat pumps is often not used. When applying heat pump cooling, it is necessary to pay attention to the heating and cooling energy distribution system (fan coils, wall or ceiling cooling). Applying both heat pump heating and cooling reduces the payback period, which is one of the main guidelines according to which the investor makes a decision on the choice of heating and cooling technology. In addition, the possibility of installing an

	additional unnecessary cooling system (additional expense) is eliminated if the installed heating distribution system is suitable for both space heating and cooling. Also, with seawater heat pumps, there is the possibility of direct seawater cooling. Assuming seawater is available, and the local environmental and regulatory standards can be met, the use of direct seawater for cooling requires the least external electrical power generation and is the most cost-effective, safe, and process stable. However, the simultaneous provision of heating and cooling makes seawater heat pumps a more attractive technology with lower operating costs compared to others. d) <u>Design of central heating/cooling systems with seawater heat pumps</u> Design of central heating stations with seawater heat pumps provides space heating and cooling of several buildings at the same time, i.e. district heating and cooling. As in this case, the heat pumps are located in the same central space, the intake of seawater from coastal wells or directly from the sea occurs in one place. This reduces the required investment cost for seawater intake systems, and the investment cost in general, as it is not necessary to drill wells or lay pipes in the sea for each building separately. In addition, the application of electricity produced from RES and smart regulation in such district heating and cooling systems makes them energy independent and efficient.
Industrial change	a) <u>Heat pump market drivers</u> Heat pumps are a possible substitute for standard fossil fuel-based burners. Functionally equivalent, they provide heating and sanitary hot water. Reversible units have the ability to also provide cooling, which improves efficiency and adds additional comfort to the user. In a rational world, consumers would base their purchasing decision on a mix of cost and comfort criteria. Thus, they would calculate the total cost of ownership (TCO) over the expected useful life of each alternative and choose their heating system accordingly. In reality, investors are more often guided by a short-term focus on investment cost only, ignoring the TCO perspective. In the past, a TCO perspective revealed a cost advantage for heat pumps due to much lower operating costs, and this advantage decreased significantly in many markets as a result of a parallel reduction of fossil fuel prices and an increase in the cost of electricity. This leads to a less favourable energy price ratio for heat pumps. To overcome the resulting negative impact on sales developments, manufacturers need to focus more strongly on creating awareness both for the concept of the total cost of ownership as well as of the side benefits of heat

pump systems increasing cost competitiveness over the useful life of the product: influencing factors are increased efficiency at current cost and cost reductions across the value chain offering additional value to the consumer such as the integration of heat pumps into the buildings ventilation system, the use of electricity produced on-site, the employment of free waste heat from cooling processes for heating and sanitary hot water. The latter is particularly noteworthy in large commercial buildings.

Learning curve effects are expected to materialise in the (near) future as a result of steadily increasing total aggregated sales. At current market growth levels, the European heat pump sales will double every 8 – 10 years, which should result in a cost reduction of approx. 22% by 2024 and approx. 39% by 2030. Figure 7 highlights the path for sales growth and costs. For this projection, an annual growth rate of 10% is assumed.

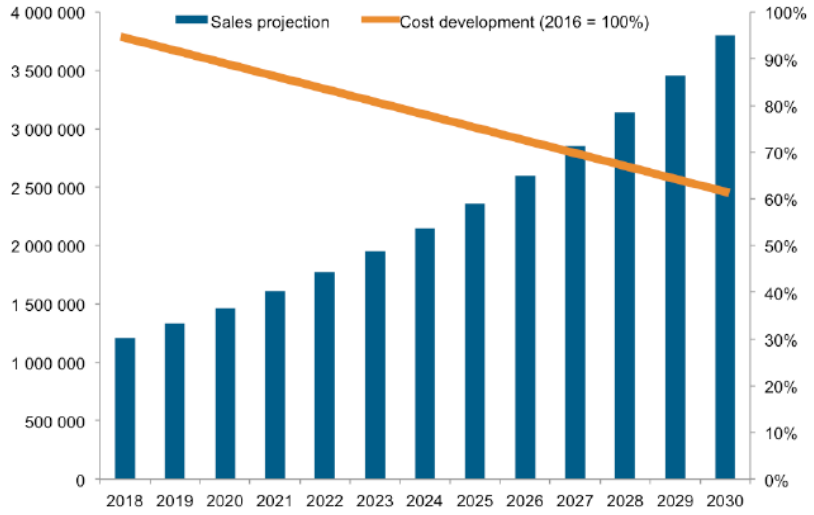


Figure 7: Projections of heat pump sales and manufacturing costs until 2030

Both cost and efficiency improvements can be expected from dedicated developments at the component level. Compressors are optimised for heat pump applications, expansion valves, three-way valves and control systems are getting more standardised and are sold in much larger numbers. The manufacturing of pre-fabricated sub-units (refrigerant cycles, complete outdoor units) that are then integrated into the casing and connected to the hydronic system greatly helps to reduce manufacturing time and cost.
Standardisation on the heat pump unit itself will allow for an easier, faster installation, whilst also limiting the scope for installation quality issues. Subsidy schemes and other incentive programs by government and industry stakeholders can in principle also help to overcome cost disadvantages. They need to be designed with a long-term perspective, ideally independent of government budgets.

The most cost-efficient impact on heat pump market development will be the development of a decarbonisation pathway for society in general and the heating/cooling sector in general. If governments develop these plans,

	announce them, and set a time table for their execution, the industry can and will adjust R&D as well as production planning. End users will react likewise. Suppose it becomes clear that regions will be disconnected from the gas grid. In that case, investors will stop choosing combustion technology today in order to avoid the disadvantage of system change in the future. b) <u>Training for heat pump designers and installers</u> Due to the lack of knowledge and experience in designing as installing and running seawater heat pump systems, as well as heat pump systems in general, it is necessary to enable regular education of heat pump designers, installers and service technicians. The ultimate goal is to be able to guarantee the quality of designing, planning, drilling, installation work and maintenance of the system in order for it to be reliable and sustainable. Before installing or servicing a heat pump system, the technician must have proper training and knowledge of air conditioning/refrigeration theory, principles and operation. With today's energy demands and costs soaring, there is a tremendous need for highly efficient equipment. These systems pose new demands for installers and service technicians. New heat pump systems with single, dual, and variable capacity are being utilized, which requires trained technicians with the ability to install, service, and maintain this equipment. Heat pump design engineers should also be regularly educated as heat pump technology is a technology that is still evolving and constant learning and upgrading of knowledge are inevitable. One of the most important parts of the system for its efficient and reliable operation is the seawater intake system. The quality in the installation of it, in particular when drilling for coastal wells, is crucial, which is why installers must be specially trained for this as well. An educated workforce will be responsible for well-installed systems, which will lead to satisfied investors and, consequently, more and more investors will decide to invest in such technology, i.e. seawater heat pump technology and heat pump technology in general. At the same time, the considered technology becomes cheaper as the proper installation and maintenance of the system reduce both planned and unplanned operating costs. Training for heat pump designers and installers should be the responsibility of the relevant state institution and large manufacturers in whose interest it is to increase the application of such systems. ▪ improving the performance characteristics of the heat pump due to biofouling → self-cleaning system → reduction of maintenance time
Social change	a) <u>Promotion of heat pump technology through brochures, pilot plants and</u>

	media attention Due to the lack of public awareness about seawater heat pump technology, as well as heat pump technology in general, and sustainable energy management, a small number of potential investors opt for such technology. In order to increase the application of heat pumps, and in particular seawater heat pumps, it is necessary to present the basics of the considered technology to end-users (investors) in a concise, simple and understandable way for them. One of the ways to do this is to create brochures or leaflets that would contain the content mentioned above that could then be distributed to interested investors by the competent state institution, and could also be distributed to heat pump system designers who would then also distribute them to potential investors who turn to them for advice or to design such a system. Since the investment cost of a heat pump system is high, it is understandable that each of the investors wants to know what they are investing in and whether it is profitable. In addition, greater coverage of heat pump technology in the media would change public awareness and thus increase the number of interested investors. In Croatia, there is already a large number of pilot plants that could be used for these purposes. It is assumed that each of the pilot plants has built-in measuring devices and thus could directly demonstrate the efficiency of such systems. b) Visible register of installed heat pumps in Croatia The register of installed heat pumps in Croatia would contain a list of installed heat pump systems according to the type of heat source/sink, heating capacity and installation location. When the end-user (investor) would see that the technology of heat pumps and thus the seawater hat pumps have already been applied in many cases in Croatia, the awareness of the considered technology as something new, untested and experimental would change into reliable and safe. This would increase the number of investors considering these technologies and thus, those who would decide to install such a system.
Policy change	1) Involvement of heat pumps in the energy strategies of the Republic of Croatia In order to increase the implementation of seawater heat pumps, and heat pumps in general, their application must be included in the national energy strategies, in this case, *Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030*. Heat pumps are barely mentioned in several parts (measures) of the energy strategy of the Republic of Croatia as already mentioned in the Milestones to achieve strategy goals section. Heat pumps have not been given sufficient

importance in the energy strategy of the Republic of Croatia, while seawater heat pumps are not mentioned at all.

2) Strategy for exploiting the potential of heat pumps in the Republic of Croatia

The development of a strategy for exploiting the potential of heat pumps in the Republic of Croatia would contribute to greater interest in this technology and a greater number of investors who would opt for it. The strategy would contain mapped potential locations for the installation of heat pumps depending on the type of heat source/sink, which would provide investors with insight into the cost-effectiveness of implementing such systems in the considered locations. In addition, it would be good to include examples of simulated heat pump systems (case studies) at different locations with different heat sources/sinks of heat pumps, in order to see the relative efficiency of such systems.

This would also include more locations on the Adriatic coast and islands related to the implementation of seawater heat pumps. Providing data on sea temperatures up to 20-30 m depth at these locations would also be of great benefit since the water intake for heat pump operation is done at these depths.

3) Defining seawater utilisation

First, and probably the biggest problem regarding the use of seawater heat pumps in the Republic of Croatia is the lack of instructions for installing the seawater intake, especially from the legal point of view. Since the coastal area mostly isn't in the property of a natural or legal person, for the installation of the seawater intake system, concession approval for special use of the marine domain needs to be asked from the authorities.

Moreover, usage of seawater is not under the direct jurisdiction of Hrvatske vode (Croatian legal entity for water management established by the Water Act), if the intake isn't done through a well. While for land water usage a fee is prescribed by the Water Act, for seawater usage, the fee is prescribed by the local administration for each project separately. In order to be sure that everything is done legally, a lot of communication with the authorities is needed.

Therefore, it is necessary for the Water Act or the ordinance that will be under the Water Act to define the use of seawater as a maritime good, whether it is direct use or from subsurface wells. This shortens the unnecessary waiting time for the permit for the use of seawater by the authorities and the realisation of the seawater system can be achieved as planned.

4) Financial incentives for the implementation of seawater heat pumps

Subsidies for using RES plants were enabled by the Environmental Protection Fund, the ministry responsible for energy and a number of cities and counties, on several occasions. These sources have financed the initial investment, most

	often up to 40% of the total amount, predominantly in the solar thermal systems for the preparation of hot water and other heat systems using the RES. RES resources are also available within the framework of the European Structural and Investment Funds, primarily within the Operational Program Competitiveness and Cohesion 2014-2020, from which, for the promotion of energy efficiency and renewable energy, more than EUR 530 million is available. After the Fund co-financed the purchase and installation of biomass boilers and heat pumps in 2018, in 2019, in addition to the above, solar thermal collectors for water heating were added to the incentive program. Citizens will be able to get 40, 60 or 80 percent of the co-financing, depending on the location of the house. On May 14, 2020, the government made a decision to accept the energy renovation program, which provides EUR 19.000.000,00. State incentives for energy renovation of family houses include: replacement of external windows, thermal insulation of the outer shell of the heated space and installation of systems for the use of renewable energy sources, which include heat pumps. There is no incentive for the application of seawater heat pumps, however, smaller households can also apply for the incentives mentioned above. The Environmental Protection Fund plans to publish incentives for the use of seawater heat pumps in the near future.

7 Involved stakeholders

Suggested stakeholder target groups which could be involved in implementing the suggested methodology activities mentioned in the previous section, *Key focus areas* are listed in the table below:

Table 5: Stakeholder target groups

STAKEHOLDER GROUP	INSTITUTION	METHODOLOGY ACTIVITY
National public authority	▪ Ministry of Construction and Physical Planning ▪ Ministry of Environmental Protection and Energy ▪ Ministry of Regional Development and European Union Funds ▪ Ministry of Science and Education	▪ Standardization of the seawater intake system installation ▪ Heat pump market drivers ▪ Training for heat pump designers and installers ▪ Promotion of heat pump technology through brochures, pilot plants and media attention ▪ Visible register of installed heat pumps in Croatia ▪ Involvement of heat pumps in the energy strategies of

		the Republic of Croatia ▪ Strategy for exploiting the potential of heat pumps in the Republic of Croatia ▪ Defining seawater utilization ▪ Financial incentives for the implementation of seawater heat pumps
Local and regional public authority	▪ Municipal Council ▪ City Council ▪ County Assembly ▪ City Assembly ▪ Regional Energy Agency	▪ Encouraging the construction of coastal wells ▪ Heat pump market drivers ▪ Promotion of heat pump technology through brochures, pilot plants and media attention ▪ Visible register of installed heat pumps in Croatia ▪ Financial incentives for the implementation of seawater heat pumps
Bussines support organisations	▪ Croatian Bank for Reconstruction and Development ▪ Croatian employers association ▪ Croatian National Bank	▪ Providing heating and cooling together ▪ Heat pump market drivers ▪ Financial incentives for the implementation of seawater heat pumps
Small and medium-sized enterprises (SMEs)	▪ Producers of related equipment and designs ▪ Design offices	▪ Encouraging the construction of coastal wells ▪ Providing heating and cooling together ▪ Design of central heating/cooling systems with seawater heat pumps ▪ Heat pump market drivers ▪ Promotion of heat pump technology through brochures, pilot plants and media attention ▪ Training for heat pump designers and installers
Enterprises	▪ Hotels ▪ Private companies ▪ Apartment complexes	▪ Encouraging the construction of coastal wells ▪ Providing heating and

		cooling together ▪ Design of central heating/cooling systems with seawater heat pumps ▪ Promotion of heat pump technology through brochures, pilot plants and media attention

8 Opportunities

International good practice

As the Republic of Croatia does not have a defined co-financing strategy and benefits for the application of heat pumps and RES in general, apart from occasional subsidies and incentives, good international practice must be considered to enhance the implementation of such systems. Reviewing the financial incentives of other countries such as Sweden, Belgium, France, Great Britain and Italy, proposed measures that could be applied in Croatia and thus increase the application of seawater heat pumps, as well as heat pumps in general, are:

- Training programmes for RES-installers, EHPA Eucert, a European training and certification program for heat pump installers.
- Tax deductions offered by the Government for energy-saving measures (deduction also covers the expenses related to the installation of these systems to substitute existing systems).
- Investment grants for renewable heating installations, i.e. funding for the utilisation of renewable energies for heat generation (there are limits for a seasonal performance of heat pumps in order to benefit from the support incentives).

9 Current activities

The Republic of Croatia is currently preparing a call for project proposals *Increasing energy efficiency and the use of renewable energy sources in manufacturing industries* in connection with promoting energy efficiency and the use of renewable energy sources (RES) in the private sector of manufacturing in the Republic of Croatia.
The call will finance all forms of heat pumps that use water as a secondary medium. It was explicitly stated that the air-to-air, water-to-air and ground-to-air heat pumps would not be funded.

The call is currently available for consultation with the interested public.

10 Key findings

Croatia has several documents that represent national legislation on RES with a more generic reference to the heat pump technology. Seawater heat pumps are not included in any national legislation documents.
Gross final renewable energy consumption in the Republic of Croatia for heating and cooling (RES-H&C) is accounted for 62 %. In absolute terms, **RES-H&C** remains the dominant RES market sector in Croatia due to the still large number of households heating with biomass. Heat pumps, multi-

split systems and solar systems make up a smaller share.

In order to meet the following goals, the Republic of Croatia has adopted an *Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030*, in which some of the most important set goals are 36.4% share of RES in gross final energy consumption and reduction of greenhouse gas emissions for the ETS sector, compared to 2005, by at least 43%.

Several key strategies describe the activities of the Republic of Croatia in the following periods in order to achieve the set decarbonisation and energy efficiency goals as *The Energy Development Strategy of the Republic of Croatia until 2030 with an outlook to 2050*, *The Long-Term Strategy to Encourage Investment in the Renovation of the National Building Stock of the Republic of Croatia by 2050* and others. Measures related to the heating and cooling sector are based on high-efficiency cogeneration and efficient district heating and cooling taken from the document *Programme for the use of efficiency potential in heating and cooling for the period 2016-2030*. Heat pumps are barely mentioned in several parts (measures) of the energy strategy of the Republic of Croatia.

Croatia has many barriers that hinder the increase in the implementation of heat pumps, including seawater heat pumps, and the most significant of them are the lack of knowledge and experience in designing as installing and running such systems, lack of legislation governing the installation of seawater intake, bureaucracy, lack of public awareness and incentive subsidies.
The document proposes suggestions that could facilitate the implementation of such systems such as standardization of the seawater intake system installation, promotion of heat pump technology, the involvement of heat pumps in the energy strategies of the Republic of Croatia and many others. Many stakeholder target groups could be involved in implementing the suggested methodology activities, from the national public authority to enterprises.

It is important to promote the technology as much as possible, and also to educate the professions involved in order to see progress in the implementation of seawater heat pumps, as well as heat pumps in general, with an emphasis on successful implementation and subsequent operation. The co-financing strategy and benefits for the application of heat pumps and RES, in general, should be defined as soon as possible.

11 Source of data

(1) Share of renewable energy in gross final energy consumption in Europe, https://www.eea.europa.eu/data-and-maps/indicators/renewable-gross-final-energy-consumption-4/assessment-4
(2) Energy in Croatia 2018, http://www.eihp.hr/wp-content/uploads/2019/12/Energija2018.pdf
(3) Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030, https://mzoe.gov.hr/UserDocsImages/UPRAVA%20ZA%20ENERGETIKU/Strategije,%20planovi%20i%20programi/hr%20necp/Integrated%20Nacional%20Energy%20and%20Climate%20Plan%20for%20the%20Republic%20of_Croatia.pdf
(4) EHPA Market Report 2019, https://www.ehpa.org/market-data/market-report/report-2019/
(5) Call for project proposals *Increasing energy efficiency and the use of renewable energy*

sources in manufacturing industries, https://esavjetovanja.gov.hr/ECon/MainScreen?entityId=14087

2.2 SLOVENIA

1 Country	Slovenia
Partner institution/company name	Goriška Local Energy Agency, Nova Gorica
Address	Trg E. Kardelja 1, 5000 Nova Gorica
e-mail	info@golea.si

2 Summary

Present national legislation on RES:

- **Energy Act** transposes several EU directives concerning electricity and gas markets, energy efficiency and renewable energy sources. It also establishes a basis for the operation of Eco Fund with financial support for Renewable Energy Sources and Efficient Energy Use. Eco Fund has been established with the Environmental Protection Act.
- **Energy Concept of Slovenia** sets the long-term national energy policy goals. In general, the goals are to be achieved with improved energy efficiency, awareness-raising among energy users, the development of new sustainable energy technologies, the transition away from fossil fuels towards low-carbon renewable, and the introduction of advanced energy systems and services. It is the base for the National Renewable Energy Action Plan and National Energy Efficiency Action Plan.
- **Waters Act** governs the management of marine, inland and ground waters, and the management of water and waterside land with the aim to achieve a good condition of waters and other water-related ecosystems, to ensure protection against the adverse effects of waters, to preserve and balance water quantities, and to promote the sustainable use of waters for various types of use, facilitating a variety of types of water use by taking into account the long-term protection of available water sources and their quality. The water permit must be obtained for every use of inland, ground and marine water.
- The objective of the **National renewable energy action plan (NREAP)** is to assess and determine the necessary quantitative values of energy consumption from RES by individual sector (heating and cooling, electricity and transport) and to propose measures to facilitate consumption of the desired quantity of energy from RES in future years.
- The Slovenian government has adopted in February 2020 the Integrated **National Energy and Climate Plan (NEPN)** in accordance with the European Regulation on the Governance of the Energy Union and Climate Action.

The share of energy from renewable sources in gross final energy consumption in 2017 was 21.6%. From this, the share of the gross generation of electricity from RES in that year represented a 32.4% share in the total electricity generation. The final consumption of heat/cold in 2017 accounted for 33,3 % from renewable energy sources.

In the NEPN Slovenia's national objective is set at 27 % by 2030 (share of energy from renewable sources in gross final energy consumption).

3 Regional/national strategy objectives and targets

The objectives of Slovenia's energy policy for renewable energy sources are:

- ensuring a 25% share of renewable energy sources in final energy consumption and a 10% share of renewables in transport by 2020, which under current predictions will involve a doubling of energy generated from renewable sources relative to the baseline year of 2005,
- halting the growth of final energy consumption,
- implementing efficient energy use and renewable energy sources as economic development priorities,
- in the long term, increasing the share of renewable energy sources in final energy consumption up to 2030 and beyond.

In order to achieve this renewable energy source objectives, the Slovenian Government will ensure an adequate support environment for:

- energy rehabilitation of existing buildings…,
- replacing heating oil with wood biomass and other renewable energy sources,
- district heating systems based on renewable energy sources and heat and power cogeneration,
- replacing electricity for producing sanitary hot water with solar energy and other renewable energy sources,
- generation of electricity from renewable energy sources,
- developing industrial production of technologies for efficient energy use and renewable energy sources.

The contribution of each technology for obtaining energy from renewable sources to the trajectory and targets for 2020 in the sectors of electricity, heating, cooling and transport is estimated in a possible future scenario. In the case of hydro energy, an evaluation is made of the contribution of plants with less than 1 MWe, between 1 and 10 MWe and over 10 MWe installed capacity. In making estimates for the heating and cooling sector, estimates are given of the installed capacity and production for technologies exploiting geothermal and solar energy, heat pumps and biomass, where biomass is separated into solid, gaseous and liquid biomass. An estimate is given of the contribution of district heating systems using RES.

The table below presents the planned installations of RES technology for heating and cooling. Renewable energy from hydrothermal heat pumps can also be produced with a seawater source, which is considered as blue energy. (1 ktoe = 11.63 GWh).

[ktoe]	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Geothermal energy	16	18	18	18	19	19	19	19	20	20	20	20
Solar energy	3	5	6	7	8	9	10	12	15	17	19	21
Biomass	445	415	431	447	463	479	495	501	507	513	519	526
Solid	401	415	429	442	456	470	483	486	489	492	495	497
Biogas	0	0	0	0	0	0	0	0	0	0	0	0
Liquid biofuel [1]	43	0	2	5	7	9	12	15	18	22	25	28
Renewable energy from heat pumps	2	8	14	20	26	31	37	41	46	50	54	58
Aerothermal	0	1	2	3	4	5	7	8	10	11	12	14
Geothermal	0	4	9	13	17	22	26	29	31	34	36	38
Hydrothermal	0	2	3	3	4	4	5	5	5	5	5	5
TOTAL	465	445	469	492	515	538	561	574	587	600	612	625
District heating	8	17	20	24	27	30	34	36	39	42	45	48
In households	329	332	343	354	365	376	387	388	389	391	392	394

The key objectives for 2030 identified in the NEPN are:

– at least a 35% improvement in energy efficiency, which is higher than the target adopted at the EU level (32.5%),
– at least a 27% share of renewable energy sources; due to the relevant domestic circumstances, Slovenia had to agree to a lower target than that of the EU (32%) but will strive to increase this ambition in the next NEPN update (2023/24).

Share of RES in final energy consumption between the years 2020 and 2030 in heating and cooling sectors (settled national goals)

Year	Share of RES in the heating and cooling sector
2020	36,4
2021	36,6
2022	36,8
2023	36,9
2024	37,1
2025	37,3
2026	38,1
2027	38,9
2028	39,7
2029	40,5
2030	41,4

National goals divided per each renewable energy technology between years 2020 and 2030 in the heating and cooling sector

ktoe	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gross end RES use for heating and cooling	658	647	636	626	615	604	606	608	609	611	613
Solar energy	12	12	13	13	14	14	15	15	16	16	17
Biogas	0	0	0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4
Biomass	515	499	483	466	450	434	425	415	406	397	387
energy accumulated in the environment	78	82	85	89	93	97	100	104	107	111	114
Other RES heat	53	54	56	57	58	59	66	73	80	87	94

(Source: NEPN)

4 Milestones to achieve strategy goals

In order to achieve the objectives mentioned above Slovenia published in 2019 and 2020 the following programmes, grants, public calls and tenders:

- Government Office for Development and European Cohesion Policy, Managing Authority for ERDF, ESF and Cohesion Fund, has issued a grant decision for a **call for proposals that co-finances energy-saving renovation of buildings owned and used by municipalities in 2020, 2021 and 2022.** The Ministry of Infrastructure published the call in February 2020. The available funding under the call for proposals amounts to EUR 25 million of which the Cohesion Fund contribution stands at EUR 21.25 million. The call for proposals co-finances energy-saving renovation of buildings owned and used by municipalities in 2020, 2021 and 2022. The funding under this call for proposals is available to municipalities upon the day of the signature of the co-financing agreement.

- In May 2019 the **SID Bank** (a promotional development and export bank, 100% owned by the Republic of Slovenia**) published loans for financing for comprehensive energy renovation of public buildings**. Affordable loans are offered to the public sector and energy service companies (ESCO) via the Fund of Funds for the complete energy renovation of public buildings. Those loans are accompanied by lower collateral requirements, a lower interest rate and a longer repayment period.

- In December 2019 the Slovenian Government Office for Development and European Cohesion Policy, Managing Authority for ERDF, ESF and Cohesion Fund, issued a grant decision for the **call for proposals "Support for micro, small and medium-sized tourism-related companies to enhance their material and energy efficiency"** that was published by Ministry of Economic Development and Technology. The total European Regional Development Fund support available under the call for proposals stands at EUR 21.5 million of which EUR 18 million will be allocated to cohesion region Vzhodna Slovenija and EUR 3.5 million to cohesion region Zahodna Slovenija. The available funding will be spent for enhancing the competitiveness of micro, small and medium-sized tourism-related companies (SMEs), namely for promoting measures for the use of renewable energy sources and measures reducing the use of materials and energy. The call for proposals aims to reduce operating costs and the development gap of SMEs.

- **Eco Fund's main purpose is to promote development in the field of environmental protection. It is the only specialised institution in Slovenia that provides financial supports for environmental projects. The financial assistance is offered mainly through soft loans from revolving funds and since the year 2008 through grants (fund are available each year).**

A public call for loans for environmental investments of individuals (65OB19):
The objectives of the public call are loans to individuals for environmental investments such as:
- installation of appliances and systems for energy-efficient heating and ventilation and preparation of domestic hot water,
- use of renewable energy sources for heating and preparation of domestic hot water,
- advanced devices for electricity production (solar, hydro, wind, CHP)
- reduction of heat losses as part of the renovation of existing residential buildings,
- construction or purchase of low-energy or near zero-energy residential buildings,

- purchase of energy-efficient household devices,
- purchase of environmentally friendly vehicles,
- separation and purification of wastewater and rainwater,
- substitution of material containing hazardous substances and management of biodegradable waste from the households,
- efficient use of water sources,
- drinking water supply.

As part of renewable energy heating sources also use of water/water heat pump is supported – for production of domestic hot water and household heating. The energy efficiency of the heat pump must meet defined specification. Only natural persons can apply for loans, within loan amount between 1,500€ and 40,000 €.

A public call for individuals for grants for investments in renewable energy sources and the higher energy efficiency of the residential buildings (74SUB-OB19):

The objectives of the public call are grants to individuals for new investments in renewable energy use and the higher energy efficiency of the residential buildings such as:

- installation of a solar heating system,
- installation of a wood biomass boiler for heating,
- installation of heat pump for heating,
- connection of the existing residential building to district heating with a renewable energy source,
- installation of wood windows as part of the renovation of existing residential buildings,
- reduction of wall heat losses as part of the renovation of existing residential buildings,
- reduction of roof heat losses as part of the renovation of existing residential buildings,
- installation of heat recovery ventilation systems,
- construction or purchase of near zero-energy residential buildings,
- complete renovation of an existing residential building,
- purchase of an apartment in an existing residential building renovated as near zero-energy building.

As part of renewable energy heating sources also use of water/water heat pump is supported – for production of domestic hot water and household heating. The energy efficiency of the heat pump must meet defined specification. Only natural persons can apply for grants, within amount up to 2,500 € (4,000 € and 5,000 € in some cases) and maximum 20% (40% and 50% in some cases) of the investment.

A public call for loans for environmental investments (56PO16):

The objectives of the public call are loans to enterprises for environmental investments such as:

- reduction of greenhouse gasses emissions,
- reduction of air pollution,
- waste management,
- water protection and efficient water use,
- discharge of wastewater and drinking water supply,
- investments in environmental technologies.

Among reduction of greenhouse gasses emissions also installation of systems for heating, cooling and domestic hot water preparation can be supported over this public call. In the case of blue

energy water/water heat pump is supported. Only legal entities can apply for loans, within amount from 25,000 € up to 2,000,000 € and a maximum 85% of the investment.
Total available amount for loans in this public call is 5 million €.

A public call for loans for environmental investments in local communities (60LS17):
As above, but only for local communities.

5 Barriers

Part of the policy roadmap is to identify barriers and to suggest the best steps to overcome them.

- *Socio / Politic*
  - Seawater intakes and pipelines may influence on bathing waters and consequently on tourism.
  - Social and political barriers usually interact with each other; when governmental and/or local authorities are reluctant to make decisions and, through lack of knowledge, they fail to properly inform citizens on the necessity (or not necessity) of planned projects. The later leads to inaccurate opinions expressed by others, which are usually then adopted by citizens.
  - The lack of environmental education in the community leads to an unfavourable reaction to the construction of plants. When the latter is combined with contradictory political interests, the procedure may present serious delays.

- *Economic*
  - Absence of economic advantages and motivations for implementing systems in buildings. Moreover, the initial cost is still high both for commercial and domestic use. Only a small effort has been made over the last term to reduce the price of installations, but the overall investment remains expensive.
  - 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.

- *Legislation / Administration*
  - Obstacles in obtaining construction and water permits.
  - Restrictions in protected areas.
  - Some governmental procurement policies have been developed, aiming at the promotion of sustainable commercial development of renewable energy, but the still prevailing inefficient bureaucracy continues to create major obstacles.
  - SWHP developments may require several planning permissions. The process can be complex and time-consuming.
  - The lack of a national spatial master plan for RES is another barrier in many countries. Often, a RES-specific spatial plan was published, but its implementation has shown that there are many questions to be answered before it can help to speed up the whole procedure.
  - The same projects are simultaneously monitored concerning their operation and performance by different authorities (fragmentation).

- The serious problem is that in many countries, there is still a lack of compliance control mechanisms as well as major capacity and institutional gaps. This situation has resulted partly from past but still partly prevailing attitude of regarding legislation more like a wish and less as an obligation. To change this, there is a need to both modify administrative structures and to put in place effective control mechanisms among all levels of government, as well as raise awareness and build capacities at all levels and in a continuous way.
- Lack of both specialized and administration data (land registry, property and use, and management of protected areas).
- Land ownership can also be an issue as the developer may not own the land next to the sea.

- *Funding*
  - Most relevant is the Eco Fund funding scheme which yearly publishes different public calls, there are no other fundings that would help to overcome high initial technology cost both for commercial and domestic use.

- *Technologic*
  - Problems with mud and dirt may occur in pipelines and heat exchangers. Also, biofilms in the heat exchangers decrease the system efficiency. Periodical cleaning is very important.
  - Lack of knowledge to the know-how but also experience in installing such kind of systems.
  - Possible issues around potential design versus built performance. Could be caused by poor quality design and feasibility studies; poor installation; fragmented supply chain; poor operation and maintenance of systems. May lead to SWHPs not being considered as an option/ being designed out during the development of a project.
  - Varying approaches are taken by DNOs / possible future challenges (i.e. reinforcement of electricity grid) as a number of heat pumps increases.

- *Environment*
  - Impact of laying and maintenance of pipelines on the sea bottom,
  - locally changed seawater temperatures can cause an effect on seawater environment and seawater life.

  The effects on environmental barriers can be recognized on the ecosystems, on the landscape and the change of land use. More analytically, fauna and flora can change until a project is completed. SWHP developments may encounter resistance at the planning stage for many reasons. For example, because they are in a conservation area; on a tourist route; the public has concerns about the impacts of a 'novel' technology; the site is on a flood plain; and/or possible wider impacts on the landscape, e.g. tree root systems.
  Effectiveness and sustainability depend on developing the capacity of the local authorities to manage natural resources and using appropriate means to prevent and control any environmental concern. There are cases in which a facility proved environmentally unfriendly since the discharge were disposed of either onto land or water.

- *Energy potential*
  - if too many or too powerful systems are constructed, seawater temperature may

change as a consequence of installed heat pumps,
- energy potential can be used as far a seawater temperature does not change significantly.

6 Key focus areas

In order to increase the implementation of seawater heat pumps, it is necessary to remove as many of the obstacles mentioned in the previous section as possible. Simplified, the question is how to more easily apply heat pumps, i.e. seawater heat pumps.

The key areas where changes are needed are listed below. For each area, suggestions are made that could facilitate the implementation of such systems.

SECTOR	STEPS
Technological change	Technological changes and new applications to the seawater heat pump system that would lead to a greater and easier application of such systems. (Dominant designs, emerging technologies, interoperability) It is possible to achieve technological changes with designing and installation of pilot projects. For designing pilot projects, it is important to sometimes think out of the box and to define solutions which are not yet in general use. Proven solutions are the most reliable, but for a leap in technology, it is necessary to try new designs. With the help of different financing schemes research centres and companies will be able to develop new solutions and achieve progress in the SWHP sector. Connecting different institutions into clusters and associations will help generate new ideas and speed up development.
Industrial change	How to make seawater heat pumps systems cheaper, i.e. more affordable, by industry, designers, contractors, etc. State how to bring technology closer to investors and stakeholders. (Networks of technology developers, lobbying, standardisation) The main problem is how to properly design the SWHP system and simultaneously reduce costs. Salty water needs special materials for pipelines and heat exchangers. Also, it is a process of industrial change to adopt new materials and technologies with the aim of biofouling and mudding problem reduction. In Slovenia the majority of the systems are “open-loop” systems, some others are “closed-loop” systems with heat exchanger installed on the sea bottom. For Slovenia, it is interesting to adopt “open-loop” system with boreholes. Seawater flow is directed thru the ground, which acts as a filter. With this technology, we reduce problems with biofouling in the pipes and in heat exchangers. The system, therefore, operates with lower maintenance cost. Moreover, the installation of the boreholes is often cheaper than the construction

	of a pipeline to the seashore and further on the sea bottom to the intake and discharge point. Accelerating heat pump market development Industry orientated support schemes of institutional or financial nature (commonly referred to as incentives) can accelerate the deployment of heat pumps.
Social change	Promotion and public awareness of seawater heat pump technology. (Behaviour, routines, values, preferences, demand, end-users) Opinion about RES in public is in general very good. However, when it comes to interventions in the environment, local public opinion can change instantly. Public awareness is, therefore, one of the determining factors in achieving the objectives in the SWHP sector. It is important to address the public on different events and with promotion thru media channels. Energy agencies have an important role, and they help local authorities with the promotion of RES. Within different projects, they can provide EU funds for knowledge transfer and small-scale investments. End-users will decide to invest in SWHP technologies more often when cost for installation and permitting will be affordable, and when permitting process itself will be less complex. The increase of the acceptance of electricity as an energy source for heating and cooling is beneficial to a faster deployment of heat pumps.
Policy change	How to encourage the implementation of seawater heat pump systems through changing and/or regulating legislation, i.e. how to address the previously mentioned legislation barriers. (Regulations, economic instruments, governance, agreements) Through a quadruple helix approach and with the organisation of different events and meetings, it is possible to provide and disseminate transference of knowledge related to SWHP. Policy changes must be based on real problems. It is crucial to simplify the procedures of permitting without reducing environmental protection and other important factors. Local energy agencies are preparing Local energy concepts for municipalities; these documents can bring more focus on the use of seawater thermal energy with SWHP technology. Additional funding schemes for investors, or upgrade of existing ones, would be needed to increase interest in SWHP technologies. The challenge in this sector is to incentivize a political will that requires more ambitious political effort to modify the legislative framework governing heating and cooling. Governments should become even more active in shifting away from the fossil fuels toward the use of renewable sources (with the emphasis on the exploitation of locally available renewable sources), and to follow some EU countries (like Denmark, Norway) that have for example banned the use of oil boilers

	and gas boilers in new buildings. Policy-makers should incentivize the activation of private capital to finance the energy transition and prepare strategies and infrastructure for further decarbonisation of its energy system by 2050. Heat pumps will gain in importance when near-zero energy buildings become the building standard in Slovenia.

7 Involved stakeholders

Local public authorities can be involved in Policy changes with implementing local legislation, changes in municipal spatial acts and with financing schemes for local investors. On the field of Social changes, local public authorities can promote the use of RES and host different events for promotion.

SME and Enterprises are both in the field of technology and the field of end-users. In the sector of Technological and Industrial change, companies can develop new technologies and design new systems, which are more efficient, durable and cheaper. In the field of end-users, companies act in the role of investors. Their capability is to invest in new technologies with the aim to lower current costs of operation and with the aim to promote green / blue technologies to their customers.

National public authorities can be similar to Local PA involved in Policy changes with implementing legislation, changes in national spatial acts and with financing schemes.

BSO role is to bring together different companies, to support them with information about possible joint activities and to help them with financing options. Banks can offer innovative financial mechanisms to support companies in achieving technological and industrial change.

The general public is important to achieve Social change. Addressing them with promotion activities will help to increase public awareness and social acceptance. On the other hand, the general public can also be end-user of SWHP, so it is important to support them in the process of investment.

Education centres and schools are the main points of sharing knowledge among young future experts. It is crucial to give students important information about SWHP sector and to prepare them for their role in both industries of SWHP systems and the sector of end-users. Universities and research centres are the cradle of technological change and the basis for Industrial change in next step.

8 Opportunities

In Slovenia, some of already installed SWHP systems use “Closed-loop” technology, but most of the SWHP systems use “Open-loop” technology with direct seawater intake and discharge. Since gaining permits for direct seawater, use is very difficult, and it is very promising to adopt technology used in other countries. With borehole technology, we also use seawater as an energy source with “Open-loop” system. Since the boreholes are located on the land, gaining permits is less complicated. Moreover, when seawater flows thru the ground, it is filtered, and we reduce problems with biofouling.

9 Current activities

Act on energy efficiency

National authorities are in the process of implementing the new Act on energy efficiency. The act will address topics from different EU directives and part of the existing Energy Act. The objectives in the field of energy efficiency and energy efficiency will be in particular:

- reduction of energy use;
- efficient use of energy;
- increasing energy efficiency;
- reliability of energy supply;
- efficient energy conversion;
- the transition to a climate-neutral society using low-carbon energy technologies;
- increasing the energy efficiency of all stakeholders, especially the public sector;
- protection of consumers as final consumers of energy.

Currently in Slovenia is no legislation update addressing SWHPs directly. The National Energy and Climate Plan (NEPN) adopted in February 2020 supports the accelerated integration of heat pumps and technologies for electricity production from renewable energy sources. The NEPN scenario also envisages increased use of heat pumps by 2030.

10 Key findings

The basis for the use of renewable energy sources in Slovenia is defined by different national legislation; the most important between them is the Energy Act.

The objectives of Slovenia’s energy policy for renewable energy sources are defined in National renewable energy action plan (NREAP), the aim is to ensure 25% share of renewable energy sources in final energy consumption by 2020.

Different existing financial schemes already incentivize the investments into seawater heat pumps, additional funding schemes for investors, or upgrade of existing ones, would increase the interest in SWHP technologies.

Slovenia has a short coastline and different natural barriers that limit the use and the installation of sweater heat pumps. Some pilot examples have already been installed where appropriate in past years, and there is still the possibility to install some lower number of additional systems. It is crucial to take into account the social acceptance and environmental restrictions. To this end,

the water and construction permits are requested to be obtained. Anyway, the procedures of permitting should be simplified without reducing environmental protection and other important factors.

Creation of associations and coalitions, as well as a higher number of initiatives, could be organized at the national and local level in order to bring together different stakeholders (researchers, universities, installers, government, etc.) with the aim to support the research in this field and to accelerate the investments in seawater heat pump sector.

11 Source of data

(1) Energy Act - Energetski zakon (Uradni list RS, št. 60/19 – uradno prečiščeno besedilo in 65/20)
(2) Energy Concept of Slovenia - https://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/energetski-koncept-slovenije/
(3) Waters Act - Zakon o vodah (Uradni list RS, št. 67/02, 2/04 – ZZdrI-A, 41/04 – ZVO-1, 57/08, 57/12, 100/13, 40/14, 56/15 in 65/20)
(4) National renewable energy action plan (NREAP) - http://www.energetika-portal.si/fileadmin/dokumenti/publikacije/an_ove/posodobitev_2017/an_ove_2010-2020_posod-2017.pdf
(5) National Energy and Climate Plan (NEPN) - https://www.energetika-portal.si/fileadmin/dokumenti/publikacije/nepn/dokumenti/nepn_5.0_final_feb-2020.pdf
(6) https://ec.europa.eu/eurostat/documents/2995521/9571695/8-12022019-AP-EN.pdf/b7d237c1-ccea-4adc-a0ba-45e13602b428
(7) https://www.ekosklad.si/prebivalstvo/pridobite-spodbudo/objava/javni-poziv-za-kreditiranje-okoljskih-nalob-obanov-65ob19
(8) https://ekosklad.si/gospodarstvo/pridobite-spodbudo/objava/javni-poziv-za-kreditiranje-okoljskih-nalob-56po16
(9) https://www.ekosklad.si/prebivalstvo/pridobite-spodbudo/objava/javni-poziv-74sub-ob19-nepovratne-finanne-spodbude-obanom-za-nove-nalobe-rabe-obnovljivih-virov-energije-in-veje-energijske-uinkovitosti-stanovanjskih-stavb
(10) https://www.gov.si/zbirke/javne-objave/podpora-mikro-malim-in-srednje-velikim-podjetjem-s-podrocja-turizma-za-povecanje-snovne-in-energetske-ucinkovitosti/

2.3 ALBANIA

1 Country	Albania
Partner institution/company name	National Agency of Natural Resources
Address	Blv. Bajram Curri; Bll. Vasil Shanto
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2 Summary
Albania is in the process of drafting legislation that will facilitate the development of renewable energy sources. The new law on Renewable Energy Resources (RES) will be based on the Directive 2009/28/EC. The law aims to promote and support the use of RES and to produce electricity and heat, especially through the use of water, solar, biomass, wind and geothermal energy. An important item of the law will be the establishment of the renewable energy fund. The Fund shall be used for financing projects and studies for identification of the renewable energy potentials in the country; for financing projects that support the use of renewable energy sources, for providing incentives for them; for testing and monitoring the new technologies utilizing energy from renewable sources; for financing awareness campaigns for the use of renewable energy sources, etc. The RES law addresses several issues trying to be in compliance with the EU Directive 2009/28/EC on the promotion of renewable energy sources, including the following: Authorizes the Government to set overall national targets of renewable in the final consumption consistent with the Albania international commitments; Requires the Government to approve a national action plan for renewable energy sources; Requests the competent state authorities and bodies to provide any information and training to increase the awareness of producers and consumers of RES technology; Establishes the Renewable energy fund; Supports the streamlining licensing and permitting procedures. (The one-stop energy shop licensing centre) The feed-in tariff, the green certificate, access on the grid The government plans to introduce some support schemes for the use of renewable energy sources for heating and cooling. The government is reviewing the RES law to add a provision to finance heating and cooling projects, which mainly use biomass in the agricultural sector. The financing is expected to be made through the grants from the RES fund set up by the government. The grants will reach up to 30% of the total cost of project investment. Ministry of Infrastructure and Energy in cooperation with the Ministry of Tourism and Environment is identifying the most suitable projects based on their financial realization and the influence to fulfil the objective of RES. Share of heating and cooling for 2019 in renewable energy is 12.1%. Albania has no specific law focus on seawater heat pumps or heat pumps in general. There are not any official guidance available to local administrative bodies on planning, designing,

building and refurbishing industrial and residential areas to install equipment and systems using renewable energy sources in electricity, heating, and cooling.
The law on renewables (Article 8) provides that the Ministry responsible for energy and the agency authorized to be responsible for renewable energy sources shall ensure that information on support measures for installations is made available to all relevant stakeholders, such as developers, sponsors, investors, financial institutions, builders, installers, architects, and suppliers of heating, cooling and power equipment and systems compatible with the use of energy from renewable sources.

3 Regional/national strategy objectives and targets

The Government has committed to a policy of increasing the use of renewable energy, primarily hydropower, solar and wind, with small-scale hydropower having the highest priority. Methodologies for offering support schemes have been developed as part of this strategy and are described in the Technical Annex. At this stage, they address general principles. However, the detail will need to be kept under review as the Albanian power market evolves. In particular:

- The government will ensure that the levels of all renewable energy sources generating electricity offered to the market are manageable within the framework of other electricity sources and the evolving market.
- There is already extensive experience in commissioning small-scale hydro projects through concession agreements. Such hydro projects are, therefore, likely to continue to be the main source of renewable energy projects, building on this experience. However, for solar and wind projects, there is little previous experience. The Government has defined the FiT for solar, wind and biomass energy in order to promote the best site and at the same time help to reach the respective targets
- The development of a regional market is likely to lead to greater variation in prices over the day, season (winter-summer) and the benefits of by optimizing the utilization of scale hydro projects with small solar photovoltaic and wind power plants to help balance intermittent solar and wind power will increase benefits significantly, and the tariff policy should recognize this.

Table 6 presents RES share in final energy consumption in Albania

Indicative Trajectory			
2011-2012	2013-2014	2015-2016	2017-2018
32.60%	33.20%	34.30%	35.60%

Albania has a wide approach to the development of renewable energy sources (RES) without a specific reference to heat pumps.

4 Milestones to achieve strategy goals

Albania as one of the Contractual Parties of Energy Community Treaty is compelled to transpose and to be in compliance with the EU Directive 2009/28/EC “On the enhancement of energy use from renewable resources, and it must amend and then abrogate Directives 2001/77/EC and 2003/30/EC”. This comes even as a request of Law 138/2013 “On Energy Renewable Resources”.

One of the requests of law and this Directive is the preparation and the approval of the National Action Plan for Renewable Energy (NREAP), which would stipulate the national objectives on renewable energies in the final consumption of domestic energy.
On the other hand, the Albanian government has considered the promotion of renewable energy use as an important tool of energy policies for the increase of the security for energy supply, economic development, energy sector sustainability and environment protection.

Regarding the heating and cooling sector, in Albania, seaside hotels showed interest in heating and cooling their facilities with seawater. Factors contributing to the market's development were:

a) The increase in oil prices compared to the price of electricity;
b) Awareness of public and installers of heating/cooling systems;
c) Introduction of the licensing process for the installation of the systems.

There was no activity in Albania to increase the use of heat pumps until 2020.

5 Barriers

More specifically concerning seawater heat pumps and heat pumps in general, the following barriers have been identified in Albania:

Technological barriers
Lack of knowledge to the know-how but also experience in installing such kind of systems SWHP.

Environmental
The effects on environmental barriers can be recognized on the ecosystems, on the landscape and the change of land use.

Social and political barriers
Excessive bureaucratic obstacles, non-transparent administrative procedures, with lengthy, complex and cumbersome authorization procedures for new RES projects. Acquiring all the necessary documents can take an exceptionally long time, and responsible authorities are not usually required to respond to applications promptly.

Economic barriers
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.

Legislative and administrative barriers
SWHP developments may require several planning permissions. The process can be complex and time-consuming.

6 Key focus areas

The amount of support varies for each renewable energy production with which Albania aims to improve:

Administrative and legal barriers as part of policy change mostly include excessive bureaucratic obstacles, unnecessary complexity concerning permitting procedures, legal uncertainty due to changing legislation, lack of cooperation and lack of clear delineation of responsibility among various authorities, long and complex procedures to obtain zoning and siting permits as well as unresolved property issues and other administrative problems.
The key focus area for Albania is Social change and Policy change.

SECTOR	STEPS
Technological change	Technological changes and new applications to the seawater heat pump system that would lead to a greater and easier application of such systems. (In Albania there are several SME which install heat-cooling pump system, and it's no problem to change the technology for installation the seawater heat pump system)
Industrial change	How to make seawater heat pumps systems cheaper, i.e. more affordable, by industry, designers, contractors, etc. State how to bring technology closer to investors and stakeholders. (Albania do not exist the industry in order to make seawater heat pumps systems)
Social change	Promotion and public awareness of seawater heat pump technology. (In Albania exist the connection with institutions for promotion RES, such is Energy Agency, University and Municipality)
Policy change	How to encourage the implementation of seawater heat pump systems through changing and/or regulating legislation, i.e. how to address the previously mentioned legislation barriers. (In Albania national policy for RES prepared by Ministry charge for Energy and Local Authority)

7 Involved stakeholders

Stakeholders involved in SWHP technology in Albania are:

- Local public authority: *Policy change*
- Higher education and research: *Technology change*
- SME: *for Technology change*
- Regional public authority: **Policy change**
- National public authority: **Policy change**
- Enterprise, excluding SME: *Technology change*
- Business support organisation: Industrial change
- General public: Social change
- Education/training centre and school: Social change

8 Opportunities

International good practice applicable in Albania is Croatia case through the integration

The example of Croatia as a new entrant to the EU shows a path to reforming the energy market

to comply with the EU legislation to benefit from competitive energy supply and to enable early integration with the EU energy market. We should also cooperate closely in sharing knowledge and experience and in creating a regionally synchronized and transparent market space.

9 Current activities

Transposes several EU directives concerning electricity and gas markets, energy efficiency and renewable energy sources. It lays down the principles of energy policy, principles and measures in order to ensure reliable supply, as well as it regulates the area of energy infrastructure and heat distribution.

The RES law contributes to national targets for reducing greenhouse gas emissions and for promoting green economic growth. In order to provide a long-term sustainable support scheme for electricity from renewable sources, the government has more power in making decisions which technologies and to what extent they will be encouraged in the future.

Energy Act does not directly address SWHP topics, but it establishes a basis for the use of renewable energy sources, part of which is also the use of seawater heat pumps.

10 Key findings

Albania has a broad approach to the development of renewable energy sources (RES) without special reference to heat pumps. In any case, Albania is working to develop a strategy to promote all types of RES.

Regarding the heating and cooling sector, in Albania, through the use of seawater, it's necessary to take into consideration:

a) the increase in oil prices compared to the price of electricity,
b) awareness of public and installers of heating/cooling systems and
c) introduction of the licensing process for the installation of the systems.

Barriers on the national level are:

- Lack of knowledge to the know-how but also experience in installing such kind of systems SWHP.
- The effects on environmental barriers can be recognized on the ecosystems, on the landscape and the change of land use.
- Excessive bureaucratic obstacles, non-transparent administrative procedures, with lengthy, complex and cumbersome authorization procedures for new RES projects. Acquiring all the necessary documents can take an exceptionally long time, and responsible authorities are not usually required to respond to applications promptly.

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.

SWHP development may require several planning permissions. The process can be complex and

time-consuming.

11 Source of data

(1) Albania Energy Strategy 2018-2030
(2) Albania Action Plan of Renewable Energy 2019-2020
(3) Albania Action Plan of Energy Efficiency 2018-2022
(4) Albania RES Law
(5) Albania Energy Efficiency Law
(6) Albania Energy Balance 2018

2.4 GREECE

1 Country	Greece
Partner institution/company name	CERTH
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2 Summary
Share of RES in the final energy supply In Greece, the decarbonisation of the national energy market has been declared a top priority under Law 3851/2010, which set the target of increasing the share of RES in gross final energy consumption to 20% and in gross energy consumption to 40% by 2020. Further, as part of its "Clean Energy for all Europeans" package, the European Commission has adopted an update of the RED for the period 2021-2030 (RED II) raising the overall EU target for RES consumption by 2030 to 32% and energy-efficiency target of at least 32.5% with an upwards revision clause by 2030. Based on the latest Eurostat reports, the share of RES in 2017 reached 16.95% of the overall energy production, approaching the target that Greece has set for the end of the decade. In terms of capacity, currently, operative RES projects account approximately 5.5 GW, with the target to stretch to 13 GW by 2030 and more than 23 GW by 2050. Based on the monthly report published in December 2018 by the RES & Guarantees of Origin Operator ("DAPEEP") the Greek power production from RES in 2018 was allocated as follows: (a) wind farms accounted for 45.6% of the installed capacity and 49.6% of the total power produced; (b) PV parks accounted for 44.5% of the installed capacity and 31.5% of the total capacity produced; while (c) hydropower plants accounted for 4.35% of the installed capacity and 6.4% of the total capacity produced. **Licensing and permitting procedures** **Licensing and planning** A local licensing system in accordance with Ministerial Decision (1249/2009) applies to all GSHP (including SWHP) system installations in each Region and is administered by the Regional Authority (Directorate of Development). The license application process must include a study that specifies the maximum heating and cooling capacity (power) of the system seeking a license. A typical cost of €300 for applying, exclusive of the costs of preparation of supporting documents, applies. A typical permit processing time of 1 month should be expected. A planning application is also applicable in the case of a GSHP/SWHP system. The application needs to be accompanied by a detailed planning study. **Drilling permits:** A permit from the Regional Authority for all drilling and groundworks' operations is applicable. The fee for this permit is included in the main cost of the above licensing process. **EIA requirements:** No environmental impact assessment requirements are applicable. **Monitoring requirements:** Metering of water extraction and reinjection quantities, as well as groundwater temperatures, is applicable in the case of open-loop systems (seawater).

System regulations: The regulations define a GSHP as a combination of equipment and/or piping networks and/or boreholes and/or installations by which heating and/or cooling of spaces is achieved through the exploitation of the heat of the geological formations and waters (surface or underground) that do not exceed 30 °C.
Environmental: Regulations specify restrictions and construction specification requirements for GHSP and ground heat exchangers.

In January 2018, the Greek Parliament voted the Law 4513/2018 on **"Energy Communities and other provisions"**. In the spirit of the European guidelines, this law introduces the establishment and operation of Energy Communities, which can be active in the fields of Renewable Energy Sources, Combined Heat and Power, Rational Energy Use, Energy Efficiency, Sustainable Transport, Management of demand and production, Distribution and Supply of energy at local and regional level (source: www.ypeka.gr).
Members of Energy Communities may be individuals, public or private legal entities and/or local authorities. The general idea is for citizens to get directly and actively involved in energy projects, as producers and consumers at the same time. The Energy Communities are, as a rule, non-profit organisations, with the basic principle to diffuse the benefits to their members and the local community.

3 Regional/national strategy objectives and targets

National Energy and Climate Plan (NECP)
Greece's new strategy for its energy sector and the climate builds on a plan to phases out coal by 2028.

The main quantitative policy objectives set in the context of the national energy plan for the period up to 2030 are also 'intermediate' objectives for reducing GHG emissions by 2050, given that the **Greek government aims to participate in the commitment for a climate-neutral economy at an EU level**. More specifically, the Government is revising the objective for **the RES share in gross final energy consumption by 2030 from 31%**, as stated in the initial NECP draft, **to at least 35% by 2030**. The current RES share in gross final energy consumption is approximately 18%[1].

As regards power generation, RES will be the major domestic source of power as early as in the middle of the following decade, with a share exceeding **65% of the domestic power generation** by 2030 and 60% of the gross final electricity consumption, by utilising most cost-effectively Greece's high potential especially for wind and photovoltaic plants.

The aim is also to put an end to the **energy isolation of our islands** by early 2029 at the latest and to have them interconnected with the mainland system, thus eliminating the utility services costs, as well as to have **innovative hybrid RES power generation systems** set up on those islands that will not be interconnected or will be interconnected later on, for the benefit of all consumers. At the same time, further using RES to cover thermal and cooling needs, in buildings,

[1]According to NECP: 16.95% in 2017 on the basis of the latest official statistics and a current estimated share ≈ 18%

in particular, promoting dispersed RES generation and advanced biofuels in transport are some of the priorities laid down in the NECP, and specific targets are being set in that context.

As far as the **energy efficiency improvement** objective is concerned, the government aims to implement an optimal combination of regulatory interventions and financial instruments in order to allow for utilising the potential for energy savings and making sure that final energy consumption in 2030 is limited to the 2017 levels[2] and is much lower than the corresponding target for 2020[3].

To attain this objective, specific measures are being planned for buildings to implement an ambitious plan for the renovation and improvement of the energy efficiency of the stock of public buildings through the participation of **energy service companies (ESCOs)** and the renewal of end-of-lifecycle buildings.

Plans are also being made for providing targeted incentives for energy efficiency improvement interventions in the stock of private buildings by adopting an ambitious strategy for the renovation of the building stock in its entirety, to make sure that 12-15% of the buildings have undergone energy renovation by 2030.

Special measures and incentives are also being planned for the bioclimatic upgrade of the urban public space in order to reduce the urban heat island effect by 20% by 2030.

These revised quantitative energy objectives of the NECP will consequently contribute to a further reduction in GHG emissions by 2030. Moreover, a core objective in the context of the revised NECP consists in attaining a **GHG emission reduction of more than 56% compared to 2005,** against a corresponding EU objective of approximately 36% (adjustment of the EU objective of 40% compared to 1990).

Table 1. Summary of national objectives in the context of the NECP.

Year of objective: 2030	NECP	New NECP objectives compared to EU objectives
RES share in gross final energy consumption	**≥35%**	More ambitious than the corresponding core EU objective of 32%
RES share in gross final electricity consumption	**~61-64%**	
Final energy consumption	**~16.1-16.5 Mtoe (≥38% compared to the 2007 predictions)**	More ambitious than the corresponding core EU objective of 32.5% and attainment of the objective-based on a new EU indicator for reducing consumption compared to 2017
Share of lignite in power generation	**0%**	

[2]According to NECP: Reduction of 1.5% - 3.6% based on the results of the two energy simulations.
[3]According to NECP: Reduction of 10.3% - 12.2% based on the results of the two energy simulations.

Reduced GHG	**≥42% compared to 1990, ≥56% compared to 2005**	Identical with core EU objectives and over-performance compared to national commitments in non-ETS sectors

4 Milestones to achieve strategy goals

The objectives set in the context of the new NECP are quantified and cost-accounted, and intermediate milestones have been defined, allowing for following up on the progress made in attaining the objectives and relating to the successful adoption and functioning of a mix of policies and measures.

As aforementioned, the objectives set are quantified and cost-accounted and include intermediate sub-objectives even at a sectoral level, to allow for continuously monitoring their implementation and contribution. The objectives are also linked to the adoption and performance of a specific mix of policies and measures. Lastly, all the annual reports on the implementation of the NECP, as required by the relevant regulation, will be based solely on the findings of the monitoring mechanism, resulting from the implementation of its individual procedures. The milestone procedures will be carried out in 2022, 2025 and 2027, when the progress made will be verified at a European level.
As regards the evolution of RES shares in final consumption, Tables 2 shows the forecast of the evolution of these shares at specific times.

Table 2. Evolution of RES shares per objective and per sector by 2030

Evolution of RES shares	2020	2022	2025	2027	2030
RES share in gross final energy consumption [%]	19.7%	23.4%	27.1%	29.6%	35%
RES share in final consumption for heating and cooling [%]	30.6%	33.8%	36.8%	38.3%	42.5%
RES share in gross electricity consumption [%]	29.2%	38.6%	46.8%	52.9%	61%
RES share in final consumption for transport [%]	6.6%	7.3%	10.1%	11.7%	19.0%

Regarding the penetration and share of RES to meet thermal needs in final consumption, it is expected that there will be a significant increase in the role of heat pumps, especially in the tertiary sector, an increased share of thermal solar systems and geothermal energy, as well as a steady contribution of biomass (Table 3).

Table 3. RES contribution to meet thermal needs in final consumption

RES for heating (ktoe)	2020	2022	2025	2027	2030
Bioenergy	1,035	1,060	1,087	1,086	1,142
Solar	296	303	312	326	411
Ambient heat, geothermal	431	590	715	792	906
Total	1,761	1,952	2,115	2,204	2,460

5 Barriers

The **incomplete regulatory framework and the absence of an implementation monitoring mechanism** are the main problems relating to the promotion of RES in nearly zero-energy buildings. At the same time, the need for the stakeholders to **obtain education/training and to adapt to the technical requirements** is also critical.

In the case of seawater or groundwater source thermal systems, the lack of information and the technical difficulties in implementing and developing the relevant **district heating networks** pose the major challenges to the use of thermal energy in various areas.

- *Socio/Politic:*

  Social and political barriers usually interact with each other; when governmental and/or local authorities are reluctant to make decisions and, through lack of knowledge, they fail to inform citizens properly on the necessity of planned projects.

  The lack of environmental education in the community leads to an unfavourable reaction to the construction of plants. When the latter is combined with contradictory political interests, the procedure may present serious delays.

- *Economic:*

  Absence of economic advantages and motivations for implementing systems in buildings. Moreover, the initial cost is still high both for commercial and domestic use. Only a small effort has been made over the last term to reduce the price of installations, but the overall investment remains expensive.

  The absence of financial advantages and measures to support 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 high cost of grid connection should also be taken into account.

- *Legislation / Administration:*

  No roadmap or action plan has been drafted for the implementation of Green Public Procurements in Greece. No reference to Life Cycle Costing or Minimum Environmental Criteria in order to identify the best solution, product or service.

  SWHP developments may require several planning permissions. The process can be complex and time-consuming regarding the size of the installation, water availability and intake method, accessibility of the property for the installation etc.

  Land ownership can also be an issue, as the developer may not own the land next to the sea.

- *Funding:*

  Most homeowners do not take advantage of funding measures/programs for the installation of heat pumps due to the high upfront cost and the low incentives provided (e.g. often a small interest-free loan along with a grant).

Installations are most probable to be implemented in the public sector due to the abundance of funding programs, e.g. energy upgrading of public buildings with the aim of the reduction of final energy in existing buildings of the public and general public sector.

- *Technologic:*

  Minimizing the CAPEX and OPEX, especially regarding OPEX in correlation with the problems to be encountered (salinity, water intake, biofouling)

  Possible future challenges (i.e. reinforcement of electricity grid) as number of heat pumps increases

  Thermal pollution due to heat rejection

  Often accompanied by auxiliary equipment for heating and cooling (especially in larger facilities)

  Lack of trained human resources (regarding installation and maintenance)

- *Environment:*

  The effects on environmental barriers can be recognized on the ecosystems, on the landscape and the change of land use. More analytically, fauna and flora can change until a project is completed. SWHP developments may encounter resistance at the planning stage for many reasons. For example, because they are in a conservation area; on a tourist route; the public has concerns about the impacts of a 'novel' technology; the site is on a flood plain; and/ or possible wider impacts on the landscape, e.g. tree root systems.

  Effectiveness and sustainability depend on developing the capacity of the local authorities to manage natural resources and using appropriate means to prevent and control any environmental concern. There are cases in which a facility proved environmentally unfriendly since the discharge of effluents from the cleaning process of the intake pipes was disposed of either onto land or water.

6 Key focus areas

In order to increase the implementation of seawater heat pumps, it is necessary to remove as many of the obstacles mentioned in the previous section as possible. Simplified, the question is how to more easily apply heat pumps, i.e. seawater heat pumps.

The key areas where changes are needed are listed below. For each area, suggestions are made that could facilitate the implementation of such systems.

SECTOR	STEPS
Technological change	Introduction of **multi-source energy systems**, especially the photovoltaic/thermal cogeneration in order to utilize the same area both for producing electricity and heat. Results: primary energy saving. Combination with **thermal energy storage** to heat and cool buildings is also an option. **Hybrid PV or multi-source heat pump systems, thermal energy**

	storage.
Industrial change	Make the technology cost-efficient: with new corrosion-resistant materials, reducing thus the maintenance of the equipment (heat exchanger, submersible pump). By construction of centralized heating and cooling networks, cutting thus the cost of heat and cold to be delivered. **New corrosion and maintenance-friendly materials, centralized systems.**
Social change	According to the National Energy and Climate Plan (NECP), the diffusion of heat pumps in the residential sector will be increased. However, the public is not aware of the various heat pump types and does not know on which criteria to select the best suiting option. The seawater heat pumps are a special category of water-to-water heat pumps, with special regard to the type of consumer, size and condition of building, access to the property and climatic condition. In this sense, there is no **one size fits all.** **Promotion and diffusion of technology to targeted end-users** (medium to large consumers, preferably hotel complexes and public administration buildings). **Type of consumer, medium to large consumers, multipurpose complexes (esp. hotels)**
Policy change	**Technical guidelines to applicants/investors:** Guidelines for the design and implementation of (geothermal) heat pumps/SWHP. Professional recommendations: heat pumps in collective housing, new and renovated buildings. Drilling operations and limits of responsibility. **Supporting tools** Technical tools (guidelines, regional atlases, underground database). Financial tools (covering geological risks, decision and investment support). **Financial tools as a decision aid: e.g. warranty** To cover the risk in case, the groundwater resource is not sufficient (exploration or sustainability). In the case of Greece (water intake: drilling): No compensation in case of total failure (cost of drilling, studies, tests) have to be beard by the investor himself. **Technical guidelines to applicants/investors** **Supporting tools** **Decision aid**

7 Involved stakeholders

Consultation with all involved stakeholders will be carried out at different stages of the process of drawing up the policy roadmap for the enhancement of H&C technologies through innovative seawater heat pump technologies.

The recent modification of the RES market seems to be a positive step towards a mature and competitive environment for all the participants. More specifically, the following actions involving stakeholders are proposed:

Local public authority (municipalities, metropolitan cities, consortia of municipalities, EGTC such as Efxini Poli)	Targeted and tailor-made diffusion, taking into account the potential applicants, such as type, number and size of public and private buildings. Promotion through events, study visits to pilot plants, media applications.
SME (designers and installers)	Establishment of a network of heat pump designers and installers with a special focus on seawater heat pumps
Regional public authority (regional councils, regional governments, regional development agencies)	Inclusion of the heat pumps and differentiation of them into the ROP and RIS strategies.
National public authority (Ministry of Environment and Energy, Ministry of Infrastructure and Transport, General Secretariat for Research and Technology, General Secretariat of the Industry)	Inclusion of the heat pumps and differentiation of them in various strategies. So far, the strategies (e.g. National Energy and Climate Plan (NECP)) are referring to heat pumps in general. No separation or differentiation is done regarding the selection of the most suitable technology. Also, a reference to energy and economic performance evaluations in different climate zones of the country should be included, when shaping relevant strategies.
Enterprises (private companies such as hotels)	Potential end-users should be approached via targeted events, study visits to pilot plants, media applications etc.
Business support organisations (various banks and creditor institutions, regional development banks, chambers of commerce	So far, SWHPs are almost excluded by the residential sector: single-family residences are not favouring the technology due to the

and industry, technical chamber of Greece and its regional departments, clusters, other associations)	high upfront cost or multifamily residences, due to the lack of awareness and perception of the specific technology. New funding and support instruments should be proposed, addressing existing building stock (energy upgrading) or the construction of new buildings.
General public	Potential end-users should be approached via targeted events, such as the "European Researchers' Night", media applications etc.
Education/training centre and school	Potential end-users, the administration should be approached in targeted events. Also, students should be informed about the new environmentally friendly technology, via social and mass media applications, events, living labs, etc.

8 Opportunities

1. Nowadays, in Greece, there are **no financial incentives to promote seawater heat pumps**

Good practice: Financial incentives to promote geothermal energy
Example: France

1.1 Financial tool: warranty

The **Aquapac warranty** for heat pumps with open-loop up to 200 m depth and power > 30 kW covers the risk that the groundwater resource is not sufficient (exploration or sustainability). Compensation with reimbursement of the guaranteed amount in case of total failure (cost of drilling, studies, tests) and capped at 140 000€.

1.2 Renewable Heat Fund

Support the production of heat from renewable energy (wood, geothermal energy, solar thermal, biogas, district heating networks,…)
Addresses collective housing, tertiary sector, industry and agriculture
Eligible installations: open-loop heat pumps, deep geothermal energy (direct use), close loop heat pumps, seawater heat pumps, wastewater heat pumps
Aids for decision and investment, such as:

Decision aids
- Characterization of the geothermal resource
- Hydrogeological tests, thermal response tests,
- Feasibility studies

Investment aids
New or existing buildings
Qualification required: minimum performance of buildings (new, renovation)
Selection criteria:

- Sustainability of the resource / Technical quality of the facilities
- Technico-economic analysis
- Quality of the project team

2. Promotion of centralized systems as an environmentally friendly option to individual heating/cooling

Greece has experience in the heating and cooling sector of decentralized systems, especially large hotel complexes when it comes to SWHPs. Centralized systems, such as District Heating and Cooling of small towns or residential areas are not implemented due to lack of awareness from the policymakers/government of any degree (see barriers section).

A good practice applicable to the country is an installation in Marseille France, the *Thassalia plant,* which is a multipurpose complex similar to Portopiccolo Sistiana (Trieste, Italy, also reported by CORTEA).

It is mentioned as a good practice since it highlights the benefits (economic, environmental) of centralized systems, which are currently not implemented in Greece.
In this sense, the following are addressed:

- Technological barriers (Dura, mentioned something similar): centralized production of cold favours a reduction of the heat island effect (important for Greece, especially on the islands) in the city, a factor that would have created a multiplication of individual units.
- Environmental barriers: Aesthetic, especially important for historical buildings or buildings with no access for construction works: in a refrigeration network, the roof terrace surfaces are cleared due to the removal of cooling towers on the top of the buildings. Their removal also limits noise pollution and drastically reduces the risk of bacterial contamination (e.g. legionella).
- Economic: the price of the energy produced is lower for centralized heat/cold production as compared to a solution using individual units. Centralization is also less sensitive to increases in electricity

9 Current activities

Legislation updates

In Greece, heat pumps using seawater as a heat source or sink are treated similarly as heat pumps taking advantage of shallow geothermal energy (lower than 30°C) in open-loop systems.

Geothermal legislation

Although to date, the generation of geothermal energy is very limited, following the enactment of a **new all-inclusive legal framework through Law 4602/2019**, Greece has expressly declared its **intension to exploit its geothermal resources and promote this newborn RES sector**.

The most important modifications of the new Law 4602/2019 are the following:

- The minimum geothermal potential setting temperature has been increased to 30 °C from 25 °C, enabling agricultural drilling to be utilized for irrigation.

The legal definition of **shallow geothermal energy** is given as the heat of geological formations and waters (surface waters or groundwaters) that are not characterized as geothermal potential as above (lower than 30°C).

Reform of the RES licensing process

On 5 May 2020, the Greek Government has adopted Law 4685/2020 on the reform of the environmental legislation and the RES licensing process. The Law aims to simplify and expedite the environmental licensing process. It also constitutes the first set of measures adopted by the Greek Government aiming to accelerate and to rationalise the RES licensing process.

The second set of measures touching upon the installation and operation license is to be issued within summer 2020. Together with the new Law, said the initiative is expected to radically reform the RES licensing process and change the regulatory landscape for what is currently considered one of the most dynamic sectors of the Greek economy.

10 Key findings

SWHPs is a technology, which is not widely applied in Greece, apart from the hotel sector on some islands, which are utilizing the seawater, an abundant and nearby source.

In general, heat pumps using seawater as a heat source or sink are treated similarly as heat pumps taking advantage of shallow geothermal energy (lower than 30°C) in open-loop systems. Thus, they are not subject to cumbersome licensing, permitting and planning procedures.

The National Energy and Climate Plan (NECP), which has been released in November 2019, indicates many opportunities regarding the heat pump sector (all types), doubling almost the capacity for thermal needs until 2030.

However, no separation or differentiation is done regarding the selection of the most suitable technology. Also, a reference to energy and economic performance evaluations in different climate zones of the country should be included, when shaping relevant strategies.

Consultation with all involved stakeholders should be carried out at different stages of the process of drawing up the policy roadmap for the enhancement of this H&C technology. The recent modification of the RES market seems to be a positive step towards a mature and competitive environment for all the participants.

Barriers exist when it comes to the propagation of this technology. Especially the lack of awareness from the policymakers, but also from the civil society when searching for a good balance between environmental performance, cost considerations, market availability and ease of installation.

In this direction, the absence of any enforcement to apply the GPP criteria by the national or regional procuring authorities is enhancing the knowledge gap and low social acceptance level.

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 cost.

Another good practice comes from France, where a warranty fund is established in order to provide compensation with reimbursement covering the risk of insufficient water availability. The renewable heat fund with the decision and investment aid could also be helpful in order to remove many of the barriers to this technology.

11 Source of data

(1) National Energy and Climate Plan, Ministry of Environment and Energy, Greece, 2019

(2) Yannis Seiradakis & Eleni Stazilova, Bernitsas Law Firm, Energy 2020, Eight edition, Global legal insights

(3) Karytsas and Chaldezos. Review of the Greek Legislative Framework for Ground Source Heat Pumps (GSHPs) and Suggestions for its Improvement, International Conference on Sustainable Synergies from Buildings to the Urban Scale, SBE16. *Procedia Environmental Sciences* 2017; 38:704 – 712.

(4) Astrid Cardona Maestro, French financial incentives to promote geothermal energy, French Environment and Energy Management Agency (ADEME), GRETA midterm conference. 07th November 2017, Salzburg

3 Conclusion

SWHPs are 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.

Croatia and **Albania** have a broad approach to the development of RES in the heating and cooling sector but without special reference to heat pumps. SWHPs are not mentioned at all. Different financial schemes provide incentives for the RES technology implementation but not specifically for SWHPs.
In **Greece**, there are many opportunities regarding the heat pump sector by the government; however, no separation or differentiation is made regarding the selection of the most appropriate technology which means that SWHPs are not represented.
Slovenia also includes heat pumps as planned installations of renewable energy technology in the heating and cooling sector but also does not mention SWHPs specifically. Investments into SWHPs are already incentivised by different existing financial schemes but are not specific to SWHP implementation.

Many barriers that hinder the increase in the implementation of heat pumps, including seawater heat pumps, are encountered in all partner countries and are mostly similar. The most significant of them is the lack of knowledge and experience in designing as installing and running such systems, lack of awareness form the policymakers, excessive bureaucratic obstacles, non-transparent authorization procedures, lack of public awareness and incentive subsidies, etc.

The document proposes measures and activities that could facilitate the implementation of such systems such as standardization of the seawater intake system installation, promotion of heat pump technology, the involvement of heat pumps in the energy strategies, application of district heating and cooling systems, new corrosion and maintenance-friendly materials, engagement of policymakers around structuring the process of implementation of heat pumps and many others.
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 cost.
Training programmes for RES-installers, EHPA Eucert, a European training and certification program for heat pump installers, tax deductions offered by the Government for energy-saving measures (deduction also covers the expenses related to the installation of these systems to substitute existing systems) and investment grants for renewable heating installations, i.e. funding for the utilisation of renewable energies for heat generation (there are limits for a seasonal performance of heat pumps in order to benefit from the support incentives) are also some of the opportunities sought in other countries that could be applied and thus increase the application of seawater heat pumps, as well as heat pumps in general.

It is important to promote the technology as much as possible and to educate the professions involved in order to see progress in the implementation of seawater heat pumps, as well as heat pumps in general, with an emphasis on successful implementation and subsequent operation. The co-financing strategy and benefits for the application of heat pumps and RES, in general, should be defined as soon as possible in all partner countries if they are not already.