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ENTRAIN

DELIVERABLE D.T1.2.2

Summary report on the initial surveys in the target areas

30/09/2019

D.T1.2.2 Summary reports on the initial surveys in the target areas

A.T1.2 Initial survey in the target areas

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
CCHP	Combined Cooling, Heat and Power
CHP	Combined Heat and Power
DH	District heating
DHS	District heating system
EPEEF	Environmental Protection and Energy Efficiency Fund
OG	Official Gazette (hr. Narodne novine)
RES	Renewable energy sources
RSAG	Regional Advisory Stakeholder Group

1. Introduction

1.1. The ENTRAIN project

One of the initial activities of the ENTRAIN project is to develop and conduct a survey in the target areas in ENTRAIN project aims at improving the capacities of public authorities to develop and implement local strategies and action plans for enhancing the use of endogenous renewable energy sources (hereinafter: RES) in small district heating (hereinafter: DH) networks.

DH is considered as the main option for efficient renewable heat supply for both urban and rural areas and thus as infrastructure enabling the transition to higher RES share in energy generation and consumption. A further expansion of these networks is part of recent national and regional Climate and Energy Strategies, setting a focus on the extended use of biomass and enhanced integration of solar thermal and waste heat to improve air quality and foster more efficient use of biomass.

The outcome of the ENTRAIN project will lead to fossil fuels and CO_2 emission reduction, improvement of local air quality and socio-economic benefits for local communities through the growths of technical expertise and the start-up of investments and innovative financial tools. ENTRAIN's main objective is to promote structural cooperation between public authorities and key stakeholders at transnational level and to build-up skills and know-how for a systematic, holistic and efficient planning of small DH systems within five target regions (Austria, Croatia, Germany, Italy and Slovenia), based on renewable heat sources (solar, biomass, waste heat, heat pumps and geothermal).

As a part of the project, five Regional Stakeholders Advisory Groups (hereinafter: RSAG) involving 11 partners, 24 associated partners, and local actors will be set up and will be responsible for conducting five initial surveys and five local action plans. Acting as regional and transnational energy networks, they will be crucial for the implementation and achievement of ENTRAIN objectives, by involving local and regional authorities, DH utilities, energy and development agencies, and consumers. Heat planning guidelines and quality criteria will be made available, based on knowledge transfer from regions with advanced planning capacities and long term experience in renewable DH (Austria, Germany), also through an ambitious capacity building program with 25 training session. ENTRAIN will trigger the initiation of nine pilot local DH networks and nine heat planning studies, along with the development of three innovative local and regional financing schemes and the adaptation and adoption of the existing Austrian quality management system “QM Holzheizwerke” in at least three of the target regions.

ENTRAIN focuses on addressing challenges, which are common for the countries and regions participating in ENTRAIN, such as lack of energy planning skills and experiences of municipal and regional authorities, growing local air quality issues, land occupation of RES plants, need for increasing the use of waste heat to improve energy efficiency, as well as users’ acceptance of new energy plants. Therefore, transnational cooperation is needed to exchange best practices and models on how to tackle these challenges in different frameworks by adapting successful experiences to the local needs and conditions.

1.2. Scope of the deliverable

One of the initial activities of the ENTRAIN project is to develop and conduct a survey in the target areas in order to determine local conditions, barriers and potential opportunities for enhancing renewable heat planning and improving the DH networks using RES.

In order to collect the information on the topics of the interest, a survey was developed by REGEA. Project partners adapted it to the local framework conditions, translated and distributed it to the citizens and relevant stakeholders in the target areas in Croatia, Germany, Italy, Poland and Slovenia.

With the inclusion of the relevant stakeholders in each partner country, project partners wanted to ensure public acceptance and gain support for the project implementation. Cooperation between project partners and relevant local stakeholders is expected to continue throughout the project in a form of RSAG.

In the first part of the survey, information on the current state of RES in the region, such as energy demand, existing plants, and local DHS, as well as the potential of renewable energy production, have been collected. The second part of the survey collected information on the need to include various implementing bodies and institutions in the preparation of RES projects, while in the third part of the survey, information on funding possibilities for renewable energy projects was collected. The sample of the survey is given in Annex I of this document.

In addition to conducted surveys, in a particular region, different public documents were used to analyse the current state and potential of RES in a given area, in order to obtain a complete overview of the situation.

This report consolidates findings given in the individual reports in the national language of the five target regions, which were part of the deliverable D.T1.2.1. Each chapter of the Summary report covers one of the target regions and presents concise information about the state of the RES collected in the survey.

The results provided in this report aim to serve as a basis for the further activities within the ENTRAIN project, especially for the development of the guidelines for the evaluation of RES heat potential.

2. Croatia

NORTH-WEST CROATIA

The initial survey covered three Croatian counties: Krapina-Zagorje County, Zagreb County and Karlovac County, stretching through central Croatia and surrounding Zagreb from northwest to southwest. Krapina-Zagorje County is located north of Zagreb, Karlovac County south of Zagreb, while Zagreb County is considered to be a green ring around Zagreb due to its specific geographical location, which almost completely surrounds the capital. Of the three counties considered, Zagreb County has the highest development index, while the other two counties are ranked lower and have the status of assisted areas. The total area of the counties is more than 6.800 km^2 with more than half a million inhabitants. The climate in the selected counties is continental moderate with hot summers and moderately cold winters. All the counties have several Birds Directive Sites and Habitats Directive Sites protected under the Natura 2000 ecological network. More than the third of the county areas is covered in forests, making the area suitable for biomass production. Average annual irradiation of counties ranges between 1.200 and 1.300 kWh/km^2. All three counties are considered important transit areas, as they are situated in the vicinity of the national borders with Slovenia and Bosnia and Herzegovina, but also connect continental and coastal area.

ENERGY BALANCE

Energy consumption data at the level of local and regional self-government units in Croatia is not updated regularly, as annual energy statistics are compiled nationally. Data on the energy consumption in the three selected counties are taken from the Energy Efficiency Program for the immediate energy consumption of each individual county. Data on the energy consumption for heating purposes is not available on the regional or local level and therefore up-to-date information for the heating sector could not be included in this report.

Direct energy consumption is divided into the industry, transport and general (other) consumption sectors. General consumption is further divided into the following categories: households, services, agriculture and construction, and it includes the heating sector amongst others.

In Zagreb County total direct energy consumption in 2009 was 18,7 PJ, of which general consumption accounted for almost half of the consumption, 9,3 PJ. Biomass, electric energy and natural gas were the most used energy sources in the energy consumption in households. A similar distribution of energy sources was observed in the other two selected counties. From the available data for the Karlovac County, total direct energy consumption was 6,85 PJ, of which consumption in the general consumption sector was 1,52 PJ. Direct energy consumption in Krapina-Zagorje County was 9,9 PJ, out of which a third was used for general consumption.

FRAMEWORK CONDITIONS

The Energy Strategy of the Republic of Croatia (OG 130/09) is considered a fundamental document for further development of the energy policies of the Republic of Croatia. It follows three energy goals: security of energy supply, competitiveness of the energy system and sustainable energy development. The public consultation process for the new Energy Strategy of the Republic of Croatia by 2030 with a view to 2050 has been completed and it is expected that the new Strategy will be adopted soon.

The fundamental act in the energy sector is The Energy Act (OG 120/12, 14/14, 95/15, 102/15, 68/18), which emphasizes the use of RES as a strategic national interest. It also defines the responsibilities for establishing and implementing policies for stimulating the production of renewable energy, as well as financial incentives for the use of RES.

The National Renewable Energy Action Plan adopted at the end of 2013 sets the overall national target for renewable energy according to the prescribed methodology, as well as sectoral targets and trajectories in the production of electricity, heating and cooling energy and energy in transport from RES. The heating and cooling sector is closely linked to electricity generation in electricity generating plants and cogeneration plants, and as such contributes to the overall target of up to 20% by 2020 with a share of 8.2%. One of the development measures is to stimulate the production of heat / cooling from RES.

In order to increase the use of national heat and cooling potential, as well as the need to comply with the Energy Efficiency Directive (2012/27/EU), the Government of the Republic of Croatia has adopted the Program for the Utilisation of Heating and Cooling Potential for the period 2016.-2030. This program provides an assessment of national potentials for cogeneration and energy efficiency improvement of infrastructure, forecasting changes in energy consumption for heating and cooling over ten years, along with a description of measures, savings and opportunities to develop heating and cooling thermal energy systems in Croatia. The program mainly focuses on heating systems that use waste heat as well as thermal energy generated from cogeneration plants on natural gas and biomass, while heat pumps and solar collectors are listed as an option but not discussed in detail in this program.

In January 2019, the Government of the Republic of Croatia adopted the Fourth National Energy Efficiency Action Plan for the period until the end of 2019, which relies heavily on the Program for the Utilisation of Heating and Cooling Potential for the period 2016.-2030. and its conclusions and suggestions in the area of efficient heating and cooling. In addition, the Fourth National Energy Efficiency Action Plan for the End of 2019 emphasizes the need for a detailed mapping of demand and potential sources of heat in order to qualitatively assess the potential for exploiting potential sources of waste and renewable energy.

The Renewable Energy Sources and High-Efficiency Cogeneration Act (OG 100/15, 123/16, 131/17, 111/18) focuses on planning and encouraging the production and consumption of electricity and heat produced in plants that use RES and high-efficiency cogeneration. This act also emphasizes the national target of 20 % for the use of energy from RES. Regarding the measures for the promotion of RES, those referred to in this Act include state aid and incentive systems in the form of market premiums and guaranteed purchase prices, but only for the electricity production.

The Heat Energy Market Act (OG 80/13, 14/14, 76/18) states that thermal systems are considered an essential element of energy efficiency and are of national interest, as well as the use of RES as a heat source. The law regulates measures for a secure and reliable supply of heat energy, conditions for obtaining a concession for the distribution of heat energy, i.e. concessions for the construction of a distribution network, rules for safe and reliable production, distribution and the supply of heat energy in thermal systems, as well as measures to achieve energy efficiency in thermal systems. Amendments to the law have extended the status of eligible producer to include energy entities using a cogeneration energy facility and using waste, biodegradable waste components or RES to produce heat in an economically appropriate manner. Heat energy production in boilers with the production capacity exceeding 2 MW requires obtaining a permit

from the Croatian Energy Regulatory Agency to perform the energy activity of heat production. According to the law, buildings used for the production of heat energy are constructed and used in accordance with the regulations of physical planning and construction, regulations governing the energy sector, regulations governing the protection of the environment and special technical and safety regulations. In the case of the heat energy production from RES and cogeneration from buildings which do not require construction permit and/or main project, and which are specified in the regulations on physical planning and construction, energy permit is not required to be issued.

In addition to the strategic documents and laws at the national level, the counties in the targeted area have prepared their development strategies and Sustainable Energy Action, which also address energy efficiency and RES application in their respective area. Based on the development strategies and action plans, it is evident that the counties in the target area are continuously thinking and working on activities to increase energy efficiency in all segments of society and to encourage local community to use RES for their own energy production.

The main financing instruments for the construction and development of renewable DH systems are the funds available from the Environmental Protection and Energy Efficiency Fund (hereinafter: EPEEF) and from the European Structural and Investment Funds granted as part of the Operational Program Competitiveness and Cohesion 2014.-2020. (hereinafter referred to as OPKK). In 2019 EPEEF has published a series of public calls for co-financing energy efficiency and RES development projects in the households. By applying to these calls, citizens have the opportunity to receive grants for eligible projects ranging between 40% and 80% of the investment. Such public calls have proven to be extremely attractive to citizens and they tend to close even before the application deadline, due to the utilization of the allocated funds. However, most of these public calls are designed for private entities and households, and the local governments cannot use it for the community projects, such as implementation of the renewable DH systems. Therefore, to unlock the potential of the local RES DH systems, it is essential to provide the means in form of regional/national grants and/or incentives for funding the communal heat plants. Positive example of successful utilization of funds the biomass heating plant in Pokupsko Municipality in Croatia, which was fully funded through the pre-accession IPARD program for rural development. The 1 MW power plant is intended for heating all public buildings and households in the municipal centre, and currently 30 consumers are connected to it. With the construction of this power plant, more than 75% of Pokupsko energy needs are met by local energy sources. However, the main challenge during the plant construction was to acquire the grant funding to finance the construction of a biomass DH plant, and the overall process of obtaining the grant and meeting all the requirements and steps proved to be very complex and time-consuming.

Following Croatia's accession to the EU, financial incentives for the development of biomass heating plants have been significantly reduced, which has led to decrease in further investments in biomass heating plants. Local and regional self-government units in the areas with potential for the installation of RES heating plants are interested in the development of such projects. However, due to the budget constraints, they are not able to finance the construction of a RES heating plant without additional financial incentives. Example of such case are the municipalities of Lekenik and Perušić, where the project documentation for biomass heating plants was prepared as part of the BioVill project, financed by EU funds Horizon 2020, but due to the lack of funds, the plants were not realized. In addition to financial reasons, investments in DH and DH systems typically have lengthy and complex administrative procedures, which can be discouraging for investors.

STAKEHOLDERS

Involved parties and stakeholders in the process of DH system initialisation are similar in all selected counties, consisting of local community, local media, local government, potential plant operators, regional/national government and forest owners/biomass suppliers, if the biomass is used. Besides locally involved stakeholders, it is necessary to include external stakeholders, especially if the project is being implemented by the local government. In most cases the local government does not have the required expertise in managing such projects from start to finish and therefore involving skilled experts for some of the activities is expected. Besides skilled experts, local governments would require external funding as currently there is no available funding in form of grants, which would make the investment budget friendly.

In Croatia, for this kind of investments, potential drivers are private investors and local government/community. In the case of private investors investing in public projects, they can be stimulated by providing financial incentives and ensuring a quick return of the investment. Another option for approaching them is offering the possibility of public-private partnership. Local government can be triggered into investment by providing grant schemes or incentives and lower heating costs in the long term.

As the DH project is being installed in the local area and using local resources, it is necessary to inform the local community about the project. Timely and transparent communication is crucial, as the local community should be one of the major users of the new DH system. Without public support, it is most likely that the DH system will not be profitable, as they will be the ones buying the heat. The general attitude of the local community tends to be positive, as it is seen as a cost-efficient and sustainable way of heating. In forming the positive and accepting attitude, it is necessary to ensure transparency, but also to organise meetings and workshops with interested stakeholders and local community, where there would be an opportunity to clarify all the issues.

The main risks concerning DH project on the local level is the lack of funding for the project, as well as ensuring competent resources who will implement the project and run it later.

OPPORTUNITIES AND OBSTACLES

Further development as well as increase in the use of RES DH can be achieved through synergies between private investors and public authorities. Adopting a regulatory and legal framework that will address the difficulty of investing in such systems would allow investors a simpler and faster process initiation, resulting in reduced administrative difficulties and potentially more investment. By using incentives and grants intended to increase the share of RES in energy production, interested investors can achieve a faster return on their investment and with less risk start the investment. An additional interesting aspect to consumers is the lower cost of heating on RES, as well as an environmentally friendly way of heating.

Continuous delivery of quality wood fuels as well as high initial investments in machinery for the production of wood fuels and modern biomass boilers is one of the constraints for further development and investment in biomass DH. In addition, fragmentation and difficult accessibility of certain terrains require greater engagement of machinery and human resources, thus increasing the cost of raw materials. An obstacle to the construction of DH on solar collectors, geothermal energy and heat pumps is the low share of such systems in Croatia, leaving potential consumers unable to see the practical application and benefits of these systems and thus not wanting to risk

such investments. Continuing to encourage the installation of such systems and providing the financial means to future users will reduce the risk of investment for users, making them more willing to participate in such projects. With additional training on the RES DH system usage, it is possible to make consumers more aware of all the possibilities that such systems provide and to answer the concerns regarding the construction of such systems.

Regulated prices for thermal energy in major cities are considered to be the main competition to RES DH, as well as natural gas heating due to the expansion of the gas network in Croatia and the competitive prices.

3. Germany

With a distinctive industry and research and development sector, Baden-Württemberg is one of the most innovative and economically strongest regions in Europe. The result is a very high energy demand for this region. In 2017 the total final energy consumption in the region was approx. 291 TWh, which was covered to 14 % by renewable energy. Heat generation with 136 TWh accounts for nearly half (~ 46 %) of the total final energy consumption.

In Germany, as in Baden-Württemberg in particular, there are various requirements for an efficient and renewable energy supply.

The obligation to comply with the Energy Saving Ordinance (EnEV) and the Renewable Energy Heat Act (EEWärmeG) applies throughout Germany to the construction of new residential and non-residential buildings. The EnEV requires the minimum standard of constructional thermal insulation and the efficiency of energy supply. The EEWärmeG obliges the owner of a new building to cover a minimum share of the heat supply of the building with renewable energy. In the short term, the EnEV, the EEWärmeG and the Energy Conservation Act merged into an individual law, the Building Energy Act. However, no tightening of the individual requirements can be seen in the current drafts. Furthermore, a federal climate protection law is in work, which should regulate fixed savings targets and responsibilities for each sector. The Combined Heat and Power Act (KWKG) regulates the feed-in and the promotion of electricity from CHP plants. Since the last amendment of the law in 2016, the legislator has also introduced innovative CHP (iKWK). iKWK is tendered in addition to conventional CHP. Thereby, at least 30 % of the reference heat of the entire system must be provided by renewable energy.

At national level, there are several laws in Baden-Württemberg that regulate climate protection and energy efficiency. First of all, there is the Baden-Württemberg Climate Protection Act. This law regulates the reduction of greenhouse gases until 2050. The current advancement in 2019 contains eight key points, including the municipal heat planning. Municipal heat planning intends to create an efficient, decarbonised and sustainable heat supply in towns and cities.

The Climate Protection Act is implemented through the Integrated Energy and Climate Protection Concept (IEKK). It contains concrete strategies and measures as well as the conceptual basis of the energy and climate policy for Baden-Württemberg. Important measures within the IEKK include the supply of heat through biomass, solar heat and seasonal thermal storage with DH. Local and regional heat concepts should initiate the development of heat networks in Baden-Württemberg.

The Renewable Heat Act Baden-Württemberg (EWärmeG) has been in force since 2018. The law defines requirements for existing buildings (residential and non-residential buildings) concerning the replacement and renewal of central heating. Thus, a share of 15 % of the heat amount has to be covered by renewable energy. For both EEwärmeG Germany and the EWärmeG Baden-Württemberg, connection to a heating network can be sufficient to meet the requirements.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) founded IKENA (Integrated energy and climate protection concept) for Neckar-Alb region in 2012. The climate protection agencies of the rural districts of Reutlingen, Tuebingen and Zollernalbkreis as well as the universities of Albstadt, Reutlingen and Rottenburg helped to create the concept for IKENA. The integration of all climate-relevant areas and all relevant regional actors has achieved a broad consensus on the content and priorities for implementation.

For municipalities, the provision of overarching and comprehensive data provides the opportunity to develop their own municipal concepts and to set individual priorities. The IKENA will therefore not be a substitute for municipal projects, but rather provide assistance and incentives for municipal concepts. In the final IKENA report 2012, ten action areas were identified for the implementation of climate protection measures in the Neckar-Alb region. The focus was on energy saving, sustainable mobility, renewable energy and energy storage. From this, 65 approaches and 90 model solutions, project proposals and pilot projects were derived, which can be implemented both by the districts and their climate protection agencies, the municipalities, the industry and its associations, the energy supply companies, the population and the regional association.

In the regional plan, the energy chapter defines the political objectives of energy use. In the Neckar-Alb region, the RVNA plans to expand the renewable energy production in line with the regional settlement concept, the open space concept and the traffic concept.

The public participation procedure for the regional plan change of the Neckar-Alb region was initiated in July 2019. Promoting the expansion and use of renewable energy is a key component of the energy transition. The regional plan amendment 2019 will provide more space for the expansion of renewable energy in outdoor areas, and municipal land-use planning will have greater scope for the implementation of open-space solar systems. To this end, the regional green areas designated as a priority area, areas for nature conservation and landscape management and areas for agriculture are moderately opened for open-space solar systems. This not only applies to photovoltaic systems, but also to solar thermal systems. The generation of heat by RES is also an important component of the energy transition.

In 2005/2006, the first bioenergy village in Baden-Württemberg was built in Mauenheim. Since then, the number of bioenergy villages has increased to 96 in Baden-Württemberg. The proportion of (district) heating networks with solar heat production has also increased in recent years. In addition to the integration of solar heat into DHS, the first solar energy village was built in Büsingen in 2012. There are currently nine solar energy villages in Germany, three of them in Baden-Württemberg. Others are being planned or in the process of being realised.

Currently, the development and updating of a biomass plant register for the Neckar-Alb region is in progress. Based on a rated thermal input > 1 MW, the plants recorded and categorised with all relevant parameters. The focus here is on the Neckar-Alb region and the successive recording of smaller plants continues.

A number of obstacles often hampers the expansion of renewable energy heating networks, especially in smaller municipalities. In addition to various obstacles to the construction of the heating network itself (e.g. dependencies on operators or “bad” experiences), there are also hurdles for renewable energy systems. Thus biomass has to compete economically with fossil alternatives when investing in complex and expensive plant technology. This additional expense may compensated by comparatively lower fuel costs. This leverage can be reinforced by CO2 taxation of fossil fuels. In case of large-scale solar thermal plants, the “unknown” technology as well as the finding of the right area poses a major problem. Often a high competition for use prevails on the surfaces suitable for solar thermal systems or there are objections of the population against the “disfigurement” of nature.

However, other influencing factors such as an existing gas network or (missing) legal framework conditions also play a decisive role in the realisation of renewable heating networks.

Finally, several best-practice projects from Baden-Württemberg show how, despite all the obstacles and influencing factors, heating networks in rural areas can be successfully implemented and operated under different boundary conditions and with different approaches.

4. Italy

Friuli Venezia Giulia is an autonomous region in the north-eastern part of Italy, with energy sector being shared competence with the State, meaning that passing of new laws is subject to an agreement between the Regional Authority and the Central Government.

The Region has 1.216.853 inhabitants (2018) and includes an area stretching from the Adriatic Sea to the Alps. Only two cities have more than 100.000 inhabitants (Trieste and Udine) while there are 20 small cities ranging from 10.000 to 50.000 inhabitants where citizens and companies converge for a wide range of local services.

The climate ranges from Mediterranean along the coast (2235 dd) to Alpine in the mountain valleys (4736 dd). Rain is significantly present in proximity and over the mountain part of the region, giving an oceanic flavour to the regional climate.

The mountain part is predominantly rural, with large forests of spruce, pines and beech-trees. Moving to the hills, forests become more temperate with oaks, horn-trees and ash-trees among the others. Here, vineyards are well spread, especially along the eastern border. Flatlands are dedicated to intensive agriculture (corn, wheat, soya beans, etc.) and industry, with few large industries (steel-making, wood-panels, paper-mills, etc.) and several SMEs in the food sector, furniture sector, cooling sector, mechanic and mechatronics sectors. Along the coast, tourism and harbour activities play the main economic role with a very important activity in the naval sector, with one of the most important shipbuilding yards in Italy (Monfalcone).

Wooded surface accounts for 318.454 ha of which 191.072 are productive. The potential of timber wood production accounts for around 300.000 m3 per year of which 150.000 m3 are already used.

ENERGY BALANCE

Regional energy sources are represented only by renewable sources, both for the electrical and the thermal sector. In the following table is reported the total power production of 2017 in FVG Region.

Electricity production (2017)				
Source	**GWh**	**%**	**Notes**	**Source**
Fossil	8018	76	Imported	Terna -Regional Statistics 2017 & GSE-Statistical Report 2017
Hydro	1236	12	Regional	Terna -Regional Statistics 2017 & GSE-Statistical Report 2017
Biomass	748	7	Regional	Terna -Regional Statistics 2017 & GSE-Statistical Report 2017
Solar	562	5	Regional	Terna -Regional Statistics 2017 & GSE-Statistical Report 2017
Geo	0	0	Not present	Terna -Regional Statistics 2017 & GSE-Statistical Report 2017
Wind	0	0	Not present	Terna -Regional Statistics 2017 & GSE-Statistical Report 2017
Total	**10564**	**100**		

Table 1 The total power production of 2017 in FVG Region

In the following table is reported RES heat production of 2017 in FVG Region.

Heat production (2017)				
Source	**GWh**	**%**	**Notes**	**Source**
Solid Biomass (wood, pellet, biochar)	2618	58	Regional and imported	GSE-Statistical Report 2017
Heat pumps	1223	27	Regional	GSE-Statistical Report 2017
Organic fraction of solid waste	460	10	Regional	GSE-Statistical Report 2017
Solar	126	3	Regional	GSE-Statistical Report 2017
Geo	39	1	Regional	GSE-Statistical Report 2017
Liquid biomass	10	0	Mainly imported	GSE-Statistical Report 2017
Total	**4476**	**100**		

Table 2 The total RES heat production of 2017 in FVG Region

At national level, on average, 91% of heat production is used directly by families and private companies; the remaining 9% is derived through local DHS from power plants supplied with renewable sources of which 90% work in CHP asset while the remaining 10% are heat generation plants.

In the region there are 19 DHS except for two systems, the other main power plants work as CHP or CCHP plants. The Servel Mera plant is owned by a private company and was originally designed for power production; located in the industrial area, now is developing a DHS in order to recover part of the huge amount of available waste heat.

The DHS of Udine has been developed in the north side of the city, taking advantage from the revamping of the heat generation system of the local hospital and enlarging it to distribute further heat to important final users. The project was promoted by the local Polytechnic, which is now working on another DHS in the southern part of the same city, taking advantage from the presence of an important steel-making plant with lots of waste heat available. Moreover, another industrial symbiosis is under feasibility evaluation to recover further heat from a biogas plant (2,4 MW_{th}) that is under construction in the same part of the city by the local waste management company.

The CHP plant of Arta Terme will likely face a revamping in 2023, when the present generator will reach its end of life. This plant, supplied with woodchips, had many problems both on generation and distribution side, since the actual final energy demand is significantly lower than that one predicted in the design phase.

Besides, APE FVG has investigated the regional potential of waste heat recovery under the CE-HEAT project, financed by the Central Europe Interreg Programme. The output of this work is available online at www.atlanteenergetico.fvg.it and the project aimed to collect data to consider local, specific investments.

The total waste heat in Friuli Venezia Giulia was estimated in 5.500 GWh of primary energy in 2017.

FRAMEWORK CONDITIONS

The Italian energy strategy has been outlined in the National Plan for Energy and Climate, published on 31 December 2018 and is still under the evaluation by the European Commission. The national plan will develop into the 5 dimensions of energy:

1. transition to a low carbon economy;
2. increase of energy efficiency;
3. energy security;
4. energy union and market coupling;
5. research, innovation and competitivity.

The national strategy foresees the possibility to integrate solar energy into DHS and to couple RES and CHP plants, if high efficiency cogeneration can be ensured. The national potential for increasing the quantity of thermal energy supplied through DHS is around 4.000 GWh, equivalent to further 900 km of networks in addition to the existing 4.100 km. Of these, 700 GWh, equivalent to further 253 km of networks, could be covered in a sustainable way by biomass. In this direction, also solar energy capacity will be encouraged by means of grants and high efficiency cogeneration by means of energy efficiency certificates (so called "*white certificates*").

Localisation and promotion of DHS is up to the regional authority, by means of its regional energy plan. As well SEAPs and Energy Master Plans usually provide more detailed evaluations of opportunities to develop DHS. The present regional energy plan encourages the development of DHS supplied with biomasses through annual grants for public authorities. Every year the Regional Authority publishes a call with several measures of interventions and grants up to 75% of investment costs for designing new DHS supplied with biomass or extension of existing ones. Financial resources are allocated on yearly basis and, usually, accounts for 1 million €.

The national revolving fund for energy efficiency will provide financial resources and guarantees for the implementation of efficient DHS: 30% of its allocation will be devoted to guarantees for construction of new or for extensions of existing DHS.

Operational advantages for DHS supplied with renewables are:

- reduced VAT on heat supplied (10% instead of 22%),
- additional tax credit for customers on heat derived from DHS,
- lower cost of the energy source with respect to traditional energy vectors.

Moreover, priority "Green Europe" under the European Fund for Regional Development foresees a minimum allocation in the range of 25-30% of available financial resources for low-carbon economy measures, in the period 2021-2027. At present, operational programmes are under development by Regional Management Authorities and, usually, these programmes support local investments defined in the Regional Energy Plan.

In Friuli Venezia Giulia region, wood biomass represents a strategic asset since it is an important raw material in several regional supply chains (wood panels, furniture, wood carpentry, etc.). Around 20% of the total amount used in the Region becomes a by-product of other manufacturing activities that can be used as an energy source. Natural gas is the most competitive alternative to renewable DHS: it is competitive in price, connection to the grid is easy and cheap, comfortable to use and clean with respect to air pollution. The distribution grid has been developed from the '80s of the last century, is well spread over the region with the exception of some alpine valleys and other extremely rural areas where the cost of the infrastructure is too high compared to potential customers.

But those areas where natural gas is not available are among the most interesting for DHS supplied with renewables. Lots of them are in the mountain and in other rural parts of the region: however, local markets must be evaluated carefully since inhabitants have already developed satisfactory alternatives based on private use of biomass, especially firewood, available locally at a very competitive price. Heating private homes in this way is less efficient and comfortable than DHS but extremely competitive from the economic viewpoint. Timber wood is available at 90€/ton with a water content (M) in the range of 30-40%: local market is not transparent, and many exchanges still take place among private citizens out of the official market channels. Consequently, on average and as a general indication, heat sold through DHS cannot exceed 100€/MWh to be competitive.

Lastly, the next Regional Energy Plan will include financial measures to recover waste heat. APE FVG proposed a waste heat strategy to the Region within the CE-HEAT project that has been accepted. This strategy is the result of a long consultation with regional stakeholders, mainly those ones who own the major sources of waste heat. They requested co-financing of projects developed

to recover waste heat in order to guarantee bankability to the investment and keep financial parameters (payback period, IRR, NPV, etc.) within acceptable market conditions. Co-financing intensity has not been already discussed but the overall strategy has been retained.

In Italy, RES DH has been well developed in South Tirol, an autonomous province, bordering with Austria and Switzerland, where the local economy has been strongly oriented to climate protection and self-sufficiency. Consequently, biomass has always represented a strategic asset for this territory: one key factor for the sustainability of this policy was the decision to keep the major alpine valleys off the enlargement of the natural gas grid. This choice boosted the development of energy alternatives based on local resources: in this framework, wood biomass has become the most important energy source for thermal use.

Besides policy decisions, other key factors that played an important role in the development of the investments were the capacity to involve local communities in the projects. Initiative to invest was up to local stakeholders, who had to promote the idea and to develop the most suitable mechanism to implement it. This process turned out into two different models of development:

1. local energy cooperatives;
2. private companies totally owned by local public authorities.

The first model proved to be the most successful, but it took more time for implementation. Sense of ownership, mutual interest and a strong focus on local added value were perceived as significant advantages that can overbalance the risk of investment. Support in terms of capacity building and public discussion/participation were provided by local public authorities to associations, NGOs, private citizens to investigate pros and cons as well as for awareness raising at all levels.

Where these conditions were satisfied, the autonomous province supported the bankability of DHS through grants to the Cooperative or to the Company in charge of the project investment. Municipalities, Enterprises and private citizens participated in the investment in different measure, proportional to individual investment capacity and interest.

Nowadays, 60% of the wood is local while 40% comes from abroad, mainly Austria and Bavaria, because demand overcomes availability. Local biomass potential is a limiting factor that should be taken in due account to control the energy source price and avoid volatility.

OPPORTUNITIES AND OBSTACLES

Northern Italy experiences frequent problems of air pollution with respect to PM10 pollutants. An important contribution to this type of air pollution has been recognized in the traditional and well spread use of biomass, mainly firewood, to heat private buildings with obsolete technologies (open fireplaces, old wood stoves, etc.). So, when bigger heat or CHP generation plants are developed, there is a widespread fear among the population that pollution is going to increase. Consequently, social acceptance of biomass as a RES should be well managed both with respect to central government and local communities' attitude. State-of-the-art technologies allow to adequately manage this problem. Moreover, heat generation plants supplied with biomass can take advantage of their dimension with respect to air pollution: biomass conversion into energy is more complete in those furnaces where combustion is stable and maintained at high temperature (>900°C).

A negative perception for new energy infrastructures has been reinforced when, in recent past, private companies not belonging to local communities, came and promoted the construction of big energy plants supplied with biomass, in order to speculate on generous national incentives

available for power production. There is a widespread idea that private initiatives are mainly driven only by profit making and public authorities are not able or not willing to monitor and control these plants, once constructed and operative. In such cases, communication is key in the development process and too often under evaluated or, worse, forgotten. In many cases, it appeared like decisions were taken without informing local communities: this always resulted in opposition instead of support. Energy cooperatives could be an interesting alternative since they are based on mutual interest of promoters and ownership is well spread among the participants.

Some fossil fuels are still extremely competitive in final energy price i.e. natural gas and heavy fuel oil, making it arduous to convince people to abandon these energy sources. Well designed RES DH can be competitive in price of final heat, more comfortable in management and environment friendly. All these points of strength, together, can serve as constructive arguments for the local community to successfully switch from traditional energy sources.

Availability and, consequently, price of biomass can change over time, sometimes dramatically, which can result in increased prices. Medium to long term contracts with biomass suppliers can offset volatility of price and overcome availability problems. DHS managers cannot take advantage of cheaper periods but can avoid speculative ones. In other terms, DHS can manage the supply chain in order to ensure more stable prices. On the other hand, suppliers can benefit of long-term programming for critical and strategic investments and the entire supply chain can benefit from consolidated perspectives.

Fina heat use is a strategic parameter for DHS. Investment plans are based on pre-defined quantities of heat delivered to customers at a minimum price. Heat mapping the area can help to overcome this problem by estimating density of heat demand, establishing thresholds and identifying suitable areas for investments. Contracting of final customers is another key requirement that has to be adequately managed in order to ensure the minimum heat supply to guarantee financial sustainability to the whole investment project.

RES DH require long term investments. Financial capacity of promoters should be adequate to the investment perspective but often payback periods are not satisfactory with respect to average market conditions. This is the reason why in our Region many initiatives have been developed by Public Authorities (Municipalities) and largely subsidized with grants by the Region or the Central Government. Unfortunately, many decision makers in Public Authorities don’t have sufficient competences and experience to evaluate correctly the sustainability of these initiatives which result in under performing investments. Changing the business model, from Public Authorities to Local Communities initiatives, can be strategic to improve overall investment performance in DHS. This switch will require significant capacity building activities for local stakeholders, training for professionals and decision makers and lots of communication addressing target groups.

RES DH are a challenging investment for the amount of financial resources required as well as for technical aspects, unfriendly for those ones who do not work in this sector. Unclear investments have less probabilities to be realized, especially when you try to involve local communities and to find financial supporters. QM Holzheizwerke can help to establish a common benchmark platform to which RES DH projects should be compliant in order to be co-financed with public financial resources. Public support should be conditional to this quality protocol in order to ensure the increase the chances of success of the investment and the sustainability of the overall project.

5. Poland

Mazowsze is the largest Polish voivodeship located in the Central-East part of the country. It's capital is the City of Warsaw, which is also the Capital City of Poland. The Voivodeship covers the area of 35 558,47 km2, counts 5,39 Mio inhabitants and is divided to 314 municipalities. It is one of the most dynamically developing regions in Poland and is a transit belt between the Baltic Sea region and the Southern Europe. It is fast developing and has the biggest contribution to the country's GDP.

Regarding RES development potential in the region, the largest one is associated with biomass, which can be used for direct combustion (straw, waste wood from forests, orchards and wood industry, energy plants), biofuels production (oil crops, grain crops, root crops) and biogas production (organic waste from households and animal breeding, sewage sludge). Another important renewable source is solar energy, which can be used for supplying with heat and electricity both individual consumers and installations (e.g. solar thermal collectors for warm usable water preparation in a single households, PV panels for lighting road signs at night) and larger systems (district/local heating networks). Large part of the Mazowsze region also has favourable conditions for the generation of wind power and for energy exploitation of geothermal waters with the temperature exceeding 40oC (these are existing in the Western part of the voivodeship). There are limited possibilities, on the other hand, of the development of hydropower due to the unfavourable lay of the river valleys (without adequate falls) and the necessity to protect their natural values.

Regarding DH, the region has the 2nd biggest share in the overall DH production on the territory of Poland. The main sources of energy are coal, natural gas and heating oil and of the RES, biomass is most often used in DH network (as for the rest of the country).

ENERGY BALANCE

Use of RES in the region is still rather moderate. In 2012 the share of RES in electricity generation reached 7,7% and there are no similar data for heat energy. Out of available renewables, the most commonly used is the biomass, which is often co-combusted with other, conventional solid fuels in larger plants, including e.g. CHP plant in Ostrołęka or CHP plants in Warsaw. Also wind power is used for electricity generation with the potential of using produced electricity also for DH purposes ("power to heat" technologies). The largest wind farms are "Żuromin" farm (located on the territory of Żuromin, Lubowidz and Kluczborg – Osada) and "Iłża" farm.

Some parts of the region have good access to geothermal energy, which is used to generate district heat e.g. in Mszczonów. Less used is water energy as due to regional conditionings the hydropower potential is not so big (the biggest hydropower station is located on the Zegrzyńskie Lake).

The conditions for the development of solar energy use as similar at the whole territory of Mazowsze. Large city agglomerations have a bit worse conditions (due to increased air pollution), however the use of solar energy is more justified due to increased heat demand. Using solar thermal collectors for heat generation in rural regions is only justifies, when it aims at substitution more expensive energy sources (electricity, heating oil, LPG).

Within the ENTRAIN project the focus area will be the subregion affected by the operation of the Płońsk Energy Cluster which has been established by the City of Płońsk together with the

Municipality of Płońk, University of Ecology and Business in Warsaw and local utilities. In the future the cluster may include new bodies.

FRAMEWORK CONDITIONS

DH market in Poland is one of the most developed in Europe. It covers the heating demand of the considerate number of people living in urbanised area. The main fuel used in polish DH plants and CHP plants is hard coal and out of RES the most popular is biomass. Concession enterprises supplying consumers with district heat differ among themselves in scope of conducted activity (energy generation, transmission, distribution and sale), plant's installed capacity and the share of income coming from heating operation in the overall income. At the country level there are also large disproportions when it comes to the level of DH development in different voivodeships, both regarding existing infrastructure, used energy medium and the level of investment spending. The biggest producer of district heat and electricity is PGNiK Termika and one of the largest DH networks is located in Warsaw (capital of the Mazowsze Region). In 2014 its length came to 2992,6 km and the overall volume of distributed heat was 82 281,5 TJ. The system is supplied from four plants: two CHP plants and two DH plants with the total thermal capacity of 4700 MW. The heat is supplied to the approximately 90% of Warsaw citizens. Except Warsaw, large DH systems exists also in large cities of Mazowsze Region: Radom, Płock, Siedlce, Ostrołęka, Ciechanów, Pruszków i Legionowo, where they serve 60-70% of inhabitants.

District heat is mostly supplied locally – on the municipality scale. Due to the higher transmission costs than in case of other energy sources, heat transmission to further locations is not considered. As a result, centralised DH systems may be found at the areas with high population density – mostly cities.

Regarding RES potential for DH purposes, for the Mazowsze region the largest potential is associated with wood biomass.

National legal framework is determined by the following acts and documents:

- Energy Policy of Poland until 2030

The document creates strategic framework for the development and modernisation of the energy sector in Poland. It distinguishes 6 main priority areas of action, which include improvement of energy efficiency and development of the use of RES, including biofuels.

- National Energy Efficiency Action Plan for Poland 2014

The action plan describes intended measures aiming at improving energy efficiency in different sectors of the economy. Their implementation shall contribute to the realisation of the national target for efficient energy use set for 2016 (4,59 Mtoe of end-use energy savings), as well as to the achievement of the 20% energy consumption reduction by 2020 on the EU level.

- National Renewable Energy Action Plan for Poland

The action plan describes intended measures aiming at the achievement of the 15,5% share of renewable energy in the gross final energy consumption in 2020 (national overall target). It also sets sectoral targets for electricity, heating & cooling and transport sectors, defines mechanisms for supporting and promoting renewable energy use and lays down principles of relevant cooperation between national, regional and local level.

Above-mentioned documents establish long-term targets and courses of action not only for the national authorities, but also for different bodies operating on the energy market, including local self-governments. Their specific tasks and obligations have been determined in the following key legislative acts:

- The Act on Energy Law

The act defines principles of the development of the state energy policy, determines terms of supply & use of fuels and energy, establishes framework for energy utilities' operation and states which organs are in charge of fuel and energy economy. It aims at creating conditions for sustainable development of the country, energy security and efficient and rational use of fuels and energy.

- The Act on Renewable Energy Sources

The act defines rules and conditions for generating energy from renewable sources, as well as determines mechanisms and instruments supporting RES use. From the local perspective especially important are the provisions concerning energy prosumers and the creation of energy clusters and cooperatives.

- The Act on the Investments in Wind Power Plants

The act defines the conditions and procedures for the location and construction of wind power plants, including the conditions of their location in the neighbourhood of the residential estate. The act is considered very controversial as it significantly reduces possibilities of investing in wind power in Poland.

In the upcoming years significant influence on DH sector will have the National Plan for Climate & Energy which is currently under development. The current draft includes following main priorities and sets of activities aiming to achieve foreseen targets:

- Decarbonisation of the economy – the national target is to reduce CO2 emissions in the non-ETS sector by 7% by 2030 (compared to the value from 2005).
- Increase of RES share in the final energy consumption – the national target proposed in the plan is to reach 21% share in 2030, which should be achieved mostly through the development of solar and off-shore electricity generation, geothermal heat generation and production of biofuels. Distributed energy generation will be also supported.
- Energy efficiency – the national target is to contribute to the EU target at the level of 23%.
- Energy security – is considered as an important aspect for the Polish government. The main two targets described in the plan are ensuring diversification of energy sources and energy supplies from third countries and reducing dependence on energy imported from third countries.
- Internal energy market – the main two targets described in the plan are ensuring necessary and good quality infrastructure for energy transmission and ensuring energy users protection and improving competitiveness in the energy retail sector.
- Research, innovation and competitiveness – the main target is to increase expenses on R&D activities in Poland to 1,7% of GDP in 2020 and 2,5% GDP in 2030 and to improve economy’s competitiveness.

Regarding the funding programmes available on the EU level, they include: HORIZON 2020 (and currently developed HORIZON EUROPE for the next financing period), Interreg programmes (Europe, Central Europe and Baltic Sea Region) and UIA.

On the national level there are incentive schemes for the uptake of RES technologies, also within DH systems, such as certificate-based incentive scheme, auction-based incentive scheme, FIT for micro installations and FIT/FIP for certain biogas and hydro installations.

Energy clusters are types of local energy communities supported and promoted by the State aiming at matching local demand with local supply and increasing local energy security. They gather relevant stakeholders and focus them around the achievement of local energy targets, also concerning development of RES-based DH. In order to support use of renewables (mostly biomass) for heat generation, Poland introduced an obligation of purchasing heat produced in RES installations connected to the DH network by network operator. The amount of purchased heat however cannot be bigger than the demand for heat registered on the local market. The obligation gives competitive leverage for the entities producing RES-based heat towards other suppliers connected to the network.

The National Fund for Environmental Protection and Water Management launched a programme named “Heat from RES”, which should help DH companies in obtaining the status of efficient DH systems thanks to the simultaneous introduction of renewable energy to the system and introduction of heat storage. Other Fund’s programme potentially supporting RES use in DH is “County heat”, which is addressed to entrepreneurs producing heat for municipal purposes where the owner or co-owner (with min. 70% of shares) is a public authority (local or regional government).

OPPORTUNITIES AND OBSTACLES

When it comes to the most important barriers and challenges hindering the development of RES installations, and in particular RES DH systems, they may be divided into legal, economic and social ones, as well as local administrations' own weaknesses, as specified below:

1. Legal & procedural barriers

- Frequent and often unfavourable changes in existing law - investments in RES are long-term investments, with long payback periods, therefore they require stable and predictable legal framework, with all the necessary changes communicated and discussed with relevant stakeholders well in advance. This is not the case in Poland, where regulations concerning broadly defined low-carbon economy change frequently and often without adequate prior consultations.
- Ambiguity of some regulations – it happens that regulations are formulated in a way that is not fully clear and thus allows for different interpretations hindering implementation of some investments.
- Complexity of administration procedures and large number of decisions & permits to be obtained to install RES – depending on the type and parameters of planned installation there are various conditions that need to be met, decision and permits that need to be obtained and institutions that need to be consulted.

2. Economic & financial barriers

- Relatively long payback periods resulting from high investment costs - despite low (or almost zero) operational costs, with the current prices of fossil fuels and the necessity to compete with conventional energy generation favoured by the law, payback periods from investing in RES are quite long and thus may discourage potential investors.
- Limited budgets of local authorities and DH companies – in Poland DH networks are mostly managed by local authorities (as owners or co-owners of DH companies), which are responsible for providing citizens with secure and affordable energy. Since municipal budgets are limited and the number of tasks transferred from the national to the local level is systematically increasing, often they don't have enough funds to plan new investments, which are not considered "essential" (like e.g. repairing roads). Therefore, if no external funding is secured, such investments are often postponed.
- Large competition when applying for external funds - at present there are relatively many funding programmes and schemes available that may be used to finance low-carbon development, but there is also large competition between entities applying for external funding, which makes it harder to get it.
- Not always well-designed financing programmes - it happens that financing programmes and schemes aiming to support RES use are badly designed and thus not adapted to the needs and capabilities of potential beneficiaries, as well as the existing local RES potential. As a result, it is harder to use available funds efficiently.
- Unfavourable terms of making settlements with DSOs within Prosumer Scheme - one of the challenges faced by municipalities wishing to invest in RES within the prosumer scheme is settling surplus energy with the DSO.
- Difficult financial situation of many RES installations producers - RES installations are often manufactured by small companies, with relatively low capital, who cannot survive long with frozen funds. With the current crediting system and lack of tax preferences when importing devices from abroad, the RES market cannot develop efficiently.

3. Social barriers

- Local society's opposition to some types of investments - there are investments which raise significant concerns in the society and thus meet with protests. People fear their negative impact on their health, quality of life and estate value. Part of these fears results from ignorance and being misinformed by different interest groups, while the other part stems from so called "bad practices", i.e. examples of installations, which were badly designed or constructed and thus create burden for the people living in the neighbourhood.
- Widespread "not in my backyard" approach - it often happens that although local society considers certain investment as necessary and beneficial for the municipality, they don't want to agree to have it located in their neighbourhood.
- Lack of willingness to actively engage in common energy-related initiatives - although the citizens often declare general support for environmentally friendly investments, including RES development, they don't want to actively engage in the process and e.g. join common projects, contribute with own funding (e.g. for future benefits/revenues from the cooperative) etc.

- Fear of change – it happens that municipalities / energy utilities have problems with implementing already planned investments as single people oppose them and e.g. don't agree to be connected to the DH network even despite their current energy source is old and inefficient.

4. Other

- Inadequate consideration of local potential by the State and thus inadequate support for local RES investments – local authorities and utilities play very important role in the implementation of national climate & energy targets, yet their potential is practically not considered by the State when preparing strategy and planning documents (like e.g. National Plan for Energy & Climate). They are rarely involved in the consultation process (where regional authorities and large energy companies are main players) and thus also the support for local RES investments and making use of local RES potential is not sufficient.

MAIN OPPORTUNITIES FOR THE DEVELOPMENT OF RES DH SYSTEMS

- EU climate and energy policy - reduction of energy consumption and of accompanying CO2 emissions are among the main priorities of the EU. Therefore, EU decision makers are introducing many regulations, incentives and financing schemes supporting delivery of energy union, including decarbonisation of the energy sector. Both the European Commission and other EU institutions consider local self-governments as key partners in the implementation of the European climate and energy targets.
- Availability of EU and national funds – investors planning to invest in RES can apply for external funds, both non-repayable grants and loans. The current financial perspective of the EU offers relatively many funds allocated to energy-related projects, both on the EU and national level. On the national level municipalities can apply for funds from the Operational Programme "Infrastructure & Environment", regional operational programmes, National Fund for Environmental Protection and Water Management, voivodeship funds and Thermomodernisation and Repairs Fund.
- State support for Energy Clusters – types of local energy communities created by municipalities in cooperation with relevant stakeholders and aiming at balancing local demand with local supply.
- Development of RES technologies and their decreasing prices - growing interest in the topic of environmental and climate protection, as well as the necessity to solve many urgent environmental and social problems, result in the fast development of RES technologies.
- Active involvement of NGOs in the field of energy conservation - Polish NGOs are relatively strong and active. Many of them are working in the field of environmental protection, climate protection and resource efficiency. Among them there are both specialised organisations and those, for which environmental protection is only one of many interest areas.
- Growing energy awareness and willingness to engage in sustainable energy initiatives of local authorities - more and more local decision makers are aware of the necessity to take action in the area of energy conservation and climate protection. They are also aware of related benefits, including environmental (improvement of air quality), economic (reduction of energy costs) and social (improvement of the citizens' quality of life) ones.

This results in political decisions engaging local administration in different energy-related initiatives.

- Growing energy awareness of municipal staff involved in energy-related projects - awareness and thematic knowledge of municipal employees working in the departments and units involved in different energy conservation and climate protection projects is increasing.
- Local agencies and energy utilities support in obtaining external funds - Polish local self-governments and energy utilities are well aware of external funding sources that may be used to finance energy-related projects and initiatives. They reach for them quite often and - compared to their European peers - are pretty effective in getting them.
- Significant RES potential - local RES potential is significant and still major part of it is not used. This creates opportunities for wider RES application for DH purposes, as well as reaching also additional benefits: bringing surplus agricultural land under cultivation, making use of agricultural waste or utilisation of combustible fraction of municipal waste.
- Local agencies and energy utilities willingness to look for new solutions and share experience with their peers - more and more municipalities actively search for new solutions in the area of energy supply and RES use that they could implement on their territories.

POSSIBLE ACTIONS FOR FOSTERING THE RENEWABLE DH MARKET IN POLAND

- Recognizing local governments as important partners when planning and implementing new laws, strategies and programmes influencing DH and RES market. Also, wider public consultations, involving all entities affected by these laws and strategies, should be conducted. This would help to ensure that legal frameworks facilitate exploitation of local RES potential.
- Ensuring stable, coherent and clear legislation, allowing to plan investments in advance and correctly assess their long-term impact on the local situation (including potential costs and benefits).
- Introducing changes in existing law and new regulations that would support RES application, also for DH purposes, more efficiently than the current ones. This includes, among others, regulations encouraging consumers to become prosumers and increasing payback from investments in renewables (e.g. by allowing prosumers to sell surplus energy to the grid at favourable prices).
- Implementation of well-designed support programme for RES DH - such programme is needed for making use of the existing modernisation potential in DH and increasing share of RES in producing district heat. It should consider different local conditionings and different technological solutions. It should be implemented in stages, enabling reducing investment risk and familiarizing enterprises, cooperatives, developers and heat consumers with new solutions.
- General simplification of the legislation - the law should determine overall frameworks of municipalities' and – in general – RES producers' operation but it shouldn't impose too many

formal requirements and restrictions that make it difficult for them to implement their tasks.

- Facilitating networking, knowledge sharing and exchange of experience among relevant stakeholders, as well as wide dissemination of good practices and tested solutions.

6. Slovenia

The Lower Podravje region comprises 16 municipalities: Cirkulane, Destrnik, Dornava, Gorišnica, Hajdina, Jursinci, Kidricevo, Majšperk, Markovci, Podlehnik, Ptuj Municipality, Sveti Andraž in Slovenske gorice, Trnovska vas, Videm, Zavrč and Žetale.

The area of the Lower Podravje region, covering 647 km^2, is relatively hosted by the population working in agriculture.

The Lower Podravje region is characterized by a temperate continental climate, where precipitation and temperatures condition the harvest, especially in the arid gravel. The average annual temperature is 9.7 ° C and the average rainfall is around 1000 mm/m^2 of surface. The age structure of the Lower Podravje population is reflected in the high proportion of the elderly population in the negative natural increase. At the end of 2011, 69,399 inhabitants lived in the Lower Podravje area. Spodnje Podravje is one of the natural and geographically diverse provincial units of northeastern Slovenia, consisting of the hills of Slovenske gorice and Haloze, and the plain along the Drava River, comprising 208 settlements and 646.7 km^2, which represents 3.2% of the total territory of Slovenia. The climate is temperate to transitional Pannonian continental. The average rainfall ranges between 900 and 1100 mm, which means that the Lower Podravje ranks among the medium-rich rainfall regions in Slovenia

REGIONAL ENERGY BASELINE

Energy use and supply

Dwellings: Fuel oil consumption (30%) causes higher gas emissions than wood biomass consumption (40%). This is an individual use of this energy source, which means individual fireboxes, which are often poorly maintained, with technologically obsolete boilers, which results in low efficiency and high consumption of fuel oil. Some households switched to natural gas heating (14%), mainly in urban centers where no other energy sources can be used.

Public buildings: Public buildings are heated by heating oil, natural gas, DH, common boiler rooms and LPG. Most buildings do not have solar collectors or heat pumps installed, and they heat all domestic hot water by central heating to non-renewable energy sources or electricity. Additional thermal insulation of the facades is only in 35% of buildings. Other buildings are without insulation facade. 68% of public office furniture is energy efficient. 66% of public buildings that are constantly heated during the heating season do not have thermostatic valves installed. Also, only occasionally heated buildings do not have thermostatic valves installed.

Industry and crafts: Fossil fuels are mostly used, with 79% of the energy consumed coming from natural gas and 19% from extra light heating oil. Average awareness of economic operators about RES and EE. Companies do not have energy managers involved.

Public lighting: The average consumption of electricity for public lighting is 80 kWh per capita per year, which is 95% more than the recommended value in the Decree on the Limit Values of Light Pollution. In the municipalities of Spodnje Podravje there are 78% of luminaires which do not comply with the Decree on the limit values for light pollution. The average power of the lamps is 144 W. All municipalities have developed a public lighting plan and are progressing in the reconstruction process in order to comply with the requirements of the Decree on the Limit Values of Light Pollution.

Water supply

The automation of the water supply system covers all water supply facilities in the network. This controls the operation of the pumps, obtains data on failures, water levels in the horizontal and controls access to the facilities. The main problem is the lack of control over hydraulic conditions in the network, sections and nodes. Thus, it would be essential to arrange 12 major nodes that are deployed throughout the network, in terms of construction, hardware and automation. Each node should be equipped with flow and pressure gauges and electric motor latches to allow remote control. This would provide greater control, accuracy and cost-effectiveness in the operation of the water supply system and extend the life of the water supply network. Rapid defect detection would greatly reduce losses

NATIONAL AND REGIONAL FRAMEWORK CONDITIONS

Following the rules and regulations of the Energy Act (Energetski zakon-EZ-1) and the signed Agreement of the Covenant of Mayors of European cities, current renovation strategies on regional/local level in Slovenia should be in compliance with the following documents: Sustainable Energy Action Plans (SEAPs), Local Energy Concept (LEK).

Sustainable Energy Action Plan (SEAP) represents a basic document which, on the basis of the collected data on the existing situation, identifies the real situation and gives precise and clear guidelines for the implementation of projects based on energy efficiency, renewable energy and environmentally friendly fuels on the city level, which will result in a reduction of CO2 emissions by more than 20% by 2020. In October 2015, following a consultation process on the future of the Covenant of Mayors, the European Commission launched the new integrated Covenant of Mayors for Climate and Energy, which goes beyond the objectives set for 2020. The signatories of the new Covenant commit to reduce their CO2 emissions and to adopt a joint approach to tackling mitigation and adaptation to climate change. As a consequence, a new, upgraded version of the SEAP was conceived, namely the Sustainable Energy and Climate Action Plan (SECAP). SECAP is aimed at defining actions that allow cutting down at least 40% of CO2 emissions by 2030.

Every Slovenian Municipality, with the prior consent of the Minister responsible for energy, has to adopt and publicly announce the energy management program named Local Energy Concept (hereinafter: LEK). LEK is the most important strategic tool in planning the local energy policy. It encompasses ways by which local communities can tailor solutions for efficient, economical and environmentally friendly energy services in homes, businesses and public institutions. The document also lists the concrete effects that the local community can achieve by carrying out activities from the LEK. Based on LEK, the spatial and economic development of the local community is planned, the development of local energy utilities, the efficient use of energy and its saving, the use of renewable energy sources and the improvement of air quality in the local community. In the area of developing renewable energy sources, Slovenia must achieve ambitious targets that will contribute to increasing the reliability of energy supply, reducing impacts on the environment, economic growth and the development of jobs and employment. The most important renewable source of energy in the country is wood biomass, followed by hydroenergy, while in recent years development has been most dynamic in exploiting solar energy and biogas. The potentials of these energy sources, plus the potentials of wind and geothermal energy, will contribute to increased consumption of renewable energy sources. Priority heating sources are determined by municipalities in local energy concept.

National Energy Climate Plan (NECP)

Energy Concept of Slovenia[1] – Support of energy efficient DHS in densely populated areas, special focus on the use of excess heat, biomass (CHP), other RES and heat from waste.

Draft NECP was prepared in December 2018 and is accessible among others EU NECPs on the official EU website (see link below). DH is considered as one of priority means on how to accelerate the implementation of RES measures to achieve renewable share goals. Effective DH systems have prescribed obligatory share of RES. - Buildings in which the final energy for heating and cooling and the preparation of sanitary water are provided from the DH system meet the requirements of the energy performance of the building.

Waste wood biomass is considered of great importance in the production of heat (and electricity) in DH systems, using the latest technologies that contribute to reducing air pollution.

Co-financing of RES based DH systems is being considered as support to reach goals of EE action plan by 2020.

National Energy Efficiency action plan (NEEAP)

Issued by the Ministry of Infrastructure in May 2015, it set Slovene 2020 national target for improving of EE by 20 %.

Measures to increase the efficiency of DHS are listed among the types of energy service and energy efficiency measures for achieving energy savings by liable entities (energy suppliers' obligations).

The development of small DHS using wood biomass is encouraging.

Amongst the main measures for promoting CHP, efficient DHC and other energy-efficient heating and cooling systems it is mentioned that improvements to DHS to be made by liable entities can also be included as eligible measures in terms of energy suppliers' obligations to achieve energy savings. There is also co-financing programme for the construction of DHS using wood biomass which enables the allocation of grants for the co-financing of projects for DH using wood biomass (DHWB). Financial incentives are aimed at investments in new DHWB systems and micro-systems, as well as the expansion of existing DHWB systems and the construction of new boiler rooms containing wood biomass boilers as a source for existing DH. The programme started in the framework of Operational Programme for Environmental and Transport Infrastructure Development 2007–2013 and is continued under the Operational Programme for the Implementation of European Cohesion Policy 2014–2020 (OP-EKP) which besides 14 mio EUR EU funds ensured 2,5 mio EUR for related investment activities.

New additional measures for the support of DHS within measure for efficient heating and cooling encompass:

Preparation of Heating and cooling strategy with support for local planning (heat maps, etc.);

Stable financing of the CHP support scheme;

EKO fund subsidies for sustainable development and increase of competitiveness of DHS (new connections, RES sources, excess heat, heat storages, etc.).

National Renewable energy action plan (NREAP)

[1] Energy Concept of Slovenia, http://www.energetika-portal.si/dokumenti/strateski-razvojni-dokumenti/energetski-koncept-slovenije/

Slovene NREAP for the period 2010-2020 was published in July 2010 with an update dated of June 2017, but this renewal has not been officially accepted yet.

The following major DHS related measures are defined:

(1) As part of innovative systems for local energy supply subsidies for DHS using wood biomass and geothermal energy are defined where public tenders for financing DHWB and for promoting systems of DH using geothermal energy were envisaged.

(2) As additional policies and measures (a) introduction of support scheme - system of feed-in incentives was accepted to hook up/produce heat from RES resulted in development of CHP systems and (b) Obligatory shares of RES in DHS shall be set in the Energy Act (Share_RES >=20 %; Share_RES + Share_CHP >= 80 %).

NREAP promoted that the Rules on efficient energy use in buildings, setting out that connection to DHS operating on RES is one of means of gradual transition from fossil fuels to RES in heating all kinds of buildings. One of the guidelines (as part of the abovementioned Rules) promoted exclusive use of RES or CHP or DH in all new buildings with offtake of more than 250 kW (from 2012 on).

(3) Provision of urban planning guidelines for planning systems using RES in the built environment (by ministry responsible of the environment and spatial planning).

The action plan also includes technical specifications for the required standards of quality for wood biomass boilers which are part of DHS.

The need for drawing up the Guidance for planning RES is set out. This guidance shall ensure that obligatory local energy concepts will enforce to incorporate the best combination of RES, high-efficiency technology and DHC in planning, designing, constructing and renewing industrial or residential areas.

In order to promote DHC infrastructure development, NREAP envisaged subprogramme of the National Energy Programme which would formulate, adopt and implement intensive development strategies for local energy, relying on high-efficiency CHP, RES and DHC systems. One of the operational objectives was construction of new systems of DH based exclusively on high-efficiency CHP or RES and waste heat from industrial processes from 2012 on.

GHG mitigation action plan

Operational programme of GHG reduction till 2020 (Operativni program ukrepov zmanjšanja emisij toplogrednih plinov do leta 2020) which was published in December 2014 stresses the role of DHS in relation to air quality and reduction GHG emissions only in the following manner: (1) individual heating systems are not encouraged if they replace DHS; (2) possible prioritisation of DH in areas with an adopted decree on the air quality plan; (3) when designing incentives for the heating sector in buildings and settlements, DH has the highest priority order of heat supply according to the energy source.

DH MARKET AND INCENTIVES

Cohesion funds – subsidies, because public companies and cooperatives can get it. The rest in favourable long-term loans. The ECO fund is 20%, which is too low. This fund may be obtained by municipalities if they are properly adjusted to the requirements. Consent for distribution must be given by the Municipal Council. A project must be completed, a building permit issued (if

necessary) and a contractor selected. Cohesion – 40 %, a building permit must be issued. The previous call did not co-finance the replacement of the boiler because people at the Ministry do not understand that the investment here is very high, 60 % of the RES DHS system, because you have to build a warehouse, a metering system and flue gas treatment. Public-Private Partnership has long-term adverse effects on the public sector. A concession where prices are controlled only by the municipality, so only the municipality could approve the prices, not the Energy Agency.

BEST PRACTICE EXAMPLES IN SLOVENIA AND IN THE TARGET REGION

In region Lower Podravje two large and three small DHSs are located. The biggest DHS is in city Ptuj. Maximum load is 21 MW, peak load is around 8 – 10 MW. Energy source for this DHS is only natural gas. The owner of the DHS in is Municipality of Ptuj. Operator is the public company Javne službe Ptuj which are 100 % owned by the Municipality of Ptuj

A little bit smaller DHS is in Municipality of Kidričevo. Maximum load is 4,5 MW. All heat for DH is produced with cogeneration, which is located at the one of the biggest companies in region near centre of Kidričevo. The other DH system located in Cirkulane (school + sport hall = 200 kW), Makole (school = 300 kW + municipal building = 35 kW) and Žetale (municipal building + health center + hall = 75 kW). This are very small DHS which are intended for heating of public buildings (etc. school, health center, municipal building, multipurpose and sport hall…).

DH in Kuzma is a private investment of a local company. The motivation was a poor local situation regarding individual heating: Extensive use of wood biomass in old inefficient stoves for individual heating resulted in high biomass demand and poor air quality in winter. In addition, much heating oil was needed for individual heating and heating of larger objects (municipality building, school), which was at the date of erecting of the plant in 2012 very expensive (around 1 EUR/l).The private initiative had a positive nonfinancial support in the municipality and from the local community, providing help in administrative procedures and acquiring of required documentation. The local community has been very positive regarding the intention of the investor to purchase biomass from local suppliers. The project also received national financial support in terms of a grant within the national scheme for support of wood biomass DH. The project is a lighthouse project in north-eastern Slovenia where there are no small renewable DHSs. The production of heat is based on two biomass boilers of the producer Fröling, including a 10 m^3 heat storage which covers peak heat demand. No additional heat production using other resources is installed. Heat consumers are connected via a 1,5 km DH network and Giaflex substations.

The private investor is purchasing biomass from local wood owners. At present time the offer of biomass exceeds consumption of approximately 2.000 m^3 of wood chips, so the investor is also processing biomass and selling it to third parties–mainly to individual consumers within the radius of 40 km. The biomass is purchased in a radius of 40 km.

The overall investment amounts to 800.000 EUR. The investment was co-financed by a Slovenian national subvention fond for biomass DH-systems (Grant within the national DOLB programme, 50% co-financing rate). The project is annually saving 300 t of CO_2 and represents a positive example in Slovenia. The only problem encountered in the project was due to slow national administration and slow issuing of needed permits from the side of the Slovenian environment agency (especially water related permits for crossing a local creek.

The Municipality of Gornji Grad was one of the first municipalities in Slovenia to decide to replace individual heating systems (mainly using oil and coal) with an environmentally friendly DH plant

using wood biomass. In 1995, two boilers (each 2 MW) using wood biomass were installed. The Swedish company JfRNFORSEN produces the boilers (INTEGRAL 2000), which have an efficiency of 82% at 55% humidity of the fuel source (e.g. sawdust, bark and waste wood). See table 1 for other characteristics. The consumers of the heat produced by this method are the SMREKA company, other local companies, and individual households. The whole network measures 8300 m and currently has 224 connections.

BARRIERS AND OPPORTUNITIES FOR RES DH

Opportunities lay in increased biomass use in individual, public and industrial buildings. On the national level, the following incentives are available, which can be identified as investments opportunities:

- High national subsidies for renewable and high-efficiency DH systems,
- High feed-in tariff for small CHP project using RES.

Additionally, more opportunities lay in good availability of RES, abundant forests, untapped potential of geothermal energy, the high solar energy potential.

The main barriers are low awareness of positive impacts of centralised small scale DH (especially higher efficiency and less pollution with hard particles) of the general population, problematic legislation for above 1 MW DH networks, existing use of biomass or individual heating, low price of heating oil and natural gas. Other barriers include:

- Slow administration and problematic obtaining of needed permits,
- Few national examples of small RES driven DH projects and,
- Low public awareness on the benefits of small RES driven DH projects.

Annex I

QUESTIONNAIRE

Activity A.T1.2 Initial survey in the target areas

PARTNER:
COUNTRY:
NAME OF THE REGION:

1. *What is the size of the region?*
2. *How many inhabitants?*
3. *How many cities?*

CURRENT STATUS OF RENEWABLE ENERGY PRODUCTION IN YOUR REGION?

4. *How many district heating plants are in your region? How big are they (installed boiler load)?*
5. *Who are the operators (privately owned, state owned, bigger energy suppliers)?*
6. *How many of these DH-networks are supplied with heat from biomass/wood boilers?*
7. *How many of them use waste-heat?*
8. *How many use heats from solar thermal plants?*
9. *Are there existing issues which might pose a problem or threat for successful establishment of a district heating plant (forest ownership, nature conservation, recreation, lack of management, lack of technology and supply chains, unexciting markets, insufficient woody biomass potential, price level, peoples' opinions etc.)*
10. *What is the public opinion towards the renewable/wood based energy production at local level/in your region? (Explain the use of forest biomass for energy production in the area; households, heating plants, other)*

CLIMATE:

11. *What is the average temperature per month in your region? How big is the number of heat degree days per year?*

STAKEHOLDERS

12. *Who are potential stakeholders for a RES district heating plant establishment process in you region? Who should be involved and why?*
13. *Which external stakeholders (outside your region) should be involved in a district heating project? Why? (For instance; lack of expertise, skilled operators, investors and/or funding)*
14. *Who should be in charge of a heating plant establishment process? (public sector, private companies, public-private together, investors etc.)*
15. *What are the main objectives and drivers of establishing a RES district heating plant? (Make money, create work, support local economy, decrease GHG emissions, …)*
16. *What measures should be taken within the community to explain the establishment of a district heating plant to public and or stakeholders? (Meetings, workshops, newsletter, e-mails. webinars,…)*
17. *What are the main risks concerning a district heating project? (Technological failures, market immature, finance, funding issues, lack of skills, etc.)*
18. *What kind of management structure should be chosen for district heating plant and why? (cooperative, private entrepreneur, ltd, etc.)*

INVESTMENT AND FUNDING POSSIBILITIES

19. *Which sources of funding are available for a RES district heating plant and which one should be chosen? (investment subsidies, bank loans, etc.)*
20. *What are the conditions to receive the funding? Who is the funding authority? (Add a link to the website of the funding authority)*
21. *What is the name of the funding scheme?*
22. *How does the funding work? (Is the investment funded or feed-in-rate or something else).*
23. *What is funded and how big is the funding?*
24. *Which are the most critical factors for (funding/)investment decisions? (level of risk, payback time, available capital, community support, political support…)*
25. *Who should be responsible for obtaining the funding for a RES district heating plant?*