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

National Legislation report

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1 Introduction

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

The main **objective** of the SEADRION project 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 technology and to make the buildings energy self-sufficient and independent from fossil fuels.

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

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

In this Activity T1.1 each partner will collect and analyse data and information about:

- Legislation at national and local level in the participating countries for use of renewable energy in the tourism sector. Particular attention will be paid to those areas subject to environmental and heritage protection and for any kind of national subsidy given for the installation of technologies based on the exploitation of renewable sources.

The coordinator of the Action T1.1 “Mapping and current state situation” is CERTH, who prepared a common datasheet for collection of data regarding the existing national legislation in the field of renewable energy sources and seawater in order to determine the current situation in this field. Each partner collected data from national energy agencies, EU Commission, local administration, universities, research institutions and previous EU projects.

The general analysis of the legal framework within the area concerned has as target to define the administrative barriers and the policy strategies that could be implemented for sustainable exploitation of renewable energy sources in the Adriatic-Ionian area.

Because of the diverse geographical features of MED countries, five partner countries were involved in this activity:

CROATIA – UNIZAG and DURA

GREECE - CERTH

ITALY - CORTEA

SLOVENIA - GOLEA

ALBANIA - AKBN

The main study was focused on national perspectives and goals of the use of renewable technology, national subsidy schemes and programmes for supporting the use of renewable energy technologies that are studied, focusing on the current status and future targets of renewable energy sources in the final energy supply.

Particular attention was also paid to those areas that are subject to an environmental and heritage protection.

2. National legislation for RES and seawater in Adriatic – Ionian area

The current report presents an overview of the legislation of the participating countries which is directly or indirectly related to the seawater heat pumps. The legislative acts which concern among others water temperature, installation of heating / cooling systems and domestic hot water production regarding sea water heat pumps and heat pumps in general including development of renewable energy sources (RES), energy related products and energy efficiency of buildings are outlined in this study. In most cases, relevant European directives and decisions with which the national legislation has been harmonised are presented as below.

2. 1. Present national legislation on renewable energy (including heat/cold and electricity)

Only **Italy** has a specific reference to sea water heat pumps, *which is reflected in the Heat pump legislation, Sea water heat pump legislation with a reference to Sea water temperature conditions.*

Croatia and **Greece** have a more generic reference to heat pumps, while **Albania** and **Slovenia** have a wide approach to the development of renewable energy sources (RES) without a specific reference to heat pumps.

2.2. Current share of renewable energy sources (RES) in the final energy supply in each country - National perspectives and goals of the use of renewable technologies until the year 2020

Share of energy from renewable sources

Table 1: Share of energy from renewable sources (in % of gross final energy consumption)

	2004	2013	2014	2015	2016	2020 target
EU	8.5	15.2	16.1	16.7	17.0	20
Greece*	6.9	15.0	15.3	15.4	15.2	18
Croatia	23.5	28.0	27.8	29.0	28.3	20
Italy	6.3	16.7	17.1	17.5	17.4	17
Slovenia	16.1	22.4	21.5	21.9	21.3	25
Albania	27.8	33.2	31.5	34.4	37.1	38

* 2016 data for Greece estimated by Eurostat. Source: Eurostat "SHARES 2016 results"

Each EU Member State has its own Europe 2020 target. The national targets take into account the Member States' different starting points, renewable energy potential and economic performance. Among the partners of the SEADRION project, Croatia and Italy have already reached the level required to meet their national 2020 targets. Moreover, Albania is less than 1 percentage point (pp)

away from its 2020 target. At the opposite end of the scale, Slovenia (4.0 pp from its national 2020 objective) and Greece (3.0 pp) are the furthest away from their targets.

2.3. Heating and Cooling

In Greece the heat pump sector presented a remarkable growth after 2010, in contrast to Italy and Croatia where it started in early 2000; In Slovenia and Albania, no heat pumps are recorded until 2016.

Regarding the heating and cooling sector, in many countries, seaside hotels showed interest in heating and cooling their facilities through the use of seawater. Factors contributing to the market's development were: a) the increase of 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. Moreover, it should be noted that the market is not that much dependent on the construction of new buildings, on the contrary, it can be applied during a simple renovation of a building, thus fostering the market uptake of this technology.

In many cases, strong competition by natural gas is also a reason for the sector's recession. Other reasons of the market's stagnation are the lack of a friendly investment environment (in contrast to e.g. natural gas technologies), as well as legislative barriers, as described in the next section.

The final energy consumption for each country is presented below:

Greece

Table 2: Renewable sources for heating and cooling (RES-H&C)

Heating and cooling	2004	2013	2014	2015	2016
Final energy consumption	1.040,9	1.184,6	1.187,7	1.278,3	1.120,5
Derived heat	0,0	0,0	0,0	0,0	0,0
Heat pumps	0,0	126,8	168,0	206,7	238,6
Total (RES-H&C numerator)	1.040,9	1.311,4	1.355,7	1.485,0	1.359,1

Development and diffusion of heat pumps (general) starting in 2013. Within 3 years, the capacity has been doubled**.**

Italy

Table 3: Renewable sources for heating and cooling (RES-H&C)

Heating and cooling	2004	2013	2014	2015	2016

Final energy consumption	2.703,4	7.245,8	6.388,1	7.198,1	7.001,9
Derived heat	164,5	838,0	965,8	904,6	927,9
Heat pumps	837,9	2.519,3	2.579,8	2.584,5	2.608,6
Total (RES-H&C numerator)	3.705,8	10.603,2	9.933,6	10.687,2	10.538,4

Development and diffusion of heat pumps in 2004. Stable penetration in the last years.

Slovenia

Table 4: Renewable sources for heating and cooling (RES-H&C)

Heating and cooling	2004	2013	2014	2015	2016
Final energy consumption	430,0	617,7	539,1	588,7	612,3
Derived heat	9,7	29,6	28,3	34,7	35,4
Heat pumps	0,0	0,0	0,0	0,0	0,0
Total (RES-H&C numerator)	439,7	647,3	567,4	623,3	647,7

No heat pumps until 2016.

Croatia

Table 5: Renewable sources for heating and cooling (RES-H&C)

Heating and cooling	2004	2013	2014	2015	2016
Final energy consumption	1.190,1	1.213,4	1.072,8	1.216,2	1.174,7
Derived heat	0,0	8,6	9,0	20,1	29,0
Heat pumps	3,5	15,0	12,4	14,9	15,8
Total (RES-H&C numerator)	1.193,7	1.237,1	1.094,3	1.251,2	1.219,4

Development and diffusion of heat pumps in 2004. Stable penetration in the last years.

Albania

Table 6: Renewable sources for heating and cooling (RES-H&C)

Heating and cooling	2004	2013	2014	2015	2016
Final energy consumption	234,4	213,4	205,6	216,7	205,5
Derived heat	0,0	0,0	0,0	0,0	0,0
Heat pumps	0,0	0,0	0,0	0,0	0,0
Total (RES-H&C numerator)	234,4	213,4	205,6	216,7	205,5

No heat pumps until 2016.

Legend:

- Derived heat produced from geothermal, solar thermal, renewable municipal waste, solid biofuels and biogas as reported in the renewables questionnaire.
- Units used, *1 ktoe = 41.868 TJ = 11.63 GWh
- Source: Eurostat "SHARES 2016 results"

2.4 Barriers on national level (technological, non-technological barriers such as legal, social, economic, environmental etc.)

Most of the partners propose improvements and developments regarding their existing legislation. Therefore changes regarding the legislative framework involving the licencing process for the installation of sea water heat pump systems are recommended concerning inter alia: system definition, installation specifications, clarification of responsibilities of involved departments and technical issues and simplification of the process. More specific the following barriers have been identified on a consortium level.

Technological barriers

- Lack of knowledge to the know-how but also experience in installing such kind of systems.
- Technology is well known in many countries and copying solutions from other European countries is not the ideal solution.
- 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 taken by DNOs[1]/ possible future challenges (i.e. reinforcement of electricity grid) as number of heat pumps increases.

Environmental

- The effects on environmental barriers can be recognized on the ecosystems, on the landscape and on the change of land use. More analytically, fauna and flora can change until a project is completed. SWHP developments may encounter resistance at planning stage for a number of 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 depends 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.

Social and political barriers

- 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 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 unfavorable reaction to the construction of plants and when the latter is combined with contradictory political interests the procedure may present serious delays.

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.
- 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 still remains expensive.
- The 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.

[1] Distribution Network Operator

Legislative and administrative barriers

- 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 a number of planning permissions. 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 actually help to speed up the whole procedure.
- The same projects are simultaneously monitored concerning their operation and performance by different authorities (fragmentation).
- A 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 a past but still partly prevailing attitude of regarding legislation more as 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 specialised 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.

2.5 Most relevant national subsidy schemes and programmes for supporting the use of renewable energy technologies with a focus on sea water heat pumps or heat pumps in general

In the participating countries the use of renewable energy sources is promoted mainly through **national support schemes**, apart from Italy where also **regional support schemes** exist. The use is promoted mainly through investment subsidies for various RES installations (including sea water heat pumps), tax benefits for consumers who invest in such installations, loans offered by banks at lower interest rates, etc.

The amount of support varies for each renewable energy generation technology and for each kind of application. All **technologies** are eligible for at least one support scheme. However, each support scheme has often a different focus.

Eligible parties are either the industrial or residential sector, private individuals etc.

Albania: Tax relief

Italy (national incentives and regional support schemes available): Tax regulation mechanisms

Slovenia: Loans and grants

Croatia: Subsidies for the installation (industrial and residential sector)

Greece: Tax relief (industry), Subsidies (industry), subsidized loan, Income tax relief (residential sector)

3 References

As indicated in each case description.

4 Annex

Country/Region: **SLOVENIA**

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2. Renewable energy state of the art

Information about National and Regional level

2.1. Present national legislation on renewable energy (include heat/cold and electricity)

Energy Act transposes a number of 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 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.

A new structure of strategic documents has been established. The basic document is going to be Energy Concept of Slovenia instead of previous National Energy Program. Energy Concept of Slovenia will define the objectives of sustainable and reliable energy supply for next 20 years and outlines for next 40 years. It is the base for National Renewable Energy Action Plan and National Energy Efficiency Action Plan.

Energy Act also establishes basis for operation of Eco Fund with financial support for Renewable Energy Sources and Efficient Energy Use. Eco Fund has been established with Environmental Protection Act.

Energy Act does not directly address SWHP topics, but it establishes a basis for use of renewable energy sources, part of which is also the use of sea water heat pumps.
Waters Act governs the management of marine, inland and ground waters, and the management of water and waterside land.

The objective of the management of waters and water and waterside land is 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 act states that the bottom of coastal marine waters and territorial waters to the external boundary of the coast shall be marine water land owned by the state. Land that directly borders marine water land and extends 25 m from the boundaries of the water land shall be marine waterside land. The sea and marine water land shall be natural public marine assets.

Water permits must be obtained for use of marine water for technological purposes (as in case of SWHP, the extraction of the heat)

2.2. Describe current share of renewable energy sources (RES) in the final energy supply in your country

According to the data in the Progress Report of Slovenia (2015-2016) in Accordance with Directive 2009/28 / EC, MZIP, 2017, the share of renewable energy in the national gross final energy consumption for 2015, amounted to 22%.
From this, the share of gross generation of electricity from RES in that year represented a 32.7% share in the total electricity generation. The final consumption of heat/cold in 2015 accounted for 34.1% from renewable energy sources.
The major proportion of electricity from renewable energy sources is produced by hydroelectric power plants, while heat from RES is produced from biomass.

2.3. Describe the national perspectives and goals of the use of renewable technologies until the year 2020 or 2030

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. In the NREAP account needs to be taken of the effects of policies for efficient energy use on final energy consumption, and measures that must be adopted to achieve the target shares of RES and to fulfil the requirements of Articles 13 to 19 of Directive 2009/28/EC.

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 these 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 hydroenergy, 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 planed installations of RES technology for heating and cooling. Renewable energy from hydrothermal heat pumps can be also produced with seawater source, which is considered as blue energy. (1 ktoe = 11.63 GWh).

Table 7: Planed installations of RES technology for heating and cooling

[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

2.4. Describe current status and future targets of renewable energy sources in final energy supply on local community or regional level (describe any action plans in this respect or local development plans etc.)

The field energy efficiency and exploitation of renewable energy sources is regulated at the local level through the so-called “local energy concept” (hereinafter referred to as LEK). According to Article 4 of the Energy Act (EZ-1) (Official Gazette of RS, no. 17/2014) the LEK is defined as the conceptual development of a local community or several local communities in the field of energy supply and consumption, including measures to facilitate effective energy use and energy supply methods such as renewable energy sources, cogeneration, waste heat exploitation and other sources.

2.5. Barriers on national level (provide information about technological, non-technological barriers such as legal, social, economic, environmental etc.)

Slovenia has 47 km of seashore, where different protected areas are implemented, such as:

Ecologically Important Areas - habitat-type area, which contributes significantly to the conservation of biodiversity;

Bathing waters - is the basis for the implementation of measures in the field of water management tasks, where it should not interfere with general use of water or in granted water rights;

Natura 2000 - is European network of special protection areas, established for conservation of animal and plant species and habitats;

Protected areas - areas in Slovenia, which are protected according to the regulations on nature conservation;

Natural values – protected geological phenomena, minerals and fossils, sea shore, animal and plant species with ecosystems.

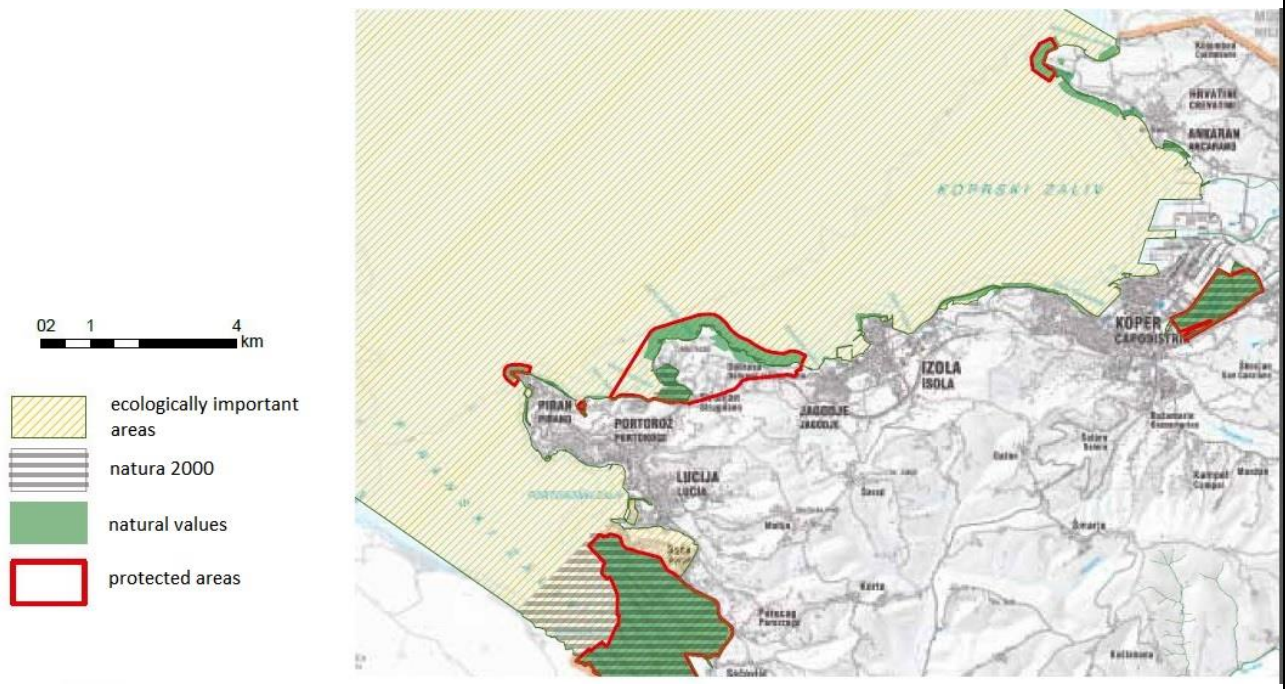

Figure 1: Protected coastal areas in Slovenia

2.6. Analyse and present barriers regarding the implementation of seawater heat pumps on specific study case locations either project related or not. Take into consideration and analyse potential impacts on: e.g. landscape, ecology, natural or cultural heritage etc.

Socio-economic barriers: Near coast water intake can influence on bathing waters and tourism.

Legislation, Funding barriers: Before construction is performed we must obtain building permit and waters permit. Propriate locations are often positioned in protected areas.

Environment barriers: Infrastructure placed in the sea water must be planned in scope to minimize impacts on the sea water environment and on the sea water life.

Technology barriers: We need to properly design sea water pipelines do minimize friction loss and consequently minimize pumping costs. If not properly designed, pumping costs can significantly reduce efficiency of the whole system.

Energy Potential barriers: Sea water heat energy potential is available in large scale, but local changes of sea water temperature must be taken into account. We need to minimize influence of temperature changes on sea water environment.

2.7. More detailed description regarding required licences on specific study case locations, either project related or not.

Describe the process of obtaining any kind of related licences or permits: e.g. abstraction licences, discharge permits (of used water), drilling permits, building permits if necessary etc.

Waters Act: Waters permit must be obtained for use of marine water for technological purposes, the extraction of the heat, the production of electricity, cultivation of water organisms.

Environmental Protection Act: An Assessment of environmental impacts must be prepared prior to implementation of anticipated operation with possible significant impact on the environment.

In case of possible impacts the Environmental Approval must be obtained and in case of possible pollution Environmental Permit must be obtained.

Building Act: The Building Act regulates the conditions for the construction of buildings. Depending on the design of the system, it is necessary to obtain a building permit for the implementation of the heat pump system using a sea water.

2.8. Describe most relevant national subsidy schemes and programmes for supporting the use of renewable energy technologies with a focus on sea water heat pumps or heat pumps in general (include responsible organizations, managing authorities etc.).

A public call for loans for environmental investments of individuals (59OB17):

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 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 waste water 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 for household heating. 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 in higher energy efficiency of the residential buildings (54SUB-OB17):

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

- installation of solar heating system,

- installation of wood biomass boiler for heating,

- installation of heat pump for heating,

- connection of existing residential building to district heating with renewable energy source,

- installation of wood windows as part of renovation of existing residential buildings,

- reduction of wall heat losses as part of renovation of existing residential buildings,

- reduction of roof heat losses as part of renovation of existing residential buildings,

- installation of heat recovery ventilation systems,

- construction or purchase of near zero-energy residential buildings,

- complete renovation of existing residential building,

- purchase of apartment in 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 for household heating. 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 the air pollution,

- waste management,

- water protection and efficient water use,

- discharge of waste water 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 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 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.

2.9. Describe how renewable energy sources and technologies are supported on local (regional) level. Describe the support mechanisms, current available support and subsidy schemes and planed future activities.

3. Source of data

Energy Act (EZ-1): *7th March 2014 (Off. Gaz. RS 17/14, 81/15);* http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO6665

Waters Act (ZV-1): *26th July 2002 (Off. Gaz. RS 67/02, 2/04, 41/04, 57/08, 57/12, 100/13, 40/14, 56/15);* http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO1244

Environmental Protection Act (ZVO-1): *22nd April 2004 (Off. Gaz. RS 41/04,017/06, 20/06, 39/06, 49/06, 66/06, 33/07, 57/08, 70/08, 108/09, 48/12, 57/12, 92/13, 56/15, 102/15, 30/16);* http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO1545

A public call for loans for environmental investments of individuals (59OB17): *18th August 2017 (Off. Gaz. RS 40/17);* https://ekosklad.si/razpisi/prikazi/tenderID=121

A public call for individuals for grants for investments in renewable energy sources and in higher energy efficiency of the residential buildings (54SUB-OB17): 13th October 2017 *(Off. Gaz. RS 56/17);* *https://ekosklad.si/fizicne-osebe/nameni/prikazi/actionID=99*

A public call for loans for environmental investments (56PO16): *15th April 2016 (Off. Gaz. RS 28/16);* https://ekosklad.si/razpisi/prikazi/tenderID=75

A public call for loans for environmental investments in local communities (60LS17): *22th December 2017 (Off. Gaz. RS 75/17);* https://ekosklad.si/razpisi/prikazi/tenderID=77

The Energy Agency in the Slovenian energy market: https://www.agen-rs.si/web/en/

Country/Region: **Italy**

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2. Renewable energy state of the art
Information about National and Regional level

2.1. Present national legislation on renewable energy (include heat/cold and electricity)

Italy National Renewable Energy Action Plan:

The Italy National Renewable Energy Action Plan is the National Renewable Energy Action Plan (NREAP) for Italy. The plan was commissioned by the Directive 2009/28/EC which required Member States of the European Union to notify the European Commission with a road map.

The Strategy also sets forth actions to streamline and rationalise the energy system, with a view to obtaining significant reductions in the costs of RES technologies, while abiding by the legislation and regulations on environmental, land and sea protection.

The report describes how Italy plans to achieve its legally binding target of energy from renewable sources in gross final consumption of energy by 2020.

On a global scale, Italy is among the promoters of Mission Innovation - a global initiative resulting from COP21 to launch leading-edge clean-technology (clean-tech) projects - and committed to doubling the value of public resources allocated for investments in clean-energy research and development by 2021.

The progressive transition towards low-emission models requires substantial efforts in supporting technological evolution, as well as research and development of new technologies. The Strategy aims to strengthen public support and create conditions to attract private investments, with the goal of contributing to developing technological concepts that can sustain the energy transition at

reasonable costs, and offer business and employment opportunities (doubling investments in clean-energy research and development: from € 222 million in 2013 to € 444 million in 2021).

Moreover, policies in the energy sector should be integrated with those in other sectors, so as to take a consistent approach, capture possible synergies, and offer new business opportunities.

This is the reason why the Strategy provides for the setting-up of a special Steering Committee. The members of the Committee, coordinated by the Ministries of Economic Development and of the Environment, are representatives from the Ministries of Economy, Transport, and Cultural Heritage, as well as from the Regions; periodical consultations with local governments are also planned.

Additionally, to ensure transparency in monitoring the implementation of the Strategy, the Government will have to present a yearly report to the Parliament on the status of implementation of the Strategy, and on the actions taken to achieve its targets, as well as to undertake a participative process of revision of the Strategy every three years.

The Strategy also sets forth actions to streamline and rationalise the energy system, with a view to obtaining significant reductions in the costs of RES technologies, while abiding by the legislation and regulations on environmental, land and sea protection.

In recent years, Italy's gross domestic product has increased by about 0.8 per cent, and the demand for electricity and gas has followed the same trend.

In particular, with regards to the electricity market, we have witnessed an increase in both demand (by almost 1.5 per cent) and net imports, an increase that has been largely possible thanks to the support of the thermoelectric sector, whose electricity production has risen by nearly 9 per cent.

An important part of electricity consumption is also covered by renewable energy sources. In 2016, the Energy Services Manager (GSE) received €15.9 billion for the incentivisation of green energy. Furthermore, Italy reached the target set by the European Union on the percentage of final electricity consumption generated from renewable sources (17.1 per cent), surpassing this goal in 2015 (17.5 per cent) and again in 2016 (17.6 per cent).

<u>Regulation in Italy:</u>

The energy market is regulated by these entities:

- Ministry of Economic Development (MISE).
  MISE is responsible for all the authorisation procedures of state competence and for the enforcement of all statutes and regulations concerning the energy sector. Within the Energy Department of the above-mentioned Ministry, a very important role in the energy sector is performed by the Commission on Hydrocarbon and Mineral Resources, which carries out an advisory function for all activities connected with the research, production and exploitation of hydrocarbons.
- The Regulatory Authority for Electricity Gas and Water (AEEGSI). Aside from its main regulatory functions (it defines the tariff-system for the use of infrastructure, ensures free access to the gas and electricity grid and promotes investments through incentives), the AEEGSI also plays an inspective role (it is granted the power to impose administrative

sanctions in case of non-compliance with its provisions, aimed at ensuring the transparency of service conditions and promoting the rational use of energy). To fulfil these activities, the AEEGSI is supported by the Antitrust Authority to ensure the implementation of the rules on free competition in the energy market. Furthermore, the AEEGSI plays an advisory role to the parliament and may issue proposals and reports (see the report published annually about the state and the activity of the energy supply sector).

- The Compensation Fund for the electricity sector (CCSE). The CCSE is a non-economic public body established through Provision No. 941, approved by the Interdepartmental Committee on Prices on 1 September 1961. It collects certain tariff components payed by the industry operators, which are then stored in management accounts in favour of the businesses.

- Energy Services Manager (GSE). The GSE is a public limited company, established by Legislative Decree No. 79 of 16 March 1999, with the function of promoting renewable energy sources in Italy, mainly through the distribution of economic incentives and information campaigns aimed at spreading the culture of environmental protection in the energy field.

- Energy Market Manager (GME). The company GME, wholly owned by the GSE, was established by Legislative Decree No. 79 of 16 March 1999. It is responsible for organising and managing the electricity, natural gas and environment markets, respecting neutrality, transparency, objectivity and competition criteria.

<u>Development of energy markets:</u>
As previously mentioned, the GME manages the Italian energy market (the Italian Power Exchange, or IPEX) on which electricity is sold and bought wholesale.

More specifically, the GME organises and manages:

- The Forward Electricity Market;
- The Daily Products Market in which continuous negotiations take place;
- The MGP, organised in the form of auctions; and
- The Intraday Market, with auctions, divided into five sessions.

On behalf of the Italian grid operator (Terna SpA), the GSE also manages both the Ancillary Services Market through which it collects offers and communicates the results, as well as a platform registering the transactions carried out over the counter. On this platform, the parties that have concluded contracts outside the IPEX register their trade obligations and set forth the relevant electricity input and output plans, committing to perform these contracts.

With the entry into force of Law No. 99 of 23 July 2009 (laying down provisions for the development and internationalisation of companies, as well as relating to energy), the GME was entrusted with the organisation and economic management of the natural gas market on an exclusive basis. The GME gas markets include:

- The natural-gas trading platform (P-GAS);
- The natural-gas market (MGAS); and
- The natural-gas balancing platform (PB-GAS).

Energy market rules and regulation:

The Italian Power Exchange is regulated by the Decree of the Ministry of Economic Development approved on 19 December 2003 (as subsequently amended by the Ministerial Decrees approved on 1 December 2005, 15 June 2007, 8 January 2008, 16 July 2008, 17 September 2008, 16 October 2009, 24 November 2009, 1 April 2011, 19 December 2011, as well as by the AEEGSI Opinion No. 8 of 26 May 2009).

The gas markets are regulated by the Decree of the Ministry of Economic Development approved on 6 March 2013 (as subsequently amended by the Ministerial Decrees approved on 21 May 2014, 9 June 2015, 25 February 2016 and 11 May 2016).

The electricity markets, M-GAS, P-GAS and PB-GAS each have their own market and technical rules. The market rules include the criteria and procedures for the admission of new participants, the trading and settlement rules, as well as the sanctions and sanctioning procedures in the event of a breach of market rules. The GME is generally responsible for the oversight of market operations, as well as for the enforcement of market rules.

Heat pump legislation - Support schemes

A price-based scheme ("Conto Termico") is in place in Italy for small RES-H sources. Heat pumps (aerothermal, geothermal, hydrothermal), biomass and solar thermal are eligible technologies and the incentive is granted for a period varying between 2 and 5 years. Furthermore, a tax regulation system is currently in place for the promotion of RES-H and the loan, provided for the years 2012, 2013, 2014, for RES-H installations is currently not available (as of 2017), as its budget has been exhausted.

While heat pumps are a mature technology, their efficiency is expected to increase by 2030 by 30-50% for heating and 20-40% for cooling, and by 2050 by 40-60% for heating and 30-50% for cooling.

Sea water heat pump legislation

The installation of seawater heat pump requires the authorization of the authorities of the Maritimo Demanio and the municipalities.

Sea water temperature conditions

For the sea and for the mouth areas of non-significant watercourses, the exhaust temperature must not exceed 35 ° C. The temperature increase of the container body must not exceed 3 ° C above 1000 meters away from the point of entry.

2.2. Describe current share of renewable energy sources (RES) in the final energy supply in your country

RES deployment in Italy can decrease not only emissions, but also energy dependence and, in the future, the gap between Italian electricity prices and European average ones.

Reconciling energy targets with landscape conservation is a critical issue for the country. This issue concerns, above all, RES with the highest residual potential still to be tapped, i.e. wind and solar photovoltaic. As landscape conservation is a mandatory requirement, the Strategy promotes the

revamping and repowering of wind, hydro and geothermal power plants, assigns priority to brownfield sites, and allocates a greater number of resources for RES and energy efficiency enhancements.

2.3. Describe the national perspectives and goals of the use of renewable technologies until the year 2020 or 2030

Under the EU Directive 2009/28/EC member countries of the European Union are obliged to draft and submit to the European Commission National Renewable Action Plans (NREAPs) outlining pathway which will allow them to meet their 2020 renewable energy, energy efficiency and GHG cuts targets.

Italy 2020 renewable energy targets:

- Overall target: 17% of share of energy generated from renewable sources in gross final energy consumption;
- Heating and cooling: 17% of heat consumption met by renewable sources;
- Electricity: 26% of electricity demand met by electricity generated from renewable energy sources;
- Transport: 10% of energy demand met by renewable energy sources.

Italy is one of 11 member states which has already reached its target, with Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Lithuania, Hungary, Romania, Finland and Sweden also achieving the feat.

Italy's National Energy Strategy 2017 (the Strategy) lays down the actions to be achieved by 2030, in accordance with the long-term scenario drawn up in the EU Energy Roadmap 2050, which provides for a reduction of emissions by at least 80% from their 1990 levels.

Here are the targets to be achieved by 2030 that are in line with the plan of the European Energy Union:

- Enhancing Italy's competitiveness, by continuing to bridge the gap between Italian energy prices and costs and European ones, in a global context of rising energy prices.
- attaining Europe's environmental and decarbonisation targets by 2030 in sustainable ways, in line with the future targets set by COP21.
- continuing to improve the security of energy supply and the flexibility of energy systems and infrastructures.

2.4. Describe current status and future targets of renewable energy sources in final energy supply on local community or regional level (describe any action plans in this respect or local development plans etc.)

To date, Italy has already achieved its RES targets by 2020, with an RES penetration of 17.5% in total energy consumption in 2015 vs. a 17% target to be reached by 2020.

The target of a 28% share of RES in total energy consumption by 2030 is ambitious but feasible. This RES share will be broken down as follows:

55% of RES-E by 2030 (33.5% in 2015)
30% of RES-H&C by 2030 (19.2% in 2015)

21% of RES-T by 2030 (6.4% in 2015)

Italy's performance in terms of energy efficiency is excellent vis-à-vis the one of other European countries. The target of the Strategy in this area is to foster low energy-consumption initiatives having the best cost/benefit ratio, so as to achieve 30% of energy savings by 2030 with respect to their trend in 2030, and give impetus to the Italian energy efficiency industry (e.g. construction of energy-efficient buildings and installation of energy-efficient facilities).

2.5. Barriers on national level (provide information about technological, non-technological barriers such as legal, social, economic, environmental etc.)

At the national political level, the barriers can be mitigated or eliminated through the so-called "*climate strategy"*, which set the objectives and the path to reduce CO_2 emissions. Recently (December 2018) the national association of Italian enterprises - Confindustria, has published the guidelines for an efficient development of renewable sources to 2030:

- Develop *an energy-climate plan,* in accordance with the strategies established by the European Commission, as a tool for the revitalization of the building heritage and the diffusion of renewable energy sources,
- Balance subsidies to fossil and renewable sources, favor and incentivize investments in energy efficiency and clean energy,
- Introduce new rules for the evaluation of projects from renewable sources, with the simplification of the evaluation procedures for small plants,
- Delete the barriers to the self-production and distribution of energy, produced from renewable sources and in cogeneration by municipalities, production districts, residential utilities, etc.,
- Promote innovations in the electricity market that allow *renewables* to compete, through the aggregation of plants and through long-term contracts,
- Revise the incentive system for efficiency measures and renewable sources, with the aim of reducing the energy expenditure of households and enterprises.

At the regional level, the greatest obstacles are due to the lack of precise planning of investment interventions in local energy networks, to accompany production from renewable energy through interventions that eliminate obstacles to the modernization of distribution networks.

Furthermore, at the technological level, the main obstacle is represented by the lack of a policy for the development of applied research and the diffusion of innovations, which demonstrate the direct and indirect advantages of the introduction of *renewables* also for small-scale power plants, service of private and public utilities also in a self-production regime and consumption of the energy produced.

However, it is a priority to obtain an overall economic asset, more advantageous for the adoption of renewable energy sources; a recent study developed by Cortea to assess the potential for diffusion of seawater heat pumps, carried out with interviews with the main trade associations of stakeholders, still leads to **this factor being the main obstacle** to their diffusion: the price difference between the electricity produced with renewable energy sources and that obtained with traditional fossil sources is still the biggest obstacle, in 34% of the cases analyzed, the investment costs are considered to be the cause of obstacle in 31% of cases, while installation costs are mentioned as obstacles in 29% of cases.

Insufficient professional knowledge of operators in the sector, belonging to plant construction and installation companies, represent 27% of the obstacles mentioned by user associations. In addition, the inertia of innovation by stakeholders contributes to the negative picture, in 16% of cases.

Instead, the multifunctionality of renewable energy sources (in 15% of cases), together with environmental protection and greater safety of renewable energy plants compared to those with fossil sources, are mentioned as elements of great force in the diffusion. The operators emphasize the important role of research and innovation as a driving force in the sector. The following table summarizes the strengths, weaknesses and opportunities of energy systems powered by renewable energy sources as noted in the above mentioned study.

Table 9: Strengths, weaknesses and opportunities of renewable energy systems in Italy

Factors of strength, weakness and opportunities	Level of Importance
Weaknesses	
Price ratio between alternative energy sources and conventional produced electricity	34%
Investment costs	31%
Installation costs	29%
Building professionals' know-how	27%
Awareness	25%
Inertia of innovation	16%
Strengths	
Multifunctionality	15%
Environmental protection	13%
Safety	11%
Opportunities	
Policies and legislation	31%
Research and development	22%
Innovative heat pump systems	20%

2.6. Analyse and present barriers regarding the implementation of seawater heat pumps on specific study case locations either project related or not. Take into consideration and analyse potential impacts on: e.g. landscape, ecology, natural or cultural heritage etc.

The investment cost of heat pump systems and other renewable sources is considered by the user as a "high investment", compared to traditional systems, therefore subsidy schemes and incentive programs are needed to break down these market barriers.

A major technical problem with the seawater heat pump systems is the corrosion of pipes transporting sea water. Normally sea water is more corrosive than fresh water. Due to the higher corrosiveness of sea water the pipes of seawater heat pump systems are made from special materials like titanium alloys or copper alloys. These materials are more resistant to corrosion (galvanic currents) which on the one side increases the lifetime of the system, but on the other side raises investment and O&M costs.

In particular, in the case of Porto Piccolo Sistiana – Trieste a first design problem was the high variability of employment, linked to the prevalent seasonal use of the settlement, and in the great climatic variability of the site. They have therefore calibrated pressures and flow rates according to the energy required / consumed by each plant, transferring the data to the central power plant, so that the plant can reduce its energy commitment.

In the case of "Complesso San Benigno – Genova", Domenico Carmosino, explains, "The biggest obstacle is obviously the bureaucratic part. In itself the infrastructure to be done is not complex and the actual work to be carried out is estimated in just over a year".

2.7. More detailed description regarding required licences on specific study case locations, either project related or not.

Describe the process of obtaining any kind of related licences or permits: e.g. abstraction licences, discharge permits (of used water), drilling permits, building permits if necessary etc.

The Italian legislature has adopted and promoted rules to simplify the authorisation process for building and operating all types of renewable energy projects. New plants exceeding certain capacity thresholds, such as 20 kW for solar PV plants or 1 MW for wind farms, can be authorised through a relatively simple single authorisation procedure, which covers all requisite permits and any environmental impact assessment. Simplified procedures, based mainly on communications between the developer and the local authorities, are also available for smaller scale plants. Numerous regions across Italy have also developed local rules and regulations which reflect and promote national energy principles and objectives.

2.8. Describe most relevant national subsidy schemes and programmes for supporting the use of renewable energy technologies with a focus on sea water heat pumps or heat pumps in general (include responsible organizations, managing authorities etc.).

Currently, the incentive for renewable energy sources in Italy is mainly based on the following mechanisms: Green Certificates (CV) and all-inclusive tariff, Energy Account, Thermal Account, Community Contributions, national and regional.

Summary of support schemes

- Feed-in tariff I. All RES plants, except for PV plants, with an installed capacity between 1 kW and 0.5 MW are entitled to choose feed-in tariff I in alternative to the premium tariff.
- Feed-in premium. All RES plants, except for PV plants, with an installed capacity between 1 kW and 5 MW are eligible for receiving this premium tariff. Plants with an installed power between 1 kW and 0.5 MW are entitled to choose the feed-in tariff I in alternative to the premium tariff.
- Tendering scheme. All RES plants beyond a certain capacity, except for PV, are eligible for receiving incentives in the form of a premium tariff after undergoing a tendering

process. This system is alternative to any other public incentive, to the "withdrawal dedicated" (Ritiro Dedicato) and to the "exchange on place" (Scambio sul Posto).

- Net-metering. Interested parties can make use of net-metering.
- Tax regulation mechanisms. Photovoltaic and wind energy plants are eligible for a reduced VAT of 10% (instead of 20%); with the State Budget Law 2018 (Legge di Bilancio), all the bonus and benefits on income tax have been confirmed for purchasing air conditioners or heat pumps. In details, they are:
  1. 50% deduction for building renovations;
  2. 65% deduction for energy efficiency measures (ecobonus).

Furthermore, the national agency "Gestore dei Servizi Energetici" (GSE) shall manage the sale of renewable energy on request. In addition to these national incentives, Italy provides for a series of regional programmes. The "Osservatorio Politiche Energetico-Ambientali Regionali e Locali" and FIRE give an overview of announcements for regional support schemes such as the regional renewable energy programmes.

2.9. Describe how renewable energy sources and technologies are supported on local (regional) level. Describe the support mechanisms, current available support and subsidy schemes and planed future activities.

Support mechanisms:

From now to 2020: promoting new investments, by granting incentives for power generation, placing more reliance on competitive auctions, taking a neutral approach to technologies with similar cost structures and levels in order to stimulate competition, and resorting to diversified support schemes for small-scale power generation and innovative technologies. After 2020: RES support schemes will evolve towards market parity, i.e. from direct incentives for power generation to enabling policies and regulatory simplification.

Actions:

- long-term contracts for large-scale power generation; promotion of self-consumption for small-scale power generation
- streamlining the permitting process for repowering wind and hydro plants
- maintaining existing power generation from bioenergy sources, without distortions to the agricultural sector chain
- increasing hydro power generation with innovative projects in existing large-scale plants

Members who support:

- Governance and Regulation Energy is a cross-cutting issue, which requires a resolute action of coordination among the various parties involved (Central Government, Regions, scientific institutions) and cooperation with the energy regulator. Moreover, policies in the energy sector should be integrated with those in other sectors, so as to take a consistent approach, capture possible synergies, and offer new business opportunities. This is the reason why the Strategy provides for the setting-up of a special Steering Committee. The members of the Committee, coordinated by the Ministries of Economic Development and

of the Environment, are representatives from the Ministries of Economy, Transport, and Cultural Heritage, as well as from the Regions; periodical consultations with local governments are also planned. Additionally, to ensure transparency in monitoring the implementation of the Strategy, the Government will have to present a yearly report to the Parliament on the status of implementation of the Strategy, and on the actions taken to achieve its targets, as well as to undertake a participative process of revision of the Strategy every three years. The Strategy also sets forth actions to streamline and rationalise the energy system, with a view to obtaining significant reductions in the costs of RES technologies, while abiding by the legislation and regulations on environmental, land and sea protection.

- ENEA provides support to: local administrations responsible for the implementation of energy plans; industrial consortia, professional associations and pools of enterprises in evaluating the environmental sustainability of territorial plans, projects and programmes to produce energy from renewable sources. Such support is aimed at ensuring that the actions proposed on the territory are fully compliant with the environmental protection laws, and is accomplished by both identifying the sites most suitable to host facilities and assessing the environmental impact under ordinary, extraordinary and emergency conditions for their whole life cycle (construction, operation, dismission).

3. Source of data

1. European renewable energy incentive guide – Italy http://www.nortonrosefulbright.com/knowledge/publications/66177/european-renewable-energy-incentive-guide-italy
2. Libro bianco sulle pompe di calore – gruppo Italiano
3. Italy's national energy strategy 2017
4. IEA, Heat pump programme (HPP), https://www.iea.org/
5. EC, 2020 climate & energy package, http://ec.europa.eu/clima/policies/strategies/2020/documentation_en.htm
6. http://www.enea.it/it
7. S. Pezzutto, G. Grilli, S. Zambotti: "European Heat Pump Market Analysis: Assessment of Barriers and Drivers"
8. Libro bianco per uno sviluppo efficiente delle fonti rinnovabili al 2030. White paper for an efficient development of renewable sources to 2030. Confindustria, December 2018 – Rome

Country/Region: **GREECE**

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2. Renewable energy state of the art
Information about National and Regional level

2.1. Present national legislation on renewable energy (include heat/cold and electricity)

1. *Electricity*

- Premium tariff. From 2016, RES and combined heat and power (CHP) plants connected to the transmission system participate in the electricity market and are awarded a sliding feed-in premium (FiP), called "Operating support based on a differential compensation price". Apart from that, feed-in premium is awarded through tenders since 1 January 2017 (see "Tender"). Hence, Operating Support Contracts for RES plants ≥1MW and wind plants ≥6MW will not be signed until a tender is announced. Exemptions apply to smaller Installations.
- Tender. From 2017, RES and CHP plants are awarded with a sliding FiP through tenders. Tenders are expected to be "technology specific". The Ministry of Environment and Energy shall issue a decision concerning the capacities available for each technology for each subsequent tender. In December 2016, a pilot tender for PV already took place. The tender included two categories of PV installations, followed a two-stage process with specific price and volume caps.
- Feed-in tariff I. Law No. 3468/2006 sets rules for the guaranteed feed-in tariff. Plant operators are contractually entitled against the grid operator/ electricity market operator to the payment of electricity exported to the grid. The grid operator is obliged to enter into these contracts. The amount of feed-in tariff varies per renewable technology. **The scheme closed on 31 December 2015, however there are certain transitional provisions in place.**
- Feed-in tariff II (rooftop PV): The scheme supports electricity generation by rooftop PV installations of up to 10 kWp through a guaranteed feed-in tariff.
- Feed-in tariff III (feed-in premium exemptions): From 2016, RES and CHP plants to be connected to the transmission system participate in the electricity market and are awarded a sliding feed-in premium (called "Operating support based on a differential compensation

price") and from 2017, feed-in premium is granted through tenders (see "Tender"). However, exemptions apply to smaller installations, i.e. wind energy plants ≤3MW and other RES installations ≤500kW, which are eligible for a feed-in tariff.

2. *Heating and cooling*

The condition that FiTs for rooftop PV applications are only applicable to residences that cover a part of their water heating needs by some other renewable energy source (e.g. solar thermal) has encouraged renewable energy use for heat production. This has stimulated fast and early deployment of both solar PV and solar thermal power in Greece. The new Development Law 4399/2016 provides an income tax relief for co-generation plants and renewable energy source heating and cooling plants and also a stabilisation of the income tax coefficient.

Solid biofuels are used for heating in residential boilers, as a means to combat energy poverty. Residential consumption accounts for the largest share of biofuel demand in Greece. Biomass from straw, olive pruning and olive kernels, cotton stalks, and wood residues is used in the food and wood industries for space and process heating.

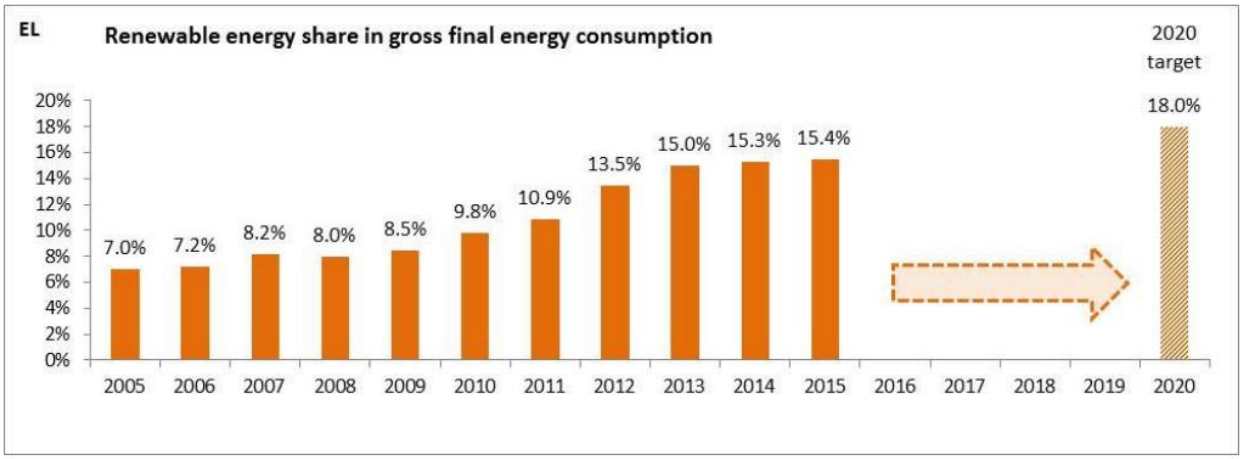
3. *Geothermal energy*

The first mention of shallow geothermal energy was made in the Greek legislation in Law 3175/2003 (Exploitation of geothermal potential, district heating and other provisions). According to this law, the installation of space heating/ cooling energy systems through the exploitation of the heat of geological formations and water (surface water and groundwater), which are not classified as geothermal potential (i.e. do not exceed 25° C) according to the provisions of this law, is allowed through a license issued by the relevant regional administration.

The required documentation and the procedure for issuing a license are described in Ministerial Decree Δ9Β, Δ/Φ166/οικ13068/ ΓΔΦΠ2488 of 2009. The decree aims to define the terms, conditions, required documentation and procedure for issuing a license for own use of space heating/ cooling energy systems through the exploitation of the heat of geological formations and water, surface water and groundwater, which are not classified as geothermal potential. In addition, the restrictions which must be taken into consideration regarding the installation and operation of the system are defined. The restrictions concern the borehole drilling or trench opening, the use of surface water or groundwater and the certification of the pumps and systems.

2.2. Describe current share of renewable energy sources (RES) in the final energy supply in your country

With a 15.4% renewables share in 2015 (against an indicative trajectory of 11.9% for 2015/2016), Greece is on track to meet its 2020 renewables target (20%). In 2015, according to Eurostat, the share of renewable electricity generation in final electricity consumption stood at 22.1% and in heating and cooling at 25.9%.



(source: Eurostat-SHARES)

Figure 2: Renewable energy share in gross final energy consumption

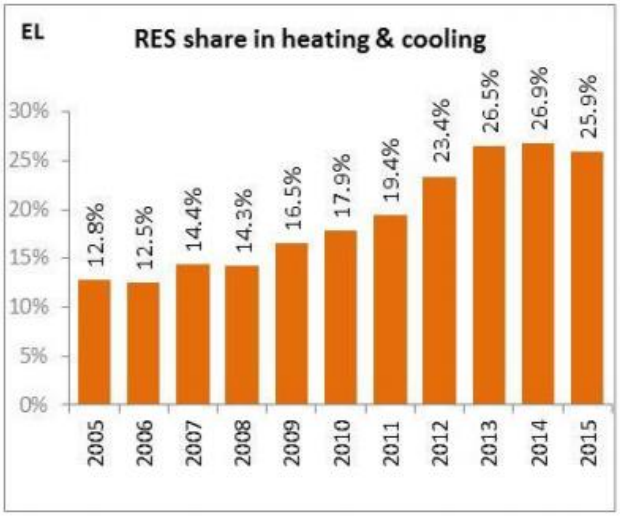


Figure 3: RES share in heating and cooling

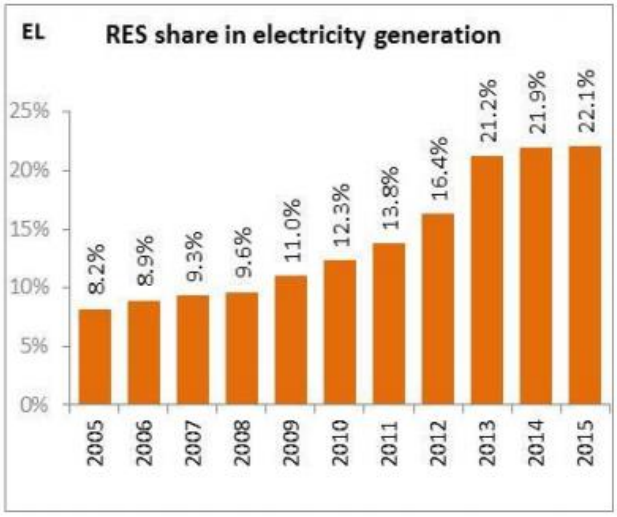


Figure 4: RES share in electricity generation

2.3. Describe the national perspectives and goals of the use of renewable technologies until the year 2020 or 2030

The Directive 2009/28/EC, regarding the promotion of energy from renewable energy sources sets mandatory national targets for their overall share in gross final consumption of energy and in transport by 2020. Furthermore, the Directive establishes a common framework for promoting energy from RES regarding statistical transfers between Member States and third countries, guarantees of origin, administrative procedures, information, training and access to the electricity grid from RES.

Particularly for Greece and according to the National Renewable Energy Action Plan (NREAP) submitted to the European Commission in June 2010 (NREAP, 2010), the percent feature of 18% defined by the aforementioned Directive 2009/28/EC, became 20% corresponding to 40% of the total national electricity production.

The new law L3851/2010 states that the protection of the climate, through the promotion of electrical energy production from RES, which reduces GHG emissions, constitutes an

environmental and energy priority of the highest significance for the country. It further sets specific targets for

- RES electricity share (40%),
- RES heating and cooling share (20%), and
- RES transport share (10%)

in order to achieve the national target of 20% contribution of the energy produced from RES to the gross final energy consumption.

Based on the NREAP compliance scenario the 40% share, is accomplished through the following secondary targets for the whole country (non-interconnected islands included):

(a) wind: capacity of 7.5 GW,

(b) hydro: capacity of 3.5 GW (including large hydropower plants (HPPs)),

(c) solar (photovoltaic): capacity of 2.2 GW and 250 MW of concentrating solar power (CSP) plants,

(d) biomass: capacity of 250 MW,

(e) 120 MW of geothermal energy,

(f) 880 MW of pumped storage systems—concerning exclusively the non-interconnected (NI) islands, and

(g) biofuels: 10% of final consumption in the transportation sector.

The RES-H target will be achieved mainly through the continuous growth of solar thermal installations in the residential and tertiary sector, the stabilisation of the biomass share in the residential sector, and the gradual penetration of heat pumps.

Moreover, an essential restructuring of the Greek energy system is vital, given that the projected penetration of RES must be accompanied by elevated energy transmission networks, being accompanied by expansion and promotion of the outland-islands connections to the mainland energy grid and storage systems. Also, while the EU has set the strategic goal of a low carbon economy for the period after 2020, increasing the amount for further investments is also needed and imperative.

Geothermal energy and GSHP goals

The annual geothermal energy use (geothermal heat pumps excluded) is set at 51 ktoe, which is more than double the annual energy use at the end of 2015 (21 ktoe).

The respective number for the geothermal heat pumps has been set to 50ktoe. Achieving the above targets by 2020 requires an annual increase of the geothermal energy use around 20%. The latter seems achievable for the GSHP sector, but rather unlikely, at least under the current circumstances, for the classical geothermal applications.

As for the geothermal energy contribution in the electricity sector, the plan of the NREAP includes power production from medium/small scale geothermal plants in the interconnected system and local plants in the non-interconnected islands. For the year 2020 the expected installed capacity from the geothermal power plants is 120 MW. This is practically impossible, judging by the zero geothermal power production in 2015, which is rather far from the target of 20MW foreseen in the NREAP for this year.

District heating/cooling installations from geothermal energy are also foreseen in the NREAP, as a contribution to meet the national targets for 2020. However, the only district heating systems that might be in operation by 2020 is the DH system in Alexandroupolis (Aristino field, Northern Greece).

The implementation of the Energy Performance of Buildings Regulation (EPBR) in 2010 has aimed to achieve tangible results for significant energy saving in the building sector. The EPBR has been an important step towards promoting RES systems for heating and cooling at the tertiary and residential sectors, as well as in agriculture and industry. The GSHP market has been favored by the implementation of Law 3851/2010, as well as from other recently introduced legislation, which included:

- Energy labelling of buildings, introduced in April 2010.
- Total coverage of their primary energy consumption through energy supplied from RES, CHP, district heating and heat pumps for all new buildings that accommodate services of the public sector. The same stands for the private sector after 31.12.2019.
- Compulsory (since 2011) energy audit certificates for all building transactions: buying-selling, letting-renting, leasing, erecting, refurbishing.
- Additional taxation on heating oil, imposed in October 2012.
- The enforcement in February 2013 of the EU Energy Performance of Buildings Directive.
- The enforcement in November 2015 of the EU Energy Efficiency Directive for compulsory energy audits in large enterprises and minimum energy requirements for the public sector during refurbishing or purchasing of used buildings.

2.4. Describe current status and future targets of renewable energy sources in final energy supply on local community or regional level (describe any action plans in this respect or local development plans etc.)

About Energy Planning in Greece (data 2016):

- Until 2014 there existed a National Energy Planning Committee.
- The Greek Road Map to 2050 was produced in 2012 (but never officially adopted) under its auspices.

Greece is at an initial stage regarding the development of an integrated national energy and climate plan (NECP) for the years 2021–2030. Greece is planning to establish a ministerial steering committee and will be supported by technical working groups with the participation of different authorities and research centres institutions, such as the Ministry of Environment and Energy, the Centre for Renewable Energy Sources and Saving (CRES) and others as required. For the analytical base Greece is planning to build on existing data and modelling experience. No targets for energy efficiency and renewable energy beyond 2020 have been set. Source: COM(2017) 688 final

- In early 2018, the National Committee for the Energy and Climate was formed; the Committee is expected to submit the draft National Climate and Energy Plan (NCEP) to the European Commission till end of 2018.

It will be supported in its work by two working groups, one focusing on measures, policies and models and a second on analysing, studying and assessing repercussions, as well as six sub-groups that will collect data and produce reports on the following areas:

- Greenhouse gas emissions
- Renewable energy sources
- Energy efficiency
- Energy security
- Energy market
- Research, innovation and competitiveness

There are only targets/goals regarding RES in general (more details in 2.1): Greece in the scope of the 20-20-20 targets and obligations has specified in Art 1 of Law 3851/2010 the following targets (in addition to the fixed ones i.e. 10% by RES of the transport energy and 6% on transport fuels, etc):

- 20% (2% above the 18% specified in Directive 2009/28/EC) of gross final energy consumption to be generated by RES by 2020
- 40% of gross electricity consumption to be generated by RES by 2020

These targets were reiterated in Law 4414/2016 (Art 1). Also GHG emissions from non-ETS sectors to decrease by 4% by 2020 compared to 2005 as specified by the ESD (to increase to 16% tentatively in 2030).

RES in Greece is supported (and not included as such) under different thematic areas within RIS3 (Smart Specialisation Strategies) on a regional level, with reference to the following:

Energy and its cross-cutting implications (transport, industrial production, etc.) -> Emphasis on renewables, efficiency enhancement technologies, cost-reduction of energy as a key input, outward-looking competitiveness, environmental impacts, smart grids, fuel cells, renewables-sourced energy storage, etc.)

Environment and sustainability -> 'green' innovation and entrepreneurship, recycling, integrated waste management, climate change and environmental impact mitigation, disaster prevention and mitigation, oil spill fighting technologies, smart networks, reduction of carbon footprint, biodiversity protection, etc.

At this point, it should be mentioned that:

The RIS3 Design Process is structured, coordinated and leaded by the Central Government (Ministry of Development -NSRF Special Secretary, Special Service for Strategy, Design and Coordination of Development Programmes- General Secretary for Research & Technology etc.) and under specific and detailed Administrative Circulars.

Regional Authorities have limited freedom and a supplementary role in the process:

- Establishing S3 Stakeholders Networks and organising workshops and regional congresses

- Gathering, indexing and condensing data and stakeholders' opinions and assigning support studies
- Expressing opinions, preparing regional development programming plans (according to the specific directions of Central Government) and submitting proposals
- Their role is focused mostly on specification of regional individual planning and implementation.

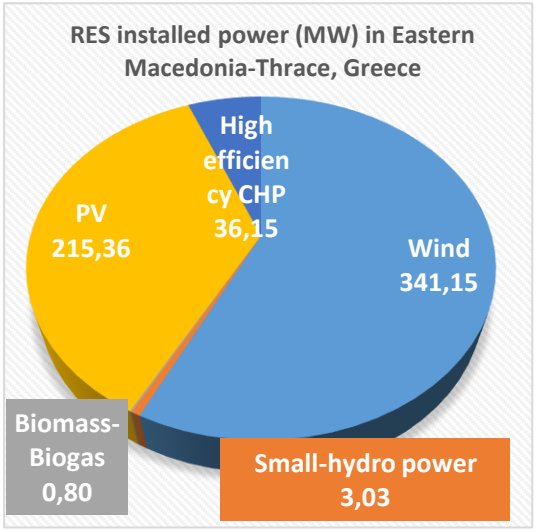


Figure 5: RES installed power in Eastern Macedonia-Thrace

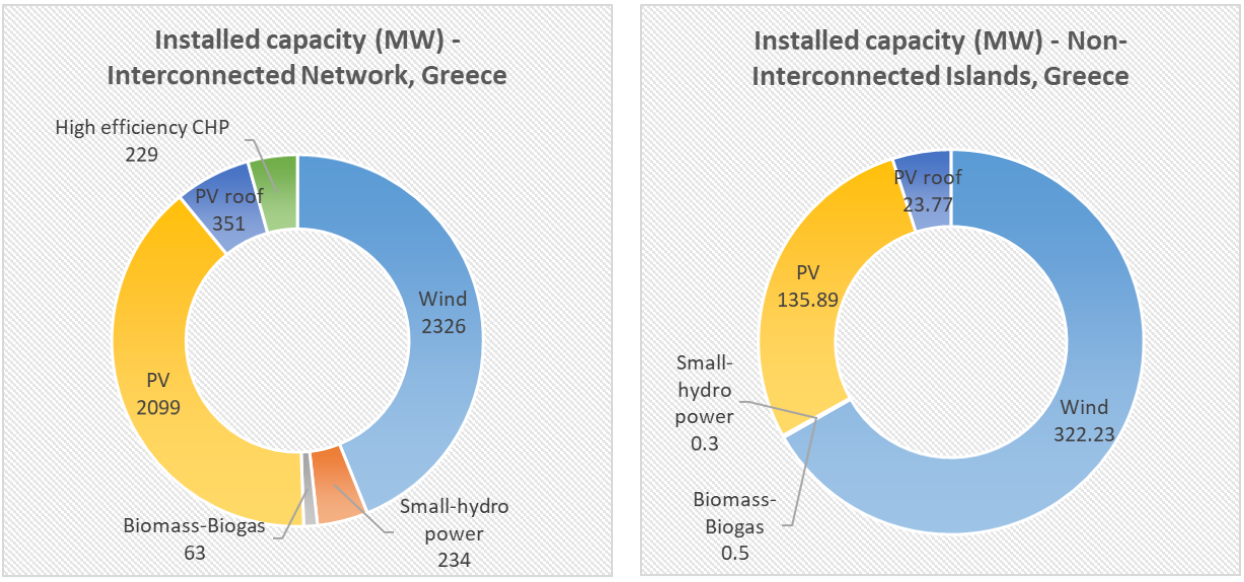


Figure 6: Installed capacity on the interconnected and non-interconnected network

Source: LAGIE, RES & CHP monthly statistics – March-April 2018, http://www.lagie.gr/fileadmin/groups/EDSHE/MiniaiaDeltiaEL/Updated_March_April__2018_DELTIO_ELAPE_v1.0_28.06.2018.pdf, data as of 28/06/2018

2.5. Barriers on national level (provide information about technological, non-technological barriers such as legal, social, economic, environmental etc.)

Eurostat (2007) used socioeconomic indicators in order to categorize the RES barriers in Greece. The five major types are (1) technological, (2) environmental, (3) social, (4) economic and (5) regulatory, administrative and legislative barriers.

The major barriers for the increase in the RES use in Greece, are:

(a) Lack of both specialised and administration data (land registry, property and use, and management of protected areas).
(b) Insufficient approaches/analysis and lack of a national strategy to evaluate the impacts of the RES projects, in particular their environmental and socio-economic impacts.
(c) The absence of financial advantages and measures to support RES projects, especially concerning
    - the creation, operation and manufacturing units for RES equipment;
    - the promotion of research, the development of technology and the concretization for commercial RES applications of local importance.
(d) Lack of a national policy for RES installation planning, which results in many problems concerning the procedure to obtain RES license and increased bureaucracy.
(e) Lack of a policy regarding industrial relations and the collaboration between companies and local authorities to promote RES development; the absence of such policy and information has caused the last years a “chain” of local reactions and legal cases against the RES installation and operation;
(f) The procedure to obtain the license for a RES project continues to be complex and long; there are many intermediate structures of consultation without having a coordination and common direction between them. The licensing procedures are involving a multitude of central, regional, prefectural and local authorities. Efforts to simplify them and to reduce the time required to successfully navigate through the procedural maze are on-going.

The following Table 10 summarizes the drivers and barriers for RES projects in Greece.

Table 10: Barriers for RES projects in Greece

Barriers	Renewable Energy Systems
Technological	Lack of trained human resources.
Environmental	Incorporation costs for RES. High cost of grid connection.
Social and political	There is no maturity to the recognition and realistic assessment of the RES potential and performance.
Economic	Lack of funds. Participation in EU funding projects in public-private partnerships.
Legislative and administrative	Delays to overall procedure. Lack of special spatial design for RES. Lack of strategic plan. Ineffective control mechanisms and administrative structures.

Unstable legislation framework.

Source: [a] DEPOIR (2007) and [b] partly based on Skoulaxinou et al. (2006) and own elaboration

With regard to the shallow geothermal energy utilisation, technical and regulative measures targeted to exploit the ground and water source potential for the GSHPs propagation, to localize the existing underground infrastructure network planning the necessary infrastructure works in order to integrate new distributed district heating and cooling networks for the cities and to facilitate the gradual decommissioning of the old and outdated heating and air-cooled systems in the buildings replaced by modern GSHP systems have to be undertaken.

2.6. Analyse and present barriers regarding the implementation of seawater heat pumps on specific study case locations either project related or not. Take into consideration and analyse potential impacts on: e.g. landscape, ecology, natural or cultural heritage etc.

Financial barriers are the main reason for the low penetration of the GSHP systems. Specifically, high investment cost compared to conventional heating/cooling and DHW technologies is the most significant obstacle for GSHP adoption by consumers. The recent years' financial recession creates a further difficulty of fund raising by consumers, thus adding to the problem of high initial installation cost; besides, the specific barrier has been pointed out as one of the main factors of the GSHPs market stagnation during the last years.

The above barriers act in combination with the absence of financial incentives (subsidies, tax exemptions etc.) in Greece concerning the installation of GSHP systems. The development of financial-oriented actions is the key to the diffusion of this technology in the residential sector.

Seawater itself was listed as a barrier, due to its corrosive nature the infrastructure requires special (and often expensive) materials. The development of seawater heating system infrastructure might create problems, as it requires technical interference that might be objected by environmental and planning organisations.

The execution of the system also requires highly skilled labour. Major obstacles against the diffusion of the technology are the low awareness level of installers/ engineers/ architects, etc. and the lack of public awareness of the technology and its benefits.

Another category of barriers involves the installation process, and specifically the difficulty to adapt the system in an existing household, as well as the discomfort that the installation process causes to the dwelling.

As with any new technology, a seawater heating system is risky and requires high levels of investment and support. This again can be changed by using various financial incentives and economic drivers. Negative publicity about climate change also does not help the maturity of new innovative technologies and reduces social acceptance and political will which are important.

2.7. More detailed description regarding required licences on specific study case locations, either project related or not.

Describe the process of obtaining any kind of related licences or permits: e.g. abstraction licences, discharge permits (of used water), drilling permits, building permits if necessary etc.

Shallow geothermal energy, i.e. the type of geothermal energy which GSHPs utilize and which according to the Greek legislation is not characterized as geothermal potential, is first mentioned in Law 3175/2003 (Exploitation of geothermal potential, district heating and other provisions). The

current applicable ministerial decree that is referred in Law 3175/2003 is Ministerial Decree Δ9Β,Δ/Φ166/οικ.13068/ΓΔΦΠ2488 of2009 (Installation licenses for own use of energy systems for heating/cooling of spaces through the exploitation of heat from geological formations and waters (surface or ground), which are not characterized as geothermal potential).

This Ministerial Decree determines the terms, conditions and required documentation and procedures for the licensing of the GSHP system. The license is a unified license for the implementation/installation of the GSHP system and operation of the licensed installation. The license is issued by the Department of Development of the Prefectural administration to which the property belongs to, in favour of the owner of the property.

With this Ministerial Decree the restrictions that must be taken into consideration regarding the installation and operation of the GSHP system are defined. The restrictions concern the cases of well drilling or trench opening, the use of surface or ground water and the certification of the pumps and systems.

Specifically, regarding the use of surface or ground water, in order to issue a license, the relevant provisions of Law 3199/2003 (Water protection and management) and the Ministerial Decree οικ.150559 of 2011 (Procedures, terms and conditions for the permit issuing of existing rights of water use) have to be taken into account.

Specific restrictions is stated that in the case of a well drilling, this must be located at least: a) two meters from the property boundaries, b) five meters from existing neighbouring buildings of different ownership, c) five meters from the boundaries of the expropriated railway zone, c) ten meters from main natural gas pipelines, d) five meters from main underground pipelines (water, sewerage, etc.), e) ten meters from high voltage electricity distribution lines —except if a building exists between the line and the well and f) five meters from medium voltage electricity distribution lines —except if a building exists between the line and the well.

In addition, it is clearly indicated that during the drilling of each well cementation must take place for at least the upper five meters, while steel tubing must be placed along the aforementioned length of the well's inner wall.

Also in this Ministerial Decree, the required documentation that must be submitted for the licensing of the GSHP system is specified. It should be noted that the decree does not state the period of time required by the Administrative Region for the issuing of the installation license of the GSHP system. However, it is worth mentioning that in practice this time period usually ranges approximately between eight and twenty working days.

Finally, cases that may require amendment of the licence and that can lead to penalty fees and license recall are mentioned.

2.8. Describe most relevant national subsidy schemes and programmes for supporting the use of renewable energy technologies with a focus on sea water heat pumps or heat pumps in general (include responsible organizations, managing authorities etc.).

According to the new development law (4399/2016), investment subsidies will be granted to small hydro plants (up to 15 MW), high-efficiency co-generation plants using renewable energy sources, hybrid renewable energy source plants in the NIIs (non-interconnected or disconnected islands) (up to 5 MW), production of heating and cooling from renewable energy sources, and high-efficiency district heating and cooling. In detail:

The new Development Law that came into force in July 2016 foresees support for CHP plants and RES H&C plants (for self-consumption, but not only):

Tax relief. The 2016 Development Law foresees support for CHP and RES H&C plants in a form of an income tax relief and a stabilization of income tax coefficient. They can be substituted with other support mechanisms, i.e. subsidies, under the Development Law.

Subsidies. The 2016 Development Law foresees support for CHP and RES H&C plants in a form of subsidies, leasing subsidies, and subsidies for the creation of new jobs. They can be substituted with other support mechanisms under the Development Law, i.e. tax relief.

Income tax relief. Law No. 2238/1994 provides an income tax relief for natural and legal persons who have performed an energy upgrading of their building either at their own expense or through participation in national programmes (e.g. "Exoikonomo / Energy efficiency at household buildings", see below table).

The available financial incentives that are offered during different time periods for the installation of GSHP systems in Greece, are presented in the following Table 11. During 2004 and 2009 there was no incentive provided. In recent years (2012 and 2014) the "Energy efficiency at household buildings" program was available for households; very few installations have been materialized through this program, as GSHP installations in existing buildings is relatively complex.

Table 11: Available financial incentives for the installation of GSHP systems in Greece

Year	Incentives
2004	The state provides no financial incentive for GSHP installation
2007	There is no subsidy for households, but a tax exception of 200€ is offered. VAT for GSHP equipment is 9%, while for natural gas system is 19%.
2009	The state provides no financial incentive for GSHP installation
2012	Direct subsidy up to 10.500€ and an interest-free loan or subsidized loan rate up to 4.500€ for residential and commercial buildings ("Energy efficiency at household buildings" program), direct grant up to 40% of the investment in hotels ("Green tourism" program), reductions of prices offered by installers ("Building the future" program)
2014	**Subsidized loan** interest up to 100%, subsidy of the final eligible expenditure, minimum cost coverage for energy inspectors through the "Energy efficiency at household buildings" program

2.9. Describe how renewable energy sources and technologies are supported on local (regional) level. Describe the support mechanisms, current available support and subsidy schemes and planed future activities.

Greece is at an initial stage regarding the development of an integrated national energy and climate plan (NECP) for the years 2021–2030. For further information, see chapter 2.4.

3. Source of data (Please state all published documents and e-sources that you use in this report. Please state the year and the e-address of the sources.)

- Goumas and Haldezos. Analysis of the current regulatory framework of the GSHPs Greek Market. *REGEOCITIES* 2012.
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- Legal sources on renewable energy, http://www.res-legal.eu/home/
- Energypedia, https://energypedia.info/wiki/Greece_Energy_Situation

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2. Renewable energy state of the art

Information about National and Regional level

2.1. Present national legislation on renewable energy (include heat/cold and electricity)

2.1.1. Energy Act (Official Gazette 120/12, 14/14, 95/15, 102/15)

The Energy Act regulates system for safe and reliable energy supply as well as its efficient production and usage. The act also regulates the establishing acts based on which energy policy and energy planning are implemented, and the execution of energy activities, on the market or as public services, and fundamental issues in the execution of energy activities.

Furthermore, the Energy Act regulates issues and relations that are of common interest for all energy activities or that are related to more types of energy forms. Issues related to gas, electricity, oil and petroleum products, heat, renewable energy and energy efficiency are regulated by special laws.

Article 3, Point 17 names the renewable energy sources such as aerothermal energy, sea energy, wind energy, hydropower, geothermal and hydrothermal energy, gas from landfills, gas plant for waste water treatment and biogas and solar energy.

In Article 4, Point 2 it is stated that the construction of energy facilities, their maintenance and use is of interest to the Republic of Croatia while Article 12 defines the efficient use of energy as of interest of the Republic of Croatia.

Article 5 introduces the Energy Development Strategy as the basic act that establishes and plans the energy development. The energy development strategy is ensuring safe and reliable energy supply and its efficient production and use, with especially focus on the use of different and renewable energy sources and environmental protection in all areas of energy activities.

2.1.2. Regulation of Energy Activities Act (Official Gazette 120/12)

This Act regulates the establishment and implementation of energy activities regulation, as well as the procedure for establishing energy regulatory bodies and other matters of importance for the energy activities regulation.

The basic goals of regulating energy activities are listed in Article 5 and are as follows:

- ensuring objectivity, transparency and impartiality in carrying out energy activities,
- to take care of the implementation of the principle of regulated network/system access,
- adopting methodologies for determining the amount of tariff items in tariff systems,
- establishment of an efficient energy market and market competition,
- protection of energy customers and energy subjects.

The regulation of energy activities promotes:

- efficient and rational use of energy,
- entrepreneurship in the field of energy,
- investing in the energy sector,
- environmental protection.

Article 7 introduces the Croatian Energy Regulatory Agency as an independent and non-profit legal entity with public authority to regulate energy activities.

2.1.3. Electricity Market Act (Official Gazette 22/13, 95/15, 102/15)

The Electricity Market Act regulates the rules and measures for safe and reliable production, transmission, distribution and supply of electricity and for electricity trading and the organization of the electricity market as part of the electricity market of the European Union. Furthermore, it establishes the rules for the protection of end customers, for the organization and functioning of the power sector, for the open access to the market, obligations and the rights of electricity customers which include the rights of end customers, etc.

The Act governs the energy approval for a new production facility. The production facilities can be built by the legal or private entity, if the intend production facility meets the criteria laid down in the procedure of issuing energy approval. The criteria for the procedure of issuing energy approval for the construction of production facilities are public and are based on the principles of objectivity, transparency and impartiality.

Article 11 states that any energy entity or any other legal or natural person that produces in the same time electrical and thermal energy and that with high efficiency, uses waste or renewable energy sources to produce electrical energy and that in an economically feasible manner in accordance with the regulations of the environmental protection area, irrespective of the capacity of the system can acquire the status of a privileged electricity producer. Privileged electricity producers may be eligible for the incentive price determined by the tariff system for the production of electricity from renewable energy sources and cogeneration.

2.1.4. The renewable energy sources and high-efficiency cogeneration Act (Official Gazette 100/15)

This Act regulates the planning and promotes the production and consumption of electricity produced using renewable energy sources and high-efficiency cogeneration. The Act determines the measures to encourage the electricity production using mentioned technologies, regulates the implementation system to encourage their use for the production of electricity and regulates the issues of construction of plants for the production of electricity from renewable energy sources and high-efficiency cogeneration on state land. The Act also regulates the management of the register of renewable energy sources and high-efficiency cogeneration projects, project developers and privileged producers of electricity from renewable energy sources and high-efficiency cogeneration, issues of international cooperation in the field of renewable energy and other issues of importance for the use of renewable energy sources and high-efficiency cogeneration.

The Act gives guidance for the planning, design, construction, use, maintenance and removal of production facilities and production units that produce electricity from renewable energy sources and high-efficiency cogeneration. The Act specifies the appropriate manners for following the regulations governing the environmental and nature protection and preservation of cultural goods, state aids, spatial planning, construction, electricity market, concession, maritime domain, water management, the right to ownership and other related rights and the provisions of other regulations.

Article 2 defines the renewable energy sources and high efficiency cogeneration as of interest to the Republic of Croatia. It also defines the purpose of the Act as promotion of production of electricity from renewable energy sources and high efficiency cogeneration, as well as promotion of production of electricity from renewable energy sources and high efficiency cogeneration at the site of consumption with the goal to increase the share of total direct energy consumption produced from renewable energy using the incentive mechanisms and regulatory framework for the use of renewable energy sources and high efficiency cogeneration. By using renewable energy sources and high efficiency cogeneration, the interests of the Republic of Croatia regarding the energy sector, as set out in the Energy Development Strategy of the Republic of Croatia, laws and other regulations regulating the performance of energy activities, are implemented.

Under Article 4, Point 11 the renewable energy sources are named, and these include: aerothermal, biomass, energy from bio-liquids, sea energy, hydropower, wind energy, geothermal and hydrothermal energy, gas from landfills, gas from wastewater treatment and biogas, solar energy and biodegradable fraction of certified waste for energy production in an economically viable manner in accordance with the regulations of the administrative area of environmental protection.

Article 7 introduces the National Goal of Using Energy from Renewable Energy Sources as the mandatory objective of using renewable energy sources in the Republic of Croatia in 2020. It defines the minimum share of renewable energy sources in total direct energy consumption of 20%. A national goal defines the methodology for determining the share of energy from renewable energy sources in the total direct energy consumption. In the methodology, the production of energy from installations using renewable energy sources not connected to the power grid is part of the energy from renewable energy sources in total direct energy consumption. Point 7, introduces the methodology that will be used to calculate how high must the usage of aerothermal, geothermal and hydrothermal energy be, in order for the heat pump to be classified as renewable energy.

Article 8 presents the National Action Plan for Renewable Energy Sources, a draft document for the period up to 2020, which sets out the National objective of the Republic of Croatia for the share of energy from renewable sources in electricity, heating and cooling, and transport. The National

Action Plan includes an overview and assessment of the energy market situation, comparative analysis, long-term goals and annual forecasts as well as the measures to achieve the objectives and other necessary data.

Other issues addressed with the Act are Report on the Progress in Promotion and Use of Energy from Renewable Sources, Statistical Transfers between Member States of the European Union, Joint projects between Member States of the European Union, as well as Calls for the right of building renewable energy plants or high efficiency cogeneration plants on the state property, etc.

2.1.5. The tariff system for electricity produced from renewable energy sources and cogeneration (Official Gazette 133/13)

The Tariff System for the production of electricity from renewable energy sources and cogeneration regulates the right of privileged producers of electricity to an incentive price of electricity paid by the market operator for the electricity produced and delivered from plants using renewable energy sources and cogeneration plants, excluding its own consumption. This Tariff System defines the elements for determining the incentive price depending on the type of source, installed power, as well as the manners and conditions for applying these elements.

Article 5 of the Tariff System explains the calculation of the incentive price which is affected by the type and capacity of renewable energy source. It also introduces the corrective coefficient, which can make the incentive prices even more favourable in case that domestic hot water preparation and / or heating system is solved as a solar cogeneration system with solar collectors or heat pumps.

2.1.6. Thermal Energy Market Act (Official Gazette 80/13, 14/14, 102/14, 95/15)

The Thermal Energy Market Act regulates measures for the safe and reliable supply of thermal energy to thermal systems used for heating and cooling. The Act also regulates the conditions for obtaining concessions for distribution of thermal energy, that is, the concession for the construction of the distribution network, policies and measures for the safe and reliable thermal energy production, distribution and supply to the heating and cooling system, and measures to achieve energy efficiency in heating and cooling systems.

Article 4, Point 3 states that the use of renewable energy as a source of thermal energy in the interest of the Republic of Croatia. A further interest of the Republic of Croatia, added in the Point 4, is the encouragement of the development and use of new, innovative and sustainable technologies in the energy sector which will be solved with opening the market of innovative solutions with the help of public procurements of goods, services and works.

Article 15, Point 2 defines that the energy entity using cogeneration unit and using waste, biodegradable waste or renewable energy sources to produce thermal energy in an economically viable manner, in accordance with the regulations governing environmental protection and waste management, may gain the status of the privileged producer of electrical and thermal energy.

2.1.7. 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)

The Rules prescribe a certification system for installers of energy-related buildings. There are several Rules that include PV systems, shallow geothermal systems and heat pumps, solar collectors, small biomass boilers, etc.

The purpose of the Rules is to establish a complete system for certification of renewable energy sources installers and the training program for certified installers of renewable energy sources.

For each technology, a separate certificate is needed, and only the installer who has the certificate to install the certain renewable energy source is permitted to do so. The Rules define the condition for getting the certificate and those are as follows:

1. The qualification level that is needed, and which varies depending on the renewable energy source,
2. Completed training program prescribed by this Rules,
3. Passed knowledge exam consisting of a theoretical and practical part in accordance with the Training Program,
4. For the solar systems, a medical certificate proving that the installer can perform work at a height of more than three meters according to a special regulation.

2.1.8. Technical Rules on heating and cooling systems of buildings (Official Gazette 110/08)

The Technical Rules stipulate technical requirements for heating and cooling systems of the building, as well as requirements for design, performance, usability, maintenance and other requirements for systems, within the framework of meeting the essential building requirements.

Design, construction, maintenance and use of buildings must be such as to meet the requirements prescribed by this Rules.

Appending A of the Technical rules contains norms and recognized technical rules for designing the facilities which also contain norms and technical rules for heat pumps.

2.2. Describe current share of renewable energy sources (RES) in the final energy supply in your country

Latest official energy data for the Republic of Croatia can be found for the year 2016 when the share of renewable energy sources in the total energy consumption amounted to 23.5 % following the EUROSTAT method of calculation. The total electricity production in Croatia amounted to 12 818.6 GWh, of which 66.8 % was produced from renewable energy, including large hydro power plants. More precisely, large hydro power plants had a share of 54.1 %, while 12.7 % of electricity was produced from other renewable sources, such as small hydro power plants, wind energy, solar energy, biomass, biogas and photovoltaic.

If gross electricity consumption is observed, electricity produced from renewable energy sources had a share of 46.7 %, in which electricity produced in large hydro power plants had a share of 37.8 %, and the electricity produced from other renewable sources of 8.9 %.

Figure 7 shows the shares of different energy sources in total energy supply over the years.

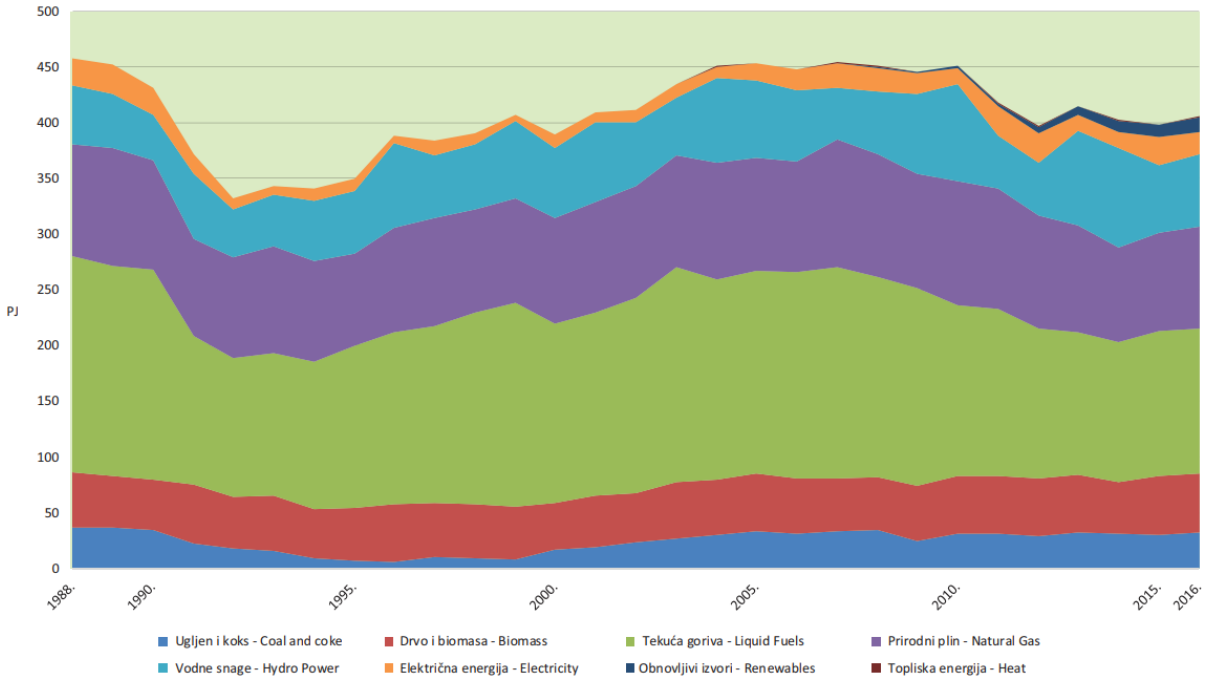


Figure 7: Total Energy Supply in Croatia

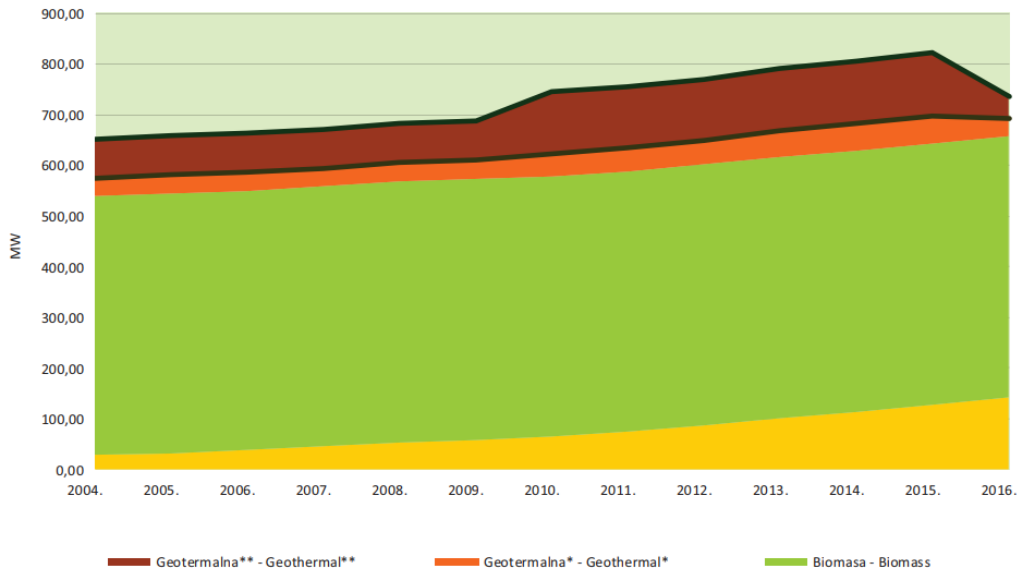
While interpreting data on installed RES capacities, it is necessary to bear in mind that there are no reliable statistical data on installed capacities for solar and biomass heating systems while heat from geothermal sources is included in two methodologies for reporting the values. Table 12 provides estimated data on installed capacitates for heat generation from renewable energy sources and statistical data on installed capacities for electricity from RES for 2016.

Table 12: Installed capacities for heat and electricity production from renewable energy sources in Croatia for 2016

OIE RES	Instalirana toplinska snaga Installed heat capacity (MW)	Instalirana električna snaga Installed power capacity (MW)
Sunce Solar	142,6	55,8**
Vjetar Wind	0	483,1
Biomasa Biomass	515*	26
Bioplin Biogas		35,9
Male hidroelektrane Small hydro power plants	0	37,4
Geotermalna Geothermal	34,9 / 43,4	0
UKUPNO TOTAL		565

In the professional literature, two methodologies of expressing the use of geothermal energy are mentioned: the energy used for space heating only, with an installed capacity of 34.9 MW, and the energy used for heating and hot water preparation, with an installed capacity of 43.4 MW.

Figures 8 and 9 show the trend of installed capacities growth of RES both for heating and for electricity production.



* 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 8: Installed capacities of RES for heating in Croatia

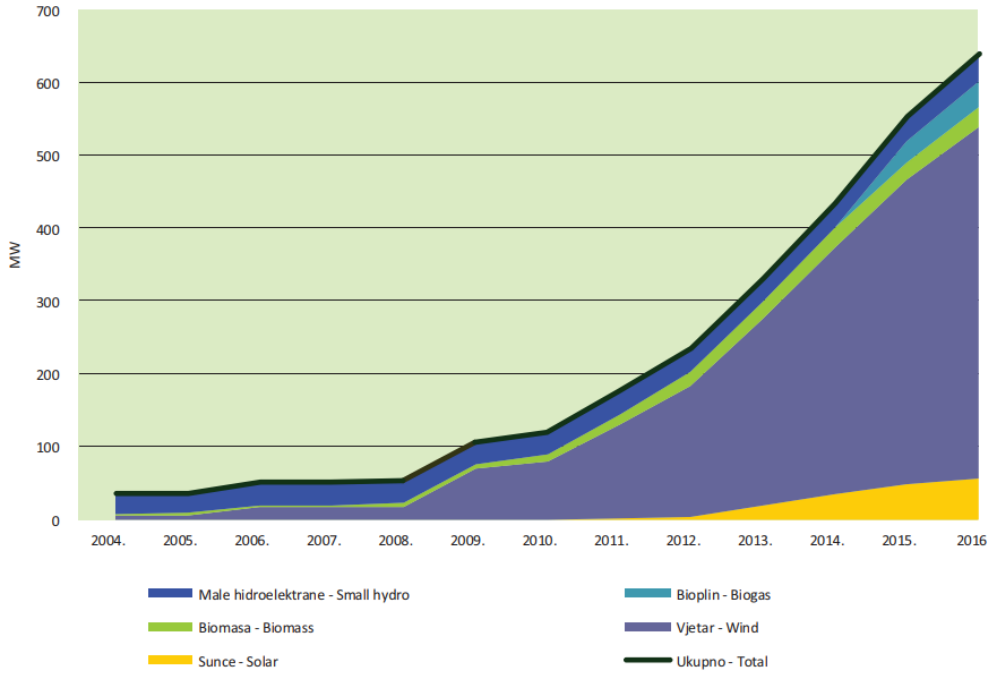


Figure 9: Installed capacities of RES for electricity production in Croatia

Figure 10 presents the shares of different sources of energy on an individual level in the total energy supply in 2011 and 2016. The share of hydropower in 2011 amounted to 11.4 %, whereas in 2016 it amounted to 16.2 %. The share of other renewable sources (wind energy, solar energy, geothermal energy, biodiesel and biogas) increased from 0.7 % to 3.1 %, as well as the share of fuel wood and solid biomass from 12.3 % to 12.9 %. The share of heat from heat pumps increased in the total primary energy supply from 0.1 % to 0.2 %.

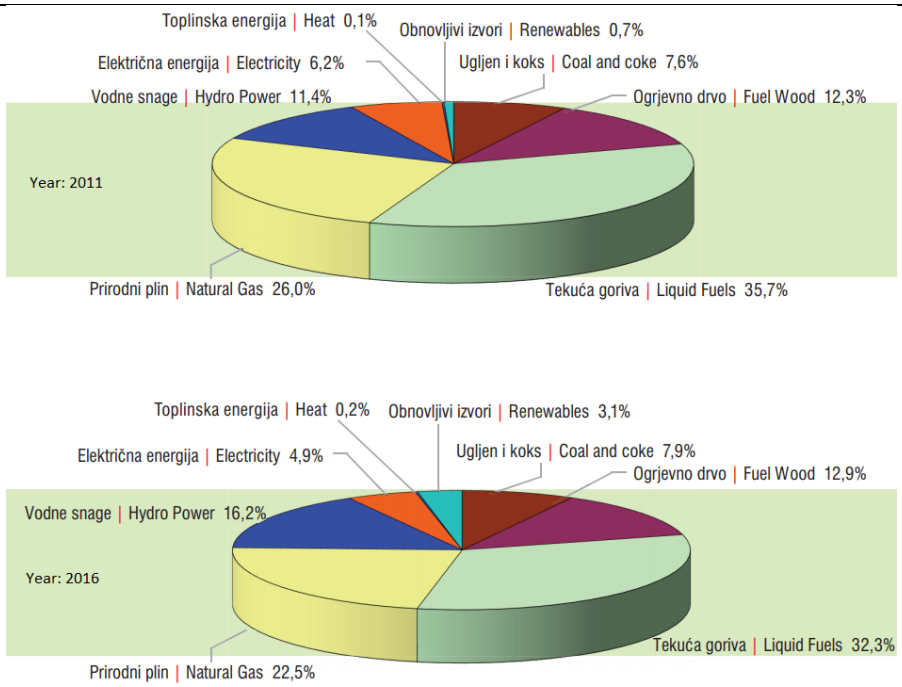


Figure 10: Shares in total energy supply

2.3. Describe the national perspectives and goals of the use of renewable technologies until the year 2020 or 2030

The Republic of Croatia aims to have a reliable and sustainable energy sector whose development will be based on the exploitation of all energy options in order to meet its own energy needs and create additional benefits for citizens, all in accordance with the principles of environmental, economic and social responsibility. The Republic of Croatia aims to reduce direct energy consumption by 10% by 2020 compared to the average consumption in the period 2001-2005.

Croatia will fulfil its obligations under the proposal of the European Union Directive considering the promotion of renewable energy sources, including large hydro power 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 hydro power plants, up to 35% in total electricity consumption by 2020.

In the Republic of Croatia, the use of micro-generating and small cogeneration of heat and electricity and the use of heat pumps will be encouraged. By using heat pumps, due to increased efficiency of energy conversion, that is, due to the use of air, ground or water energy, heat pumps will help to reduce energy consumption. Heat pumps are to be installed in low-temperature heating systems and are generally not applicable for existing heating systems. At higher primary energy prices, the heat pumps become competitive and, with the help of quality stimulus systems, are expected to become increasingly used for heating and cooling.

Furthermore, the Republic of Croatia prepared a Draft of the Strategy of Low-Carbon Development of the Republic of Croatia for the period by 2030 and with the vision of 2050. The goals of the Strategy are among else to increase security and sustainability of energy supply, to increase the availability of energy and to reduce energy dependence.

Energy transition refers to the transition to decentralized systems using low carbon technologies, while on the side of consumption the energy efficiency is growing. In the power system with a large share of variable RES, there is a growing demand for flexible production and energy storage, and of

consumption that is increasingly adapting to production. At the same time, the need for non-flexible power plants that would operate in the base regime disappears. The power system is integrating with the heat and transport system and the importance of information technology is growing.

By technological development, but also by increasing efficiency, energy consumption is increasingly moving towards electricity consumption. In the Strategy of Low-Carbon Development, it is estimated that final electricity consumption will grow at an average rate of 0.8 % to 1.2 % per year by 2030, causing the final electricity consumption in 2030 to be 15 to 20 % higher than it was 2014. In the period from 2030 to 2050, the growth will primarily depend on the share of electric vehicles in the transport sector, and the average growth rate of the final consumption of electricity will be between 0.9 % and 1.7 %, resulting in final electricity consumption in 2050 to be 35 to 70 % higher than 2014. In other words, the share of electricity in final energy consumption would rise from 21% in 2014 to 23-24 % by 2030, and would continue growing to 30-45 % by 2050.

District heating (DH) is important for decarbonisation of the energy system. In Strategy of Low-Carbon Development, 40 % of households should be covered with DH by 2050. Furthermore, it is suggested that cogeneration systems and their improvement with the help of heat-saving technologies which would save thermal energy in times when electricity is inexpensive (for example, energy from variable RES which represents a critical surplus at a given moment) are used.

It is estimated that by about 2025, relatively low average electricity prices will be maintained in the markets, whereupon average prices will rise by about 20% by 2030, but with considerably higher hourly oscillations, largely dependent on electricity production from variable RES.

It is expected that by 2020 existing thermal power plants with altogether capacity of 900 MW, and by 2030 an addition of 300 MW will be phased out.

In the period by 2030, the required investments in the RES amount to almost 1% of the annual GDP of the Republic of Croatia projected in that period. However, the market on itself will not be a sufficient incentive for a strong development of the RES by 2030. An important factor will be the successful functioning of the emission trading system (ETS), but also the continuation of some form of national incentive measures, such as the elimination of obstacles to the integration of the RES. To ensure the possibility of accepting new RES and achieving the preconditions for electrification in the transport sector, significant investment in the transmission and distribution system will be required. The strategy sets the goals of increasing solar energy use at an annual rate of 50 to 100 MW from 2021 to 2030 at a minimum. The goal of the strategy is that the share of RES in electricity production grows from 45.3 % in 2014 to 48-50 % by 2020, to 65-80 % by 2030 and to 70-99 % by 2050. Indicatively, the installed capacity of renewable energy sources for electricity production by 2030 is as shown in Table 13.

Table 13: Installed RES capacity by 2030

RES Technology	Installed Capacity (MW)
Hydropower plants (>10 MW)	2600
Hydropower plants (≤ 10 MW)	100 – 140
Geothermal power plants	30 – 40
Solar power plants	1100 – 1800
Wind power plants	1400 – 2000

Biomass, including waste	150 – 200
Biogas, including landfill gas	80 – 100

The strategy supports models of ownership of the local population in the construction of renewable energy sources and other low-carbon development projects. The strategy promotes funding schemes such as 'civil energy from renewable sources', referring to the decentralized production of renewable energy sources owned or operated by citizens or energy entities.

There is great potential for the use of solar collectors for the preparation of hot water in the household and service sector, primarily in the coastal part of the Republic of Croatia. By 2030 the target value was set at 0.35 m^2 per capita and in 2050 at 0.50 m^2 per capita. By 2050, solar collectors will meet up to 40% of the domestic hot water demand. In coastal Croatia, the focus will be on heat pumps and solar thermal systems, and in the continental Republic of Croatia on DH and the use of biomass, but in modern forms (pellets, briquettes, wood chips).

2.4. Describe current status and future targets of renewable energy sources in final energy supply on local community or regional level (describe any action plans in this respect or local development plans etc.)

Figure 11 shows the status of installed renewable energy sources in the subsidy system in the Republic of Croatia.

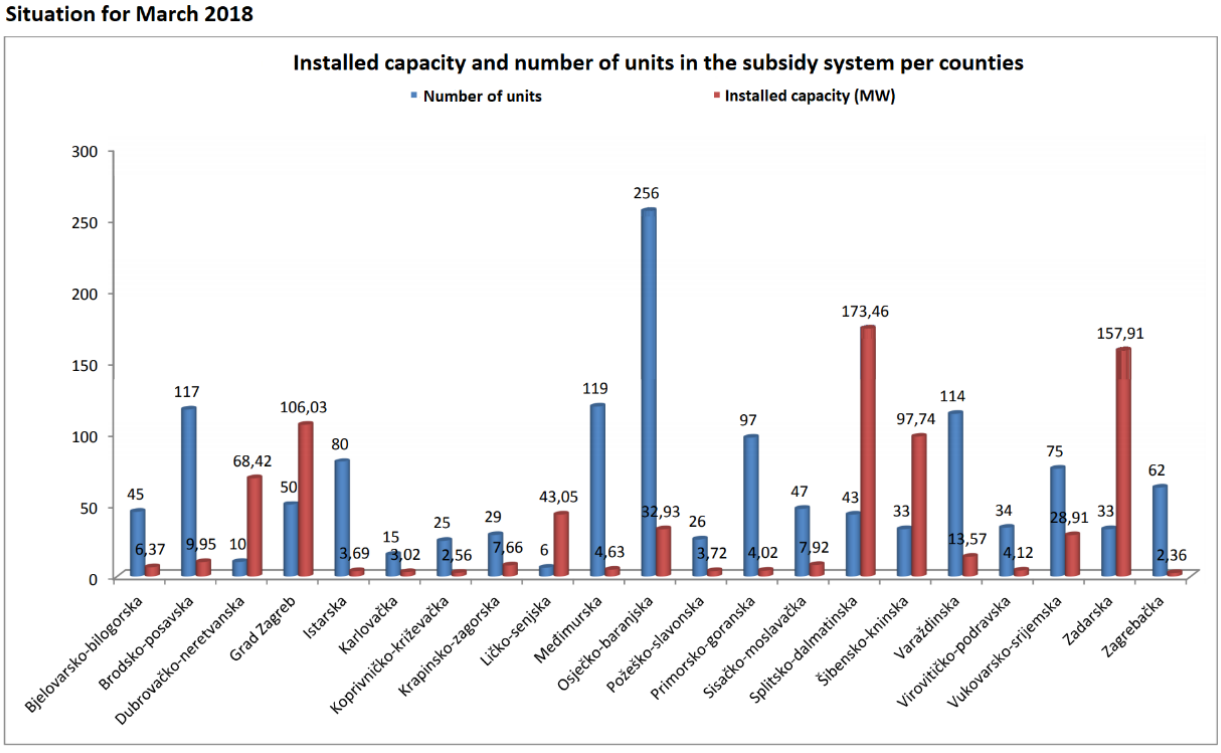


Figure 11: Installed renewable energy sources in the subsidy system in the Republic of Croatia

All counties in the Republic of Croatia support the implementation of renewable energy sources and have their development strategies set accordingly. All counties want to develop sustainable infrastructure and raise the awareness of the inhabitants of the importance of increasing the energy efficiency and use of renewables. The goal of all counties is to reduce CO_2 emissions and to become

CO_2 neutral with time. Some counties that stand out a plan to use district heating and cooling in urban areas and use heat pumps for rural areas. Development strategies of the counties don't have quantified the final number of renewables needed to be installed by a certain period.

2.5. Barriers on national level (provide information about technological, non-technological barriers such as legal, social, economic, environmental etc.)

Barriers toward implementing renewable energy sources in Croatia are lack of public awareness, both about technology and about subsidies. Although the cost of renewable technologies fell, due to the low costs of fossil fuels and electricity, in Croatia they are still not competitive with traditional technologies. Furthermore, even though Croatia has existing subsidies for renewable energy sources, not enough work has been done to promote them.

2.6. Analyse and present barriers regarding the implementation of seawater heat pumps on specific study case locations either project related or not. Take into consideration and analyse potential impacts on: e.g. landscape, ecology, natural or cultural heritage etc.

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 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.

2.7. More detailed description regarding required licences on specific study case locations, either project related or not.

Describe the process of obtaining any kind of related licences or permits: e.g. abstraction licences, discharge permits (of used water), drilling permits, building permits if necessary etc.

- *Concession for special use of the marine domain*

Concession approval needs to be asked from the authorities. The request must clearly state the natural or legal person asking for concession, the initial state of the marine domain needs to be described, as well as the planned measures. Moreover, the significance of the action, as well as the authority asked for the decision making and period of the concession must be stated.

The applicant for the concession decision making is required by the terms of Article 19. of the Maritime domain and seaport act (Official Gazette 158/03, 141/06). The Act regulates the legal status of the maritime domain, determines its boundaries as well as the management and protection of the maritime domain and its usage.

Maritime domain is used in accordance with this Act. The use of the maritime domain can be general and special. The general use of the maritime domain implies that everyone has the right to use the maritime domain according to its nature and purpose.

Article 19 says that the special use of the maritime domain is:

1. construction of buildings for religious purposes on maritime domain, carrying out activities in the field of culture, social welfare, education and science, informing, sport, health, humanitarian and other activities not performed to gaining profit,

2. building (on the maritime domain) buildings and other infrastructure facilities (roads, railways, water supply, sewage, power grid, a telephone network, etc.) for the needs of defence, internal affairs, regulation of rivers and other similar infrastructure facilities.

The decision on concession for special use for facilities of state importance is made by the Government of the Republic of Croatia and the decision on concession for special use for facilities of county importance is made by the county government, and for the facilities of local importance, the decision is made by the municipal or city council.

2.8. Describe most relevant national subsidy schemes and programmes for supporting the use of renewable energy technologies with a focus on sea water heat pumps or heat pumps in general (include responsible organizations, managing authorities etc.).

In Croatia, the use of renewable energy source has been stimulated in many ways for years. For example, 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.

During the year 2015, as well as 2018, in the Republic of Croatia subsidies for energy renovation of family houses were available in the amount of 60 to 80 %. Subsidies were withdrawn from European funds and can be used for the installation of a system for the use of renewable energy sources (solar panels and solar collectors, biomass boilers, heat pumps)

2.9. Describe how renewable energy sources and technologies are supported on local (regional) level. Describe the support mechanisms, current available support and subsidy schemes and planed future activities.

Development strategies of Croatian counties deal with promotion of renewable energy sources. The strategies are comprehensive and include informing and educating the public of rational energy use and renewable energy sources, subsidies for the refurbishment of households (for higher energy efficiency and installation of renewable energy sources), and activities regarding renewable energy sources on the county level. When subsidy schemes are available, educational workshops are organized for potential subsidy users on a regional level.

During 2018 citizens can apply for subsidies for the refurbishment of family homes in which also includes implementation of heat pumps. Also, subsidies are available for using renewable energy sources in the tourism and public sector.

3. Source of data

(1) Official Gazette, https://narodne-novine.nn.hr/
(2) Energy in Croatia 2016, http://www.eihp.hr/wp-content/uploads/2018/03/EUH2016.pdf

(3) The energy development strategy of the Republic of Croatia (Official Gazette 130/09), https://narodne-novine.nn.hr/clanci/sluzbeni/2009_10_130_3192.html
(4) Draft of the Strategy of Low-Carbon Development of the Republic of Croatia for the period by 2030 and with vision of 2050: http://www.mzoip.hr/doc/bijela_knjiga.pdf
(5) Renewable energy systems in subsidy scheme per counties and Yearly wrap up of subsidy system renewable energy sources, http://www.hrote.hr/izvjestaji
(6) Information on the preparation status of the Call for Energy Refurbishment of Family Houses, http://www.mgipu.hr/default.aspx?id=48803

Country/Region: **Albania**

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2. Renewable energy state of the art

Information about National and Regional level

2.1. Present national legislation on renewable energy (include heat/cold and electricity)

Power Sector Law No. 43/2015, establishes the main principles for the development of the power sector, including RES power plants and transmission and distribution networks. The law transposes the EU Electricity Directive 2009/72 and repeals the old law on electricity sector (Law no.9072, date 22.05.2003). This law also contains the requirements and criteria for granting a license to carry out an activity in power sector. The law contains also a number of specific provisions governing the construction of a direct line or a commercial interconnector.

The Law No. 7/2017 on the Incentives for the Use of the Renewable Energy Resources, this law promote the development of the renewable electricity market and its regional integration; Increase the diversification of the energy resources and the security of energy supply in the Republic of Albania; Promote the development of rural and isolated areas by improving their supply with energy.

The Law No. 68/2012 on Information of the Consumption of Energy and Other Resources by Energy-Related Products prepared according the Directive 2010/30/EU on energy labelling.

DCM no. 822, dated 7.10.2015 "On approval of the regulation for procedures of granting permits/authorizations for the construction of new power generation plants/facilities not subject to concession"

Albania has not specific law focus on sea water 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 and 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.

However, law does not establish any deadline or specific procedure how this information or guidance will be provided. Therefore, a specific regulation is necessary to be developed for this purpose, in the near future, and being adopted as a Ministerial order by Minister responsible for energy.

2.2. Describe current share of renewable energy sources (RES) in the final energy supply in your country

Current share of RES in Albania is 34 % and Target for 2020 is 38 %. RES target in Albania is not stable due to 80% of RES are from Hydro energy.

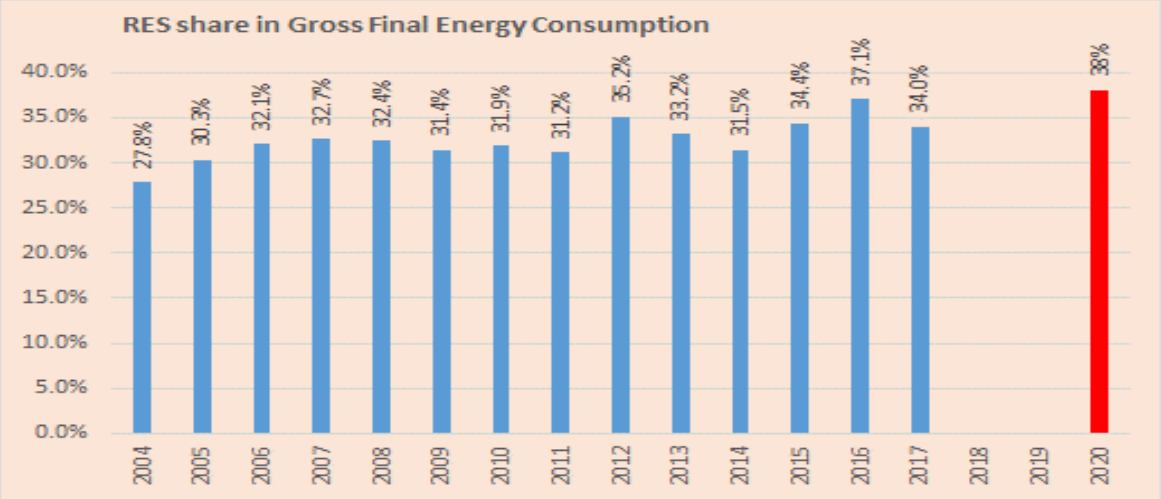

Figure 12: RES share in Gross Final Energy Consumption

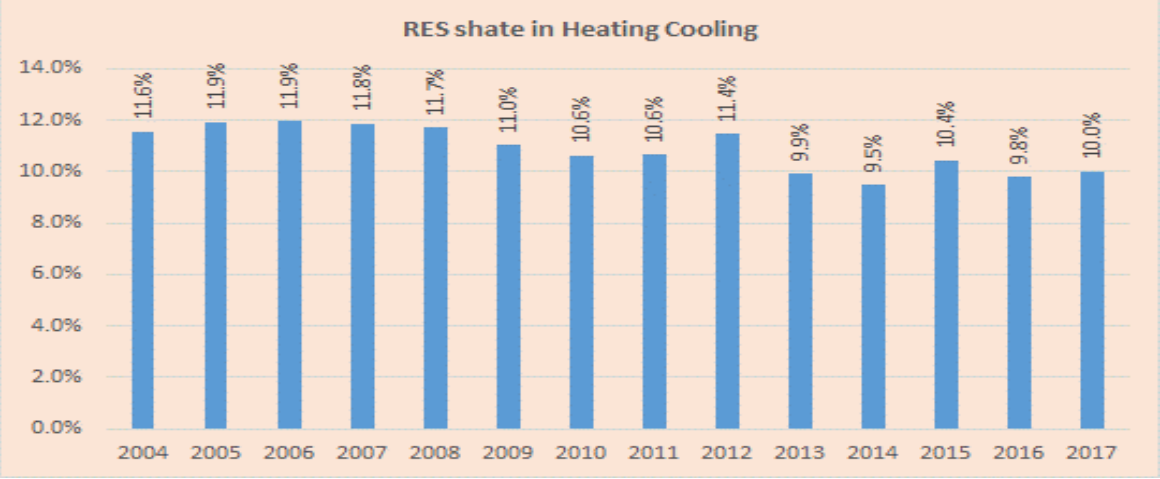

Figure 13: RES Share in Heating and Cooling

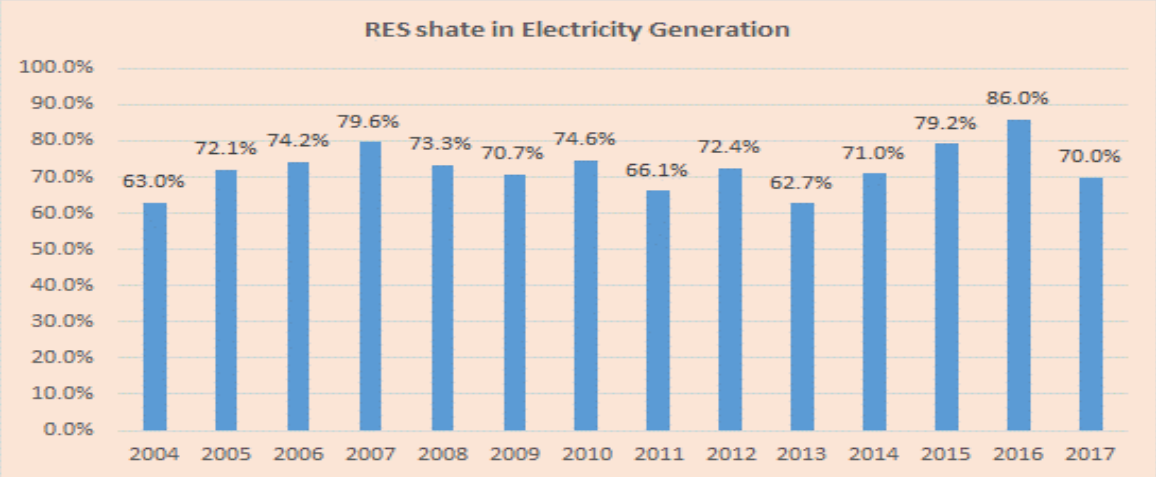

Figure 14: RES share in Electricity Generation

2.3. Describe the national perspectives and goals of the use of renewable technologies until the year 2020 or 2030

The objective of the RES Law is to facilitate the harnessing of Albania's significant renewable energy resources, in particular in the area of hydroelectric plants, biomass and biofuel resources. Through the Energy Community, Albania has set a binding target of 38% of its gross final energy consumption to be fulfilled from renewable energy by 2030, which is an ambitious target compared to 33.1% in 2017, mostly due to the increase of final energy consumption. Specifically, the RES Law will introduce a renewable energy support scheme for electricity based on Contracts for Difference ("CfDs"), which takes into account the creation of a competitive day-ahead electricity market. The details of the CfD-based support scheme will need to be closely coordinated with the Market Rules. An effective CfD mechanism will require a robust reference price that RES generators can access through a liquid wholesale market.

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 FiTs 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:

- Government will ensure that the levels of renewable power 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 and the Government could invite bids for a particular site and seek to obtain the cheapest price or the Government could offer particular tariffs and invite investors to propose sites.
- The development of a regional market is likely to lead to greater variation in prices over the day, and the benefits of fitting small scale hydro projects with reservoirs to help balance intermittent solar and wind power will increase significantly and the tariff policy should recognize this.

	SOLAR PHOTOVOLTAIC (PV)	SMALL HYDRO POWER PLANTS (SHPPs)	WIND POWER PLANTS (SHPPs)
1	An installed capacity **target should be established for each RES generation type** foreseen to be needed to be reached the 2020 targets of the RES Action Plan and for 2030 projections according to the RES scenario under this Strategy.		
2	The **FiT methodology should take into consideration the size/capacity of the RES plant**		
3	**FiT for Solar PV proposed for Albania should not be lower than all countries** and especially lower compare with border countries.	**FiT for SHPPs defined for Albania should not be lower than all countries** and especially lower compare with border countries.	**FiT for WPPs defined for Albania should not be lower than all countries** and especially lower compare with border countries.
4	**Average Annual Solar Radiation** measured for the site is a very important parameter to be used for definition of strike price (FiT)	**Average Annual Water Flow** at the Intake for the respective river is a very important parameter to be used for definition of strike price (FiT)	**Average Annual Wind Speed** for the respective site is a very important parameter to be used for definition of strike price (FiT)
5	**Average Investment Costs** based on the international benchmarks is 1500-1750 Euro/kWpeak for medium size capacity	**Average Investment Costs** based on the international benchmarks is 1000-1550 Euro/kW for medium size capacity	**Average Investment Costs** based on the international benchmarks is 1250-1650 Euro/kW for medium size capacity
6	**Operation and Maintenance** in the case of Solar PV systems are 1.2-1.5% of total first investment based on the international benchmarks	**Operation and Maintenance** in the case of SHPPs systems are 1.7-2% of total first investment based on the international benchmarks	**Operation and Maintenance** in the case of WPPs systems are 1.5-1.7% of total first investment based on the international benchmarks
7	**Electricity Generation** of Solar PV system is depended from the efficiency of unit, the solar radiation and average annual number of sunshine hours.	**Electricity Generation** of SHPPs system is depended from the efficiency of unit, the water flow duration curve and average yearly load factor.	**Electricity Generation** of WPPs system is depended from the efficiency of unit, the average wind speed, wind regime and average yearly load factor.
8	**Weighted Average Capital Cost (WACC)** consider in the calculation of FiT for RES WACC should be at least 15-16%. This value is considered the minimum for all RES scheme in general. PV power plants in particular will be financed from developer equity (banks in Albania are requiring 40-50% of total investment) and banks loans) the remaining 50-60% of total investment) based on the Project Financing Concept. So, in order to convince the Financial Institutions during the initial years of the FiT, the allowed WACC needs to be higher than 15-16%.		
9	**Duration of the incentive:** According to Concession Law related to the support scheme, the applicable promotion scheme consists of the Public Supplier (OSHEE) entering into a fifteen (15)		

	year power purchase agreement with all RES Plants admitted to the support scheme, pursuant to which OSHEE purchases electricity at feed-in tariffs. **Energy Regulatory Entity (ERE)** has decided this period to 15 years and this is good sign to investors.		
10	**Indexation of FiT:** FiTs are annually adjusted according to inflation for new power plants. Once the FiT was awarded to a specific facility, the FiT is no longer indexed. ERE has decided to index the yearly FiT with inflation index HICP according to the NACE Rev2 and published from EUROSTAT		
11	**Allocation of network investment costs**: The Albania grid code currently allows the cost of deep network connections to be charged to the developer, which increases the project costs especially for Solar PV plants and has a negative impact on the investor returns. The RES law will change this situation and states that developers should pay only of the direct costs of connection to the electricity transmission or distribution networks. ERE should improve the transmission and distribution codes in order to include practical rules for the implementation of this measure.	**Allocation of network investment costs**: The Albania grid code currently allows the cost of deep network connections to be charged to the developer. This approach increases the costs especially for SHPPs less than 2 MW and has a negative impact on the investor returns and interest.	**Allocation of network investment costs**: The Albania grid code currently allows the cost of deep network connections to be charged to the developer. This approach increases the costs for WPP developers and has a negative impact on the investor returns and interest.
12	**Licensing procedures**: Licensing procedures are almost the same for medium RES (>2MW) and very small one like Solar PV, SHPPs, WPPs (20-2000 kW) systems. This will require a lot of preparatory work (and respective investment will be increased) and FiT should be impacted. In order to reduce the investments required in preparatory phase the licensing procedures need to be simplified especially for small Solar PV, SHPPs and WPPs less than 2000 kW.		

2.4. Describe current status and future targets of renewable energy sources in final energy supply on local community or regional level (describe any action plans in this respect or local development plans etc.)

Albania's economy is in transition towards becoming an open-market economy. Since 1997 the Albanian economy has enjoyed a steady growth. Particularly during the past decade it averaged an annual growth rate of 5.6%, while substantial reduction in poverty was achieved. After the global financial crisis of 2008, the GDP growth was halved, but it managed to maintain positive growth rates. The general slowdown in economic activity also affected poverty and unemployment. According to World Bank data, poverty in Albania was reduced by half (to about 12.4%).

Nowadays, the Albanian economy is predominantly based on the service sector. Agriculture has also been one of the most important economic sectors in Albania. Nonetheless, during the last decade the Albanian economy has shifted towards industry and service due to the increased urbanization and emigration. Consequently, the service sector is today the largest sector and comprises around 60% of GDP, followed by agriculture, manufacturing and industry.

Albania's primary energy supply is dominated by oil, hydropower and biomass. The country's energy sector relies heavily on energy imports, particularly oil by products and electricity imports. Historically, electricity needs have been met almost exclusively by hydropower plants. Albania's total installed power capacity amounts to 1.8 GW, dominated by hydropower. Water resources are Albania's most important natural resources and total hydropower potential is estimated at 4,500 MW. Today, the country has exploited only 35% of its hydropower potential. Hydropower plants located and connected in a cascade on the Drini river represent around 90% of the total electricity generation.

As hydrological conditions differ from year to year, the country is forced to rely on electricity imports to a large extent. The rising electricity demand has also increased Albania's reliance on electricity imports. In particular, during the first decade (2001-2017), final electricity demand grew at an average yearly rate of 4.8%. On the other hand, the electricity generating capacity, rose at a yearly rate of 0.6%. The country has been transformed from an exporter to an importer of electricity. Hence, the expansion of the generating capacity is one of the top priorities of the Albanian energy policy sector. The future expansion of hydropower capacity is planned mainly along the Mati, Vjosa, Devolli and Bistrica rivers. In addition, the Albanian government is focusing on the diversification of its energy supply and the promotion of other renewable energy sources, such as biomass, solar and wind energy.

Albania has substantial RES potential. Its solar energy potential has been estimated at 1,500-1,700 kWh/m^2 per year. The country has also untapped wind energy potential, particularly along the Adriatic coast. According to the Albanian Investment Development Agency, a number of high wind energy potential areas have been identified, with an average annual wind speed of 6-8 m/s and energy density of 250-600 W/m^2. Albania has also substantial biomass potential from agricultural residues, estimated at 2,300 GWh/year. Renewable heating, currently provided by inefficient use of firewood, is promoted, mainly by the introduction of solar water heating systems, industrial biomass and agriculture biomasses. As far as the electricity production system is concerned, apart from hydropower that is the main RES technology expected to significantly expand through 2030, the other RES technologies such as wind, biomass or solar are expected to play a limited role although there is significant potential.

The development of final energy consumption by fuel reveals the dominance of oil by products. From 1990 to 2013 a sharp decrease in the contribution of solid fuels, i.e. coal, and natural gas can be observed. Coal was used to cover a large part of the country's total final consumption, but its share shrunk in the early 1990s. Heat consumption was also almost diminished from the final energy consumption after 1990. Biomass – basically fire wood – has played an important role throughout the years, being the main energy source used for space heating and cooking, mostly in rural households.

Industry collapsed after 1990, and as a result, the sector's energy consumption has been reduced up to 2001 and after that year is increased slightly, while the transport sector gradually expanded. The residential sector has also been an important energy consumer throughout the examined

period. In 2013 the transport sector was the biggest energy consumer, accounting for 40% of the total final consumption, followed by the residential sector (27%), industry (17%), the service sector (9%) and finally agriculture (5%).

Albania as one of the Contracting Parties of the Energy Community Treaty is obliged to transpose and comply with the EU Directive 2009/28/EC "On the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC". Albania has adopted National Renewable Energy Plan (NREAP), which would set national objectives of renewables in the final total energy consumption of the country.

On the other hand, the Albanian Government has considered the promotion of renewable energy use as an important energy policy tool for increasing the security of energy supply, economic development, energy sector sustainability and environmental protection.

Although, in Albania over 95% of electricity and 20-23% of total primary sources are provided by hydro, the energy policy objectives of the Albanian Government are to increase furthermore the use of RES. This would have also a positive impact on reducing the foreign trade deficit and increase the self-reliance of Albania with the electricity.

Worldwide, in the last decade, most of the debate concerning the promotion of renewable sources was focused on the financial support schemes and on improving grid access conditions for renewable electricity. No doubt, these are essential issues which will continue to be in the center of policy makers' attention now and in the future.

Albania could be considered a special case because its electricity generation is realized in large majority using hydro big and medium sized power plants. Also, about 10-13% of the Total Primary Energy Sources (TPES) of the country – including imports – are provided by biomass, especially fire wood.

On the other hand, Albania has considerable imports of energy which vary – depending on yearly conditions - between 30 and 60% of TPES. Renewable energy can be a solution for reducing this strategic dependence on imports and improve not only security of energy supply but also country's economic and political macro security by decreasing country's budget deficit.

Based on these facts which provide the context for possible RES role in Albanian current energy and economic situation, and based on the principals of energy security and economic value added to local economy, the following RES policy objectives are adopted:

I. Reduction of electricity imports;
II. Diversification of primary energy sources for electricity supply;
III. Reduction of transmission and distribution losses by promotion of distributed generation;
IV. Creation of local business and employment opportunities by installing and producing parts/components/systems of RES plants by Albanian industrial sector;
V. Utilisation of local energy sources especially in remote areas bringing jobs and improving life standard;
VI. Increasing share of biofuels and other fuels from renewable energy sources contribution to 10% of total fuel consumption at transport sector by 2030.

Increasing utilization of the RES technologies is a vital step towards a more sustainable society in general and with strong benefits for Albanian industry in particular. The argument of local economic added value should be used in the process of decision-making for new RES facilities incentive schemes. Supporting RES installations can offer valuable opportunity for development of local relatively poor areas.

The new RES Law specifies that a support schemes system will be introduced that takes into account the type of technology and efficiency of generating equipment. The new RES Law also provides the incentives such as:

- Establishment of a national RES target in the total energy final consumption;
- Obligatory connection to the transmission or distribution networks;
- Payment only of the direct costs of connection to the electricity transmission or distribution networks;
- Long-term (15 years) power purchase agreements for the electricity produced from Priority RES power plants up to 15 MW installed capacity will remain the same. However, the support scheme will be based on a contract for differences. ERE will prepare the respective secondary legislation for their implementation.
- Obligatory off-take of the electricity produced from Priority RES power plants.

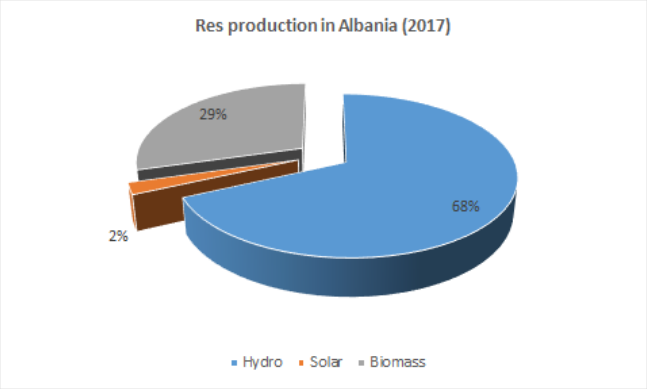

Figure 15: RES in Albania

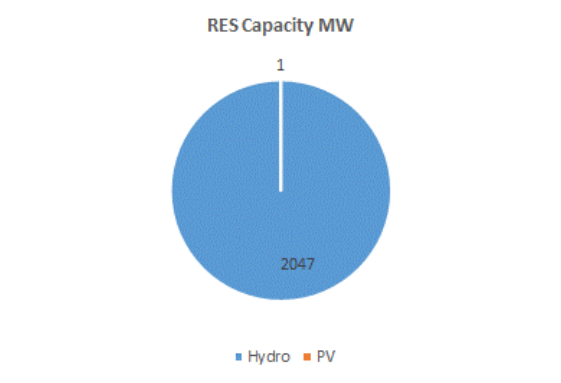

Figure 16: RES Capacity in MW

2.5. Barriers on national level (provide information about technological, non-technological barriers such as legal, social, economic, environmental etc.)

The identified barriers to renewable projects in Albania are classified in four groups:
Market, technical and regulatory barriers;

- Regulatory instability and discontinuity,
- Lack of implementing legislation and operational instructions, tools, standards and procedures,
- Lack of a competitive, integrated energy market
- Incomplete adaptation of regulatory framework for ancillary services, electricity balancing rules and balancing responsibilities,

- Lack of transparency in cross border capacities and statistical information,
- Technical barriers inability of the power system to integrate new variable RES,
- generation plants due to insufficient reserve capability leading to operational problems.
- Obsolete and insufficient infrastructure for transmission and distribution of energy,
- (grid losses, lack of adequate grid connection, and lack of real-time metering for renewable electricity generation), hinders the environmental and economic efficiency of renewable power projects even when the business case for them is attractive.

Economic and financial barriers;

Following several decades of lacking investment, in Albania the aging generation and network infrastructure is posing a challenge to renewable energy integration. A massive investment is required to refurbish the old and inefficient power grid infrastructure and enlarge the electricity transmission and distribution networks to be able to absorb variable energy from renewable power plants. Without this investment, a lot of renewable power goals and projects are very unlikely to be realized.

Common economic and financial barriers to renewable are:

- State-regulated electricity tariffs
- Banks' lack of experience with renewable power projects, as well as lack of transparency and predictability of RES support schemes
- The small size of many renewable energy projects
- Insufficient public funds
- Limited and uncertain FIT funding.
- Lack of fiscal and tax incentives, as well as lack of innovative financial instruments, other than grants.

Administrative barriers;

- Excessive bureaucratic obstacles, non-transparent administrative procedures, with lengthy, complex and cumbersome authorization procedures for new RES projects.
- Complexity of legislation on permitting procedures,
- Inefficient or limited use of public tendering processes
- Very long and expensive procedures to obtain rights-of-way:
- Restrictive quotas for particular RES technologies:

Lack of awareness, capacity and professional skills.

- Skepticism among senior policy makers
- Lack of commercial bank experience
- Lack of professional training and education
- Insufficient professional expertise among local authorities
- Lack of awareness by consumers

2.6. Analyse and present barriers regarding the implementation of seawater heat pumps on specific study case locations either project related or not. Take into consideration and analyse potential impacts on: e.g. landscape, ecology, natural or cultural heritage etc.

The main barriers discussed in these examples included a lack of familiarity with seawater heating systems and an inability of many end-users to think ahead. Seawater itself is as a barrier, due to its corrosive nature the infrastructure requires special (and often expensive) materials. The development of seawater heating system infrastructure might create problems, as it requires technical interference that might be objected by environmental and planning organisations. The execution of the system also requires highly skilled labour.
As with any new technology, a seawater heating system is risky and requires high levels of investment and support. This again can be changed by using various financial incentives and economic drivers.
Negative publicity about climate change also does not help the maturity of new innovative technologies and reduces social acceptance and political will which are so important when it comes to innovation.

Financial barriers are the main reason for the low penetration of the GSHP systems. Specifically, high investment cost compared to conventional heating/cooling and DHW technologies is the most significant obstacle for GSHP adoption by consumers. The recent years' financial recession creates a further difficulty of fund raising by consumers, thus adding to the problem of high initial installation cost; besides, the specific barrier has been pointed out as one of the main factors of the GSHPs market stagnation during the last years.

2.7. More detailed description regarding required licences on specific study case locations, either project related or not.

Describe the process of obtaining any kind of related licences or permits: e.g. abstraction licences, discharge permits (of used water), drilling permits, building permits if necessary etc.

Albania Case:

1. Permit from Local authority (used water, drilling and building)
2. Permit from Albania ministry responsibility for Energy
3. Permit from Ministry of Environment
4. Permit of Ministry of Culture

2.8. Describe most relevant national subsidy schemes and programmes for supporting the use of renewable energy technologies with a focus on sea water heat pumps or heat pumps in general (include responsible organizations, managing authorities etc.).

The financial support to RES power producers is provided through two schemes:

- Feed-in tariffs for small power producers
- Tax exemption

Feed-in tariff is applied for small HPPs with capacity up to 15 MW since 2007. After the approval of the law on renewables, the Council of Ministers adopted a new decree (decision no.125, dated 11.02.2015) which establish a new methodology for calculation of feed-in tariff. Based on this methodology the formula for calculation of feed-in tariff for small HPPs is the following:

Feed-in tariff (lek/kWh) will be the average price of Hungarian Power Exchange (HUPX) for previous year x coefficient 1.24 x average exchange rate Euro/Lek for last year.

Based on this formula, the ERE approved a new feed-in tariff for 2015.

Tax exemptions are provided for by the law no. 8987, date 24.12.2002 "On creation of facilities for construction of new power capacity" and the related Council of Ministers' decree no.839, date 5.12.2007 "On establishing of conditions and procedures for reimbursement of excise tax and creation of facilities for construction of new power capacity" as amended. The law stipulated the exemption of machineries and equipment used for construction of new power capacities using renewable energy from the custom duties and exemption from the excise tax for the fuel used by such power producers. It does worthwhile to underline that the above tax exemptions are applied for all RES power producers despite their installed capacity and for other power producers with installed capacity higher than 5 MW.

The **Energy Regulatory Entity (ERE)** is responsible for monitoring of the implementation of the feed-in tariff scheme, and it reports regularly every year to the Parliament on the developments of the power sector in general, including the RES power generation. While it appears that the private investors investing in construction of new SHPPs are somehow happy with the feed-in tariff approved by the ERE, they feel not very comfortable with the variation of the feed-in tariff according to the variation of the market prices.

Development and adoption of a feed-in tariff methodology providing a much more stable purchasing price during a certain period, could be one alternative that would be more preferable for RES power producers.

The RES Law specifies that a feed-in tariff system will be introduced that takes into account the type of technology and efficiency of generating equipment. The RES Law also provides other incentives such as:

- Establishment of a national RES target in the total energy final consumption;
- Obligatory connection to the transmission or distribution networks;
- Payment only of the direct costs of connection to the electricity transmission or distribution networks;
- Long-term (15 years) power purchase agreements for the electricity produced from qualifying res power plants up to 15 MW installed capacity will remain the same. However, the fit mechanism will change and it will be based on a contract for differences. Ere will prepare the respective secondary legislation for their implementation.
- Obligatory off-take of the electricity produced from qualifying RES power plants

In addition, all RES plants with installed capacity higher than 2 MW will now have balancing responsibilities. As a result of these measures, interest in RES power plants has grown considerably and new plants have started to be constructed – initially small hydropower and biomass power plants, which are the best-known and available technologies. In addition, several investors have started to request authorizations for wind turbines as well as solar photovoltaic power plants.

A key component of the RES law is a new tariff methodology which is the result of a study ERE had undertaken to define the most appropriate methodology. Because the private sector has been identified as the key player in the development of the RE sector, the focus of the methodology was

to consider the rate of return on the project from the viewpoint of the private investor. Hence the study came to the conclusion that the result of a long run marginal unit cost (LRMC) analysis should be the basis on which the feed in tariff for each type of qualifying RES power plant must be based. The study concluded that:

- The EU targets for renewable energy share can only be met by a significant share of new SHPPs, which requires mobilization of the private sector.
- The level of investment needed will requires considerable involvement from private investors who are looking for an attractive rate of return on their investment.
- Given the current market conditions: 7-10 years loan maturity, 2 years grace, a rate of return on equity 15-16% should make an investment attractive to this sector

2.9. Describe how renewable energy sources and technologies are supported on local (regional) level. Describe the support mechanisms, current available support and subsidy schemes and planed future activities.

The Support schemes are for small hydropower plants with a capacity of up to 15 MW and solar PV up to 2 MW and wind up to 3 MW through feed-in tariffs. The custom is free for all equipment which use RES technology in Albania.

3. Source of data

National Action Plan of RES in Albania approved 2017.