KeepWarm
Renewing district heating

Improving the performance of District Heating Systems in Central and Eastern Europe

Development of Business and Financial Models

District heating market in KeepWarm partner countries

Horizon 2020 (H2020-EE-2017-PPI)
Project N°784966

This project has received funding from the European Union's Horizon 2020 research and innovation programme under **Grant Agreement N°784966**.

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DEUTSCHE ZUSAMMENARBEIT

This project received co-funding from the German Federal Ministry of Economic Cooperation and Development.

PROJECT INFORMATION	
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List of Abbreviations

AT	Austria
CEE	Central and Eastern Europe
CoM	Covenant of Mayors for Climate and Energy
CZ	Czech Republic
DisComEx	Dissemination, Communication and Exploitation
DG	Directorate-General of the European Commission
DHS	District Heating System
EU	European Union
GHG	Greenhouse Gas
HR	Croatia
KPI	Key Performance Indicator
LV	Latvia
NGO	Non-Governmental Organisation
RES	Renewable Energy Source(s)
SI	Slovenia
SRB	Serbia
UKR	Ukraine
WP	Work Package

Summary of the project

The project “KeepWarm – Improving the performance of district heating systems in Eastern Europe” is funded under the EU Horizon 2020 programme. Its objective is to accelerate cost-effective investments in the modernisation of District Heating Systems (DHS) in Central and Eastern Europe (CEE). KeepWarm is most active in seven countries: Austria (AT), Croatia (HR), Czech Republic (CZ), Latvia (LV), Serbia (SRB), Slovenia (SI) and Ukraine (UKR). The project focuses on this region, and these particular countries, because in most cases DHSs are frequently still inefficient and for the most part overly reliant on fossil fuels (mainly gas, coal or oil).

The aim of this initiative, launched in April 2018, is to modernise DHSs around the whole region in a more sustainable manner. By improving system operations and promoting a switch to less-polluting sources, like renewable energy sources (RES), KeepWarm will contribute to reducing greenhouse gas (GHG) emissions. The eleven project partners strive to ensure that best practices for environmentally-friendlier heating and cooling will be taken up across Europe, replicating KeepWarm’s approach in other countries and regions, even beyond the end of the project in September 2020.

Project objectives

KeepWarm’s specific objectives are:

- At least 450 relevant stakeholders with increased capacities on technical, organisational, financial and managerial aspects – includes 150 DHS operators;
- At least 95 **DHS operators** are able to **develop business plans** and to identify the most suitable **financial model** for modernisation of their own DHS;
- At least 23 **business plans for the modernisation** of DHSs have been developed and **sources for investment** have been identified;
- DHS network **retrofitting** is addressed in at least 10 local **energy plans** and 7 regional or **national strategies** or plans;
- At least 23,300 **relevant stakeholders** (directly) and 125,000 (indirectly) **reached** across Europe in order to **replicate the project outputs** in primary and secondary target regions and ensure the project’s impact;
- **Support EU policies and initiatives**, such as the Covenant of Mayors for Climate and Energy (CoM) and DecarbHeat, by exploiting key lessons from KeepWarm activities and pilots to disseminate best practices across Europe.

KeepWarm consortium partners

LOGO	PARTNER NAME	SHORT	COUNTRY
	Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ) GmbH	GIZ	Germany
	University of Zagreb Faculty of Mechanical Engineering and Naval Architecture	UNIZAG FSB	Croatia
	Landeskammer für Land- und Forstwirtschaft in Steiermark	LWK	Austria
	Regionalna Energetska Agencija Sjeverozapadne Hrvatske	REGEA	Croatia
	Jožef Stefan Institute Energy Efficiency Centre	JSI	Slovenia
	ICLEI European Secretariat GmbH	ICLEI Europe	Germany
	Teplarenske Sdruzeni Ceske Republiky	TSCR	Czech Republic
	Biedriba Zemgales Regionala Energetikas Agentura	ZREA	Latvia
	Zavod Energetska Agencija za Savinjsko Salesko in Korosko	KSSENA	Slovenia
	LLC KT-Energy Consulting	KT-Energy	Ukraine
	Institut za Nuklearne Nauke Vinča	VINCA	Serbia

Content

1. DHS Market in Austria

General information on the country

Since the 1970s DHS is getting more and more important. Since the 1980s biomass DHS were built and got more important. A major uptake was since 2000. From 2000 to 2015, the heat production from DHS increase by nearly 75 %. Currently the heat production is 23.3 TWh, which covers 15 % of Austria's total heat demand. 45 % of this DHS heat comes from renewable energies.

In Austria we have the situation, that lot of DHS come to an age, where re-investments and optimizations are necessary. In addition, the business succession, especially of small and medium scaled DHS, is an issue.

There are about 2,300 DHS in Austria. Mostly small scales biomass DHS. 600 are in Styria.

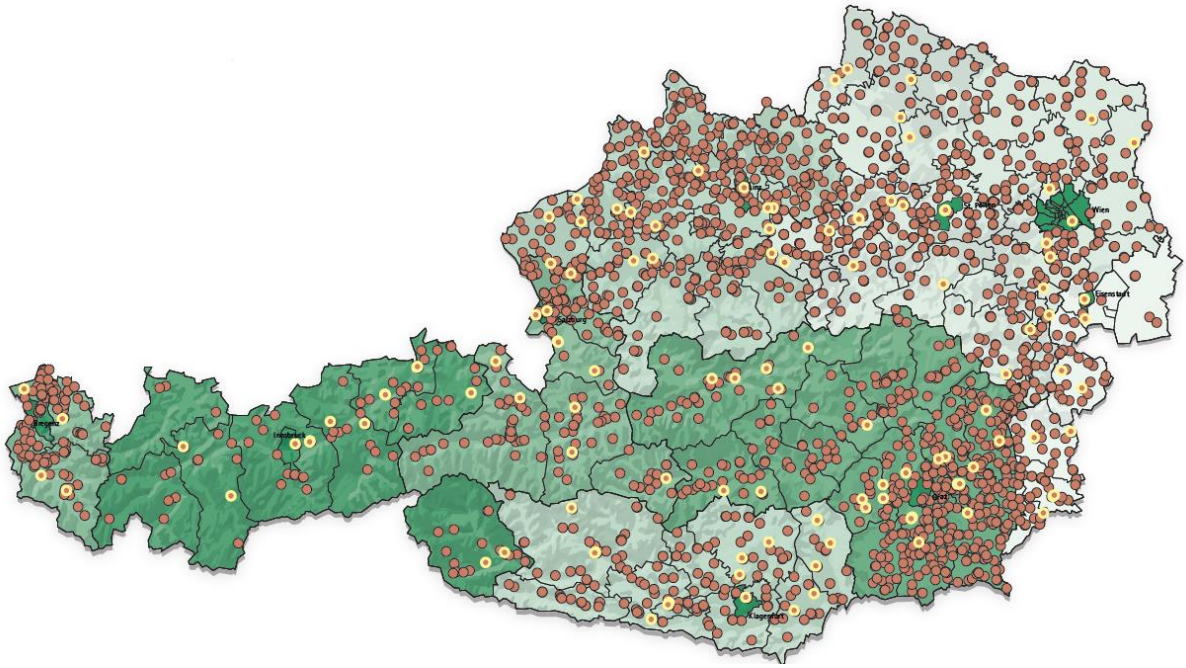

Figure 1: Map of DHS and CHP in Austria. Yellow points are CHPs. © Austrian Biomass Association

Most DHS are fired with biomass. Fossil fired (gas, oil) DHS can just be found in the big cities, but in total they cover more than 50 % of the heat demand. There are also 15 geothermal heat plants and some waste incineration plants. Waste heat from industries has just a very little role so far; however, its importance is increasing.

Talking about prices, biomass fuels are quite competitive in Austria compared to fossil fuels. However, for biomass plants it is hard to compete with depreciated fossil plants without any subsidies.

FUEL	€/KWH
Oil	0.06 – 0.08 €
Gas	0.065 – 0.075 €
Coal	0.035 – 0.045 €
Wood chips	0.028 €
Wood pellets	0.049 €
Wood logs	0.038 €

Table 1: Typical prices for fuels in Austria

The general opinion of the society about DHS is very positive. The DHS market is growing in Austria since years. Customers enjoy the advantages of DHS like the high comfort, no need of a single firing, no maintenance, and just little space requirements. Although some consider DHS as expensive, it is also price competitive and price stable. Furthermore, the high share of renewables used in DHS gives them an even better image.

The political opinion of DHS is positive as the emissions of single firing in cities are avoided. The political goal is to increase the share of DHS in Austria, also because they have the goal to get rid of about 700,000 oil fired single firings till 2030.

Use of renewables in DHS

Biomass

The sector has developed very well in the last 20 years. 45 % of this DHS heat comes from renewable energies. Mainly from biomass. The use of biomass for energy is well developed in Austria. Biomass single firings are very popular and also the use in DHS.

Many households use biomass district heating, firewood, wood chips or wood pellets for heat supply. The share of biomass single firing is about 18 % of all households. In total about 30 % of Austria's needed thermal heat for households and industries come from biomass.

2,200 DHS in Austria are operated with biomass. Therefore Austria has the highest density of biomass DHS in the world. However, the district heating systems are rather small in Austria. The average output power is about 1.5 MW.

Furthermore, also biomass CHPs are quite common in Austria. Currently there are about 130 biomass CHPs in Austria. A lot of them use the heat for a district heating network. The sizes are quite varying, from 20 kW electrical power to several megawatt. The average electrical output is 2.4 MW. Currently biomass CHPs facing the problem that feed-in tariffs are running out. By the end of 2019 about half of the CHPs will have no more tariff. This already led to first closings. Politics promised a solution with a new renewable energy law, which will be enforced from 1st January 2020. But this is already too late for some CHPs.

Because of the long-term experience and the high number of plants, there are several good

and best practice examples of using biomass in DHS. The most important biomass format used are wood chips. They are also the cheapest one in terms of fuel price. Furthermore, wood pellets are used. Wood logs are mainly used in single firings. In the past also experiments with agricultural fuels like straw or Miscanthus were made. However, the experience made was, that it is very hard to operate a DHS with such a fuel.

The supply of wooden biomass varies, with farmers, biomass trade centers and forest associations as well as the federal forest. However, especially small and medium scaled biomass DHS are quite often operated by farmers and forest owners. Therefore, they can use their own biomass for the DHS.

The use of biofuels is very well accepted in the society. Especially in rural areas and in smaller cities. In bigger cities, it sometimes has a negative image because of fine dust emissions. The political opinion on using biofuels is positive. Politicians decide on awarding of subsidies. Politics also know that biofuels are needed for a transition of the national energy system to a renewable way.

Excess/waste heat

In recent years, the use of excess heat has increased, but it is still very low. Some DHS meanwhile see the potential of using excess heat. A study of the Vienna University of Technology shows that there is a potential of 8.5 TWh excess/waste heat per year, which could be used in DHS.

The available excess heat comes from paper mills, metallurgical plants, cement plants, textile industry and other industrial processes.

For example, the excess heat of a paper mill is used to heat several cities in Aichfeld. Another quite new and big use of excess heat is the example of the City of Graz. They use excess heat from the paper mill Sappi in Gratkorn. In 2017 they built a 12 kilometre long grid to connect Sappi and the DHS grid of Graz. The annual heat supply is around 180 GWh that is about 15 % of the demand of the DHS of the City of Graz.

The use of excess/waste heat is accepted in the society. Although it is not that well known in the society yet. The political opinion on using excess and waste heat is positive. Politicians decide on awarding of subsidies. They know that it is necessary to use heat efficient to reach climate and energy goals. Therefore, they understand the need to utilize excess/waste heat.

Solar-thermal energy

The sector is well developed; many houses have installed a solar system for hot water production. However, in recent year the development of this sector is stagnant.

In general the use of solar thermal energy is well developed, in district heating systems it is only used in a few projects. Mainly in a smaller scale on the roofs of the DHS. However, there are large solar projects planned in Austria. In Graz they plan the largest thermal solar field in Europe. With a collector area of 500,000 m² and a hot water storage lake with 200,000 m³ of water, it is planned to cover 20 % of the DHS heat demand of the city of

Graz. This would be around 200 GWh of thermal heat. Furthermore, a new thermal solar field with more than 5,000 ² collector area started its operation in late 2020 in the city of Mürzzuschlag.

In the society, thermal solar projects are well accepted. Although there is the prejudice that it is not economically feasible. Furthermore, on large projects there is of course the discussion about land use by covering mostly agricultural land with solar collectors. The political opinion is positive. Although the focus on thermal solar is not that big, also because of the need of high subsidies. Politics in Austria is focussing more on photovoltaics.

Legal framework and subsidies

Emission limits

COAL	< 0.4 MW	> 0.4 – 1 MW	1 – 5 MW	5 – 10 MW	> 10 MW
Dust mg/m³	150	150	50	20	20
SO2 mg/m³	-	-	-	-	400
CO mg/m³	1,000	1,000	150	150	150
NOx mg/m³	-	400	400	400	200

Table 2: Emission limits for coal firings in Austria

OIL	< 1 MW	1 – 3 MW	3 – 10 MW	> 10 MW
CO mg/m³	100	80	80	80
NOx mg/m³ (heat oil extra light)	150	150	150	150
NOx mg/m³ (heat oil light, heavy oil)	450	450	400	250

Table 3: Emission limits for oil firings in Austria

GAS	< 3 MW	> 3 MW
CO mg/m³	80	80
NOx mg/m³	120	100

Table 4: Emission limits for gas firings in Austria

BIOMASS	< 0.4 MW	> 0.4 – 1 MW	1 – 2 MW	2 – 10 MW	> 10 MW
Dust mg/m³	150	50	50	20	20
SO2 mg/m³	350	350	350	350	350
CO mg/m³	800	250	250	250	100

NOx mg/m³	500	500	400	400	200

Table 5: Emission limits for biomass firings in Austria

All limits apply with a remaining oxygen content of 11 %.

Currently the European MCP-Directive (EU 2015/2193), which regulates the emission limits for medium combustion plants, will be incorporated to national law. With the new law there will be stricter limits for SO2. Regarding dust, limits will be stricter for DHS with an output between one and two MW.

Subsidies

In Austria there are subsidies for installing a district heating system, but only for plants using renewable fuels. For the optimisation there are subsidies for the investment cost (environmental subsidies) – subsidies for new and expansion of existing RES DHS and optimisation of existing DHS.

The subsidy is a combination of fund from EU (14-20), Austria and the federal states of Austria.

Umweltförderung im Inland (environmental subsidies) – subsidies for new and expansion of existing RES DHS. The subsidy is a combination of fund from EU (14-20), Austria and the federal states of Austria.

The subsidy is between 25 and 35 % depending on some criteria. The subsidy is also limited by the tons of reduced CO2. Meaning that you have to proof that you reduce a certain amount of CO2. These subsidies are applicable to all renewable DHS forms. Additionally there subsidies for big solar projects by the Austrian Climate and energy fund. The subsidy for using solar in DHS is 550 € on the investment per MWh solar heat. The max. subsidy is 50 %.

Furthermore, there is a 15 % subsidy for technical optimization in the DHS, which leads to a reduced fuel consumption. And there is a 25 % subsidy for optimization on the customer side, which leads either to higher total efficiency of the DHS or to a reduced return temperature in the grid.

Permissions

Building permit and plant operation permit are required. The Building Act is a matter of the respective federal state and the execution of the operating license is based on the trade regulations, which is a federal law.

The approval procedure is carried out by the responsible district administration authority. Depending on the size and location of the district heating plant other permits, such as a permit under water law may be required.

For large plants with 50 MW or more of fuel heat output an environmental impact assessment is required.

Standards

For solid biofuels (chips, granules, wood) there are elaborated standards set of properties or a specification – standard ÖNORM EN14961 and ÖNORM EN ISO 17225 (8 parts), which consist of several parts. The first part describes the general classification of raw materials and the specifications of the products available on the market. This part is flexible and allows the manufacturer or the consumer to choose the appropriate set of product characteristics that corresponds to the production or the desired quality of solid biofuel, as the individual product parameters are not related to each other. It enables the manufacturer and the consumer to agree on a product specification in accordance with each situation. The standard ÖNORM EN 14961-1 defines which product features are normative (compulsory) and informational (voluntary).

In addition to the ÖNORM EN ISO 17225-1 there is also a national Austrian norm ÖNORM C 4005 with categorizes wooden biomass into four different classes.

Exploit our DHS services for you in Austria!

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2. DHS Market in Croatia

General information in the country

DHS has been active in major Croatian cities since 1970s and been playing an important role in the heating sector up to date. A major uptake was taken in Samobor in 1984 when HEP Toplinarstvo took over both production and distribution of network including all substations. In total, 16 Croatian cities have DHS which are operated by 11 companies – in total, there are around 110 DHS of different size and type. Total installed capacity is 1 800 MW, while the latest reports show that around 2 TWh were produced and distributed to end consumers through around 415 km of DH network. The whole DHS in Croatia supply heat, domestic hot water or steam to more than 155,000 customers.

Most of DHS use gas as the primary fuel, while almost all DHS use fossil fuel for either primary fuel or back up option. However, there are several smaller DHS, which use a certain kind of renewable energy such as biomass or geothermal. In numbers, that is slightly less than 1 % of total fuel used. There is no waste heat used in any of DHS.

Figure 2: Map of DHS and CHP in Croatia

Regarding the prices, as it will be described later, prices are regulated in accordance to the provision of the Act on Heat Market. Croatian energy regulatory agency adopts tariff item amounts for heat production and tariff item amounts for heat distribution. However, heat supply and customer fee are freely determined in accordance with market conditions. In other words, price is formed by summarizing regulated part of the heat price, while the fees for the heat supply and for the activity of heat customer are freely contracted. Here are prices for customers per city.

NAME OF COMPANY	CITY	HOUSEHOLDS		INDUSTRY AND SERVICE	
		Energy €/kWh	Capacity €/kW	Energy €/kWh	Capacity €/kW
HEP Toplinarstvo	Sisak	0.024	1.03	0.046	1.67
	Osijek	0.022	1.15	0.042	1.80
	Zagreb	0.023	0.78	0.046	1.64
	Zagreb: Dubrava	0.023	0.90	0.046	1.67
	Velika Gorica	0.041	1.52	0.046	1.73
	Samobor / Zaprešić	0.041	1.49	0.046	1.59
Brod plin	Slavonski Brod	0.039	2.29	0.045	2.29
Energo	Rijeka: Gornja Vežica	0.045	1.84	0.045	1.84
	Rijeka: Krnjevo	0.045	2.24	0.045	2.04
	Other	0.042	2.24	0.042	2.24
Tehnostan	Vukovar: Borovo Naselje	0.043	1.97	0.052	1.97
	Vukovar: Olajnica	0.043	1.97	0.052	1.97
Gradska toplana	Karlovac	0.039	2.18	0.051	2.31

Table 6: Prices for DHS in Croatia per city

In general, DHS sector in Croatia is quite old and in bad condition. Most of the systems have very high energy losses, while fossil fuels are predominant fuel used in almost all DHS. Also, DHS in most of cities have significant problems with the optimization, especially since there is a lot of smaller DHS systems instead of larger ones which requires more production units and higher operation and maintenance costs.

The general opinion of the society about DHS is not very positive. Currently, energy bills, which are one of the most important factors, are too high. There is a negative trend and perception of district heating systems in the public. Most of customers do know that district heating system in their cities use fossil fuels and there is a general acceptance of renewable energy sources and their integration in district heating systems, especially solar collectors and heat pumps. Biomass is also perceived as a good energy source, especially in comparison to fossil fuels (wooden pellets were evaluated as the best biomass energy source). Most of customers do not share the optimism when it comes to prediction of future

share of households which will use district heating systems. Instead, they predict it will either decrease due to high costs, limited distribution network and promotion of renewable individual heating systems or remain the same

Since the majority of DHS are in national ownership, as well as the distribution network, it could be said that a proper development of DHS and energy transition to renewable energy and higher energy efficiency is a national interest. However, there is no significant political support.

Use of renewables in DHS

Biomass

Although the biomass is quite often used for heat generation in DHS, Croatia has only few small biomass CHP which produce heat and domestic hot water for DHS. One of examples is REGEA's project for small community-owned biomass CHP in Pokupsko, Croatia – 1 MW which supply heat to around 30 customers.

Apart from that, biomass, namely firewood is mostly used in rural area as an individual heating option since its availability, price and low investment costs. In addition to this, numerous buildings have already evaluated the feasibility of biomass usage and many public and private buildings, including Energy Centar Bračak are producing heat by burning different types of biomass – wood chips or pellets.

In general, biomass is always included in different scenarios in feasibility studies for individual heating options, but current market conditions put biomass behind fossil fuels due to fuel prices, magnitude of investment and other costs. The supply of wooden biomass varies, with farmers, biomass trade centers and forest associations as well as the federal forest.

In the future, biomass could be promoted as an alternative option for fossil fuels, especially since 99% of DHS in Croatia are fuelled by gas and extra light fuel oil. However, current political situation and opinion is not favourable since gas has been chosen as a main fuel in heating sector. In addition to this, a general perception of the society about biomass is that it could be used better in decarbonisation of transport, while heating sector should be successfully decarbonised by using solar-thermal energy, electricity (heat pumps) and geothermal energy.

Excess/waste heat

In recent years, the idea of using excess heat in heating sector has appeared numerous times, especially in areas where CHPs are used since efficiency and operational costs of DHS could be highly improved. However, the usage of excess heat is almost non-existent due to several reasons. Firstly, there are not many sources of excess heat in areas where DHS exist. In addition to this, there are not either many industry zones due to bad economic situation in Croatia – in other words, excess heat potential has been degraded over the years. The available excess heat can come from paper mills, metallurgical plants, cement

plants, textile industry, etc.

On the positive side, there is already a heat roadmap Europe where excess heat and relevant information for Croatia can be seen. This can be used for a long-term planning of heating sector including DHS, heat distribution network, usage of excess of heat.

The use of excess/waste heat is accepted in the society, but there is lack of awareness and knowledge about this type of heating. The political opinion on using excess and waste heat is positive. Politicians decide on awarding of subsidies. They know that it is necessary to use heat efficient to reach climate and energy goals. Therefore, they understand the need to utilize excess/waste heat.

Solar-thermal energy

The sector is yet to be fully developed in both individual heating and DHS. However, solar thermal energy can be perceived as the most ambitious alternative to fossil fuels.

There are many houses which have great feasibility for integration of solar thermal energy. In addition to this, many public buildings which have individual heating have been evaluating this option, while several of them included solar thermal energy as current or future energy source for heating and domestic hot water preparation.

In DHS, there is a great example of good practice in Vukovar where a local district heating owner and operator (Tehnostan Ltd) installed first Croatian solar thermal district heating system with 160 solar thermal collectors, while the total number of collectors will be around 550. When the whole project ends, the DHS in Vukovar should have around 1 MW of thermal output, while heat pumps and PV will be integrated as well.

Current political situation can be understood as being in favour of solar thermal energy, especially since our national energy company and its daughter company (HEP Toplinarstvo) has been reconsidering solar thermal energy as their main or complementary energy source in several DHS such as Samobor, Velika Gorica, Zaprešić, Rijeka, etc. In terms of individual heating, solar thermal energy is occasionally subsidised by Croatian Government through the Energy Efficiency and Environment Protection Fund.

In the society, thermal solar projects are well accepted with the moderate awareness and knowledge. Both individual users and decision makers are slowly changing their focus from fossil fuels to at least one of combination which include solar thermal energy.

Geothermal energy

One of energy source which could definitively take a relatively high share in Croatian heating sector is geothermal energy due to several reasons. Firstly, due to geographical position, Croatia has a moderately high geothermal potential which is yet to be measured and publicly acknowledged.

As for now, geothermal energy has been used in many medical resorts and spas, but also there is a 35 MW large heat production unit which uses geothermal energy of a constant output. In addition to this, there has been many attempts of a proper examination of

geothermal potential in several Croatian areas including areas around Samobor, Zaprešić and the city of Velika Gorica. Also, a new children hospital in Zagreb could use geothermal energy for both electricity and heat generation if final feasibility studies will prove its feasibility over fossil fuels and other alternative options.

Generally, both society and politics have a positive opinion about geothermal energy, but there is lack of awareness that it can be used for electricity and heat generation instead for medical resorts and spas. However, further examination of geothermal potential is very expensive, especially after the national oil company which performed these examinations were sold to foreign investor.

Legal framework and subsidies

Emission limits

Currently, emission limits are regulated by the EU-ETS (European Union Emission Trading System) for production units with the thermal output higher than 20 MW. In Croatia, around 9 big heat and electricity production units are regulated by the EU-ETS. In addition, several Acts and Laws are complementary with EU-ETS in order to monitor, verify and report on CO2 emissions in Croatian energy sector. There are several approaches of improving the whole EU-ETS in Croatia, but the clear path and concrete measures are yet to be defined.

Subsidies

Currently, there are no direct subsidies for development of DHS or integration of renewable energy sources in DHS. However, there are several side measures which can be used in DHS sector such as subsidy for highly efficient cogeneration which puts high efficient CHP in favour when it comes to selling heat and electricity produced in such plants. In other words, if CHP achieves high cogeneration, the Croatian Government guarantees buyout of produced heat and electricity at a certain agreed price.

Also, there are individual subsidies for solar thermal energy and PV, while numerous possibilities for using EU funds are available, especially for capitalization projects and projects of energy efficiency increase and integration of renewable energy.

Permissions

In terms of specific permissions needed for building and operation of DHS, there is a standardized approach which includes location permit, building permit, heat supply contract and similar. In case of large plants, an environmental impact assessment is required to evaluate the impact on ecosystem.

Exploit our DHS services for you in Croatia!

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3. DHS Market in the Czech Republic

General information about the country

The district heating is an important sector in the energy industry of the Czech Republic, providing heat needs to 1.7 million households and a significant share of industrial heat demand. The current district heating infrastructure includes over 2 000 licensed heat plants of which 1,800 have a thermal output of over 5 MWt and 7.5 thousand km of heating networks covered by a heat distribution license. There were 212 efficient district heating systems within the meaning of definition in energy efficiency directive (2012/27/EU) in 210 cities recognized in the Czech Republic by Energy Regulatory Authority in April 2018. These data consist of 663 companies with a license for the production of thermal energy and 651 companies with a license for the distribution of thermal energy.

The Czech Republic is one of the countries with a traditionally high share of district heating systems. In the European context, due to the penetration of 41% of households, the district heating system can be described as highly developed, although there is still considerable space for improvement in terms of distribution network and technology efficiency. The general opinion on heat from DHS is positive; it is a convenient and reliable way of heating. The political opinion on heat from DHS is also positive, it saves the environment. District heating is supported by the State Energy Concept.

District heating sector has to face many challenges in recent years. The most significant is the slightly decreasing heat consumption over the long term. This is due to lower demand for heat from both the industry (the importance of heavy industry is decreasing, companies are investing in energy savings) and households (thermal insulation of houses, disconnection from district heating systems, installation of measuring and control devices). Warm weather, higher prices and unfavourable economic situation was also reflected in the consumption decrease, mainly in the residential sector. In terms of the thermal energy supply to individual sectors, supply to households (41%) and the service sector (25 %) dominate, the supplies to industry account for 34 %.

Growing regulatory requirements especially for environmental protection (emission limits, involvement in emission allowance trading) have significant impact on the heating sector. In addition, there is a need for investment in heating infrastructure or in recent years a decreasing price of electricity.

District heating sector faces long-term economic discrimination compared to a local heat production. This market distortion has now escalated due to the reform of the emission market, which was endorsed by the European Council in February this year. The price of greenhouse gas emission allowances increased almost four times in one year.

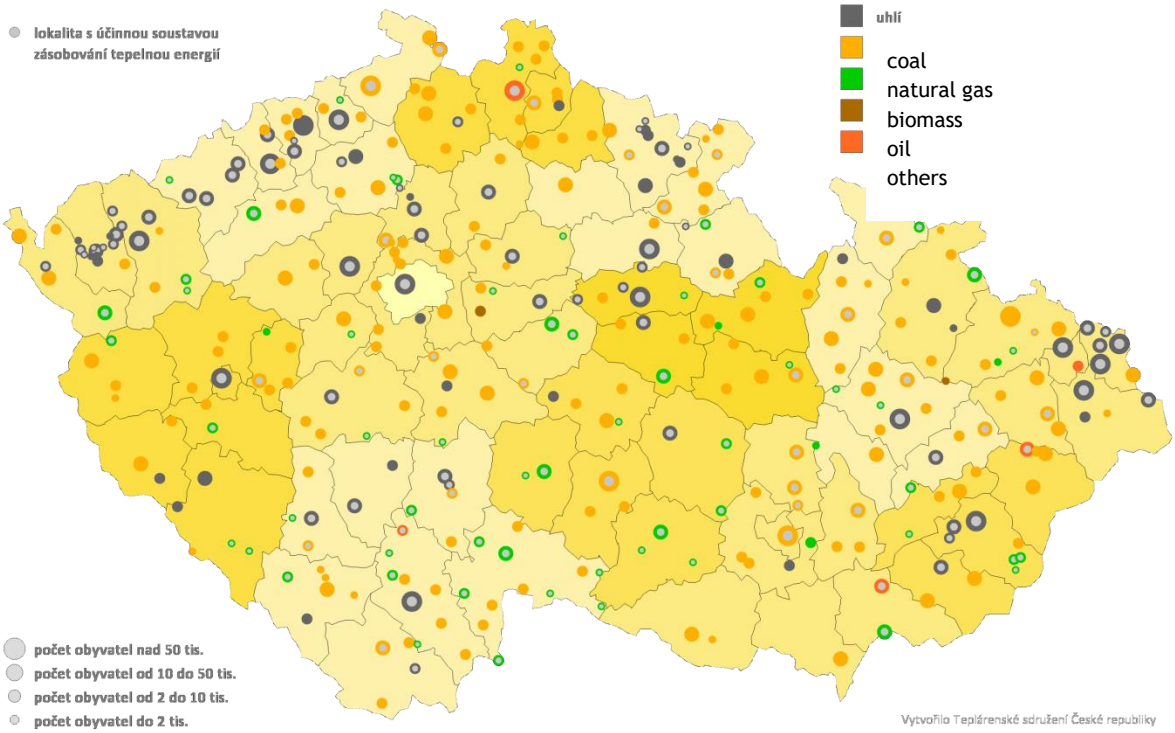

Figure 3: Map of DHS with dominant fuel designation and high efficiency heat supply system in the Czech Republic

With regard to the fuel mix of heat produced by the district heating sector in the Czech Republic over the last 10 years, coal is the dominant fuel. The share of coal consumption for heat production in DHS has decreased from 65 % in 2010 to 58 % in 2017. Coal is used mainly in heating plants that produce heat based on the principle of combined heat and power production (CHP). The share of heat produced in CHP technology was 66 % in 2017. Thus, it can be confirmed that coal is a crucial issue for district heating. The second fuel used for heat production in DHS is natural gas. The share of natural gas has remained at the level of 30 % over the last 10 years. The share of RES increased continuously from 3 % in 2010 to 8 % in 2017. The share of petroleum products is negligible and has decreased in the last decade. Currently, it accounts approximately 1 % of the heat generation resources.

The component objectives in the fuel base for DHS include supporting the shift particularly of medium and small-sized heat supply systems over to multi-fuel systems making use of locally available biomass, natural gas, as well as other fuel, where in particular natural gas will play the role of a stabilising and supplementary fuel.

The component objectives for secondary sources of energy and waste include priority support to direct (thermic) use of non-recyclable waste without prior treatment for co-generation heat supply systems in accordance with environmental protection, in particular atmospheric protection.

Main competitor for district heating in the heating market is direct use of natural gas (natural gas boilers) and heat pumps. District heating and natural gas have currently comparable

market share and together comprise over three quarters of heat market in terms of number of households served. Electricity is becoming more fashionable especially with heat pumps, even though available statistics do not cover heat pumps specifically (they are surveyed under electric heating most of the time). Biomass boilers are also becoming increasingly popular in the Czech Republic.

In terms of prices, despite significant investments in reducing emission pollutants such as dust, sulphur dioxide or nitrogen oxides, heat prices in the Czech Republic have stagnated since 2015. However, in 2019 their growth should be expected. The main reason is the mentioned increase in the price of allowances and decrease of their free allocation for heat production. In addition to allowances and taxes, the heat price also reflects the fuel used to produce thermal energy and the cost of repairing and maintaining the equipment, as well as other operating costs.

Practically all heat production from coal is burdened with the purchase of allowances, in the case of heat production from natural gas it is approximately 60 %, because the block boiler rooms in housing estates usually do not fall under this obligation.

The main reason for the increase in heat price is the increase in the cost of greenhouse gas emission allowances. VAT also plays a part in the price of heat. This will be newly charged at a lower rate. MEPs agreed to reduce VAT on heat from 15 % to 10 % from 2020.

AVERAGE PRICES OF HEAT FROM PRODUCERS BY FUEL INCL. VAT IN 2017	€/GJ
Coal	13.7
Natural gas	18.5
Biomass and other RES	10.4
Oil	16

Table 7: Average prices of heat from primary distribution by fuel in the Czech Republic

Use of renewables in DHS

State energy policy sets the target of at least 20 % of heat supply from DHS to be covered by renewable energy sources and at least 60 % by heat from CHP by 2040. Biomass is the only supplementary systemic renewable energy source which is available on a larger scale in the Czech Republic for the needs of the heating sector. Other forms of renewable sources are limited for heating sector purposes for technical and other (socio-environmental) reasons. The potential of geothermal energy is for the moment untested, but according to preliminary analyses may be significant. The use of geothermal energy is for the time being associated with high costs. Wind and water energy are not suitable for heating purposes and the use of solar energy does not have sufficient potential for centralised heating supplies. Growing importance is attached to the use of biogas, first of all in agriculture.

The main objectives for heat generation and supply include supporting the use of biomass,

other renewable and secondary sources and the maximum use of waste in combination with other fuels for heat supply networks, particularly for medium and small-sized source and reasonable collection distances.

Biomass

The use of biomass for energy purposes is traditional in the Czech Republic and in the last 20 years it has been a developing field of economic activity. Although the amount of biomass energy produced cannot compete significantly with other primary energy sources, it is taking an increasingly important complementary position in the energy mix of energy sources in the Czech Republic.

The development occurred mainly in the area of energy crops; on the other hand, there has been a lack of a fully functioning biomass market to ensure sufficient biomass use on the market and the corresponding diversification of resources and stable conditions for the development of the sector. The use of biomass is not sufficiently efficient, as well as lack of planning in this area, particularly with regard to the expected increasing demand for biomass resources. According to the Ministry of Industry and Trade, the current biomass consumption in the Czech Republic is sustainable and energy production from it has been growing in the long term.

In the future, an increasing trend in energy use of biomass can also be expected as a substitute for fossil resources. According to the National Renewable Energy Action Plan, the use of biomass in final energy consumption will increase up to 36 PJ by 2020 (without considering biomass in households). However, it will continue to face a physically availability of biomass supply. An analysis of the Ministry of Agriculture estimates the mean potential of available agricultural biomass 161 PJ and available forest dendromasses 28 PJ. Demand for biomass after 2020 will be influenced in particular by the new legislative framework at EU level given by the revision of the Renewable Energy Directive, the setting up of support schemes for the production of electricity and heat from biomass in the Czech Republic and neighbouring countries, since biomass is considered emission-free energy from the point of view of emission trading. If aggressive support schemes are introduced in one of the neighbouring countries, especially in Germany, or if the price of greenhouse gas emission allowances increases significantly, there is a significant increase in biomass demand in the CEE region, which will not be able to satisfy domestic production and the biomass price will rise. In this case, there is a need to worry about the situation where biomass will be massively exported from the Czech Republic to foreign countries at the expense of domestic consumers.

Excess/waste heat

Utilizing waste heat represents one of the ways of increasing energy efficiency. Multiple programs that offer financial support in energy efficiency are available in the Czech Republic. However, none of them is focused on waste heat utilization. Despite little attention from the government, the potential is significant and numerous projects can be found all over the country.

The potential of waste heat in the Czech Republic was unofficially estimated at around 5

PJ, but the view is very conservative, given a significant amount of waste heat available from district heating system. The heat is sometimes utilized by the enterprises to cover their own heating/electricity demand, but usually it goes unnoticed and the potential is wasted. The Czech Republic seems to be well prepared in terms of the technical infrastructure (1.5 million of households use district heating system), but does not have the right institutions to support waste heat utilization.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 695989.

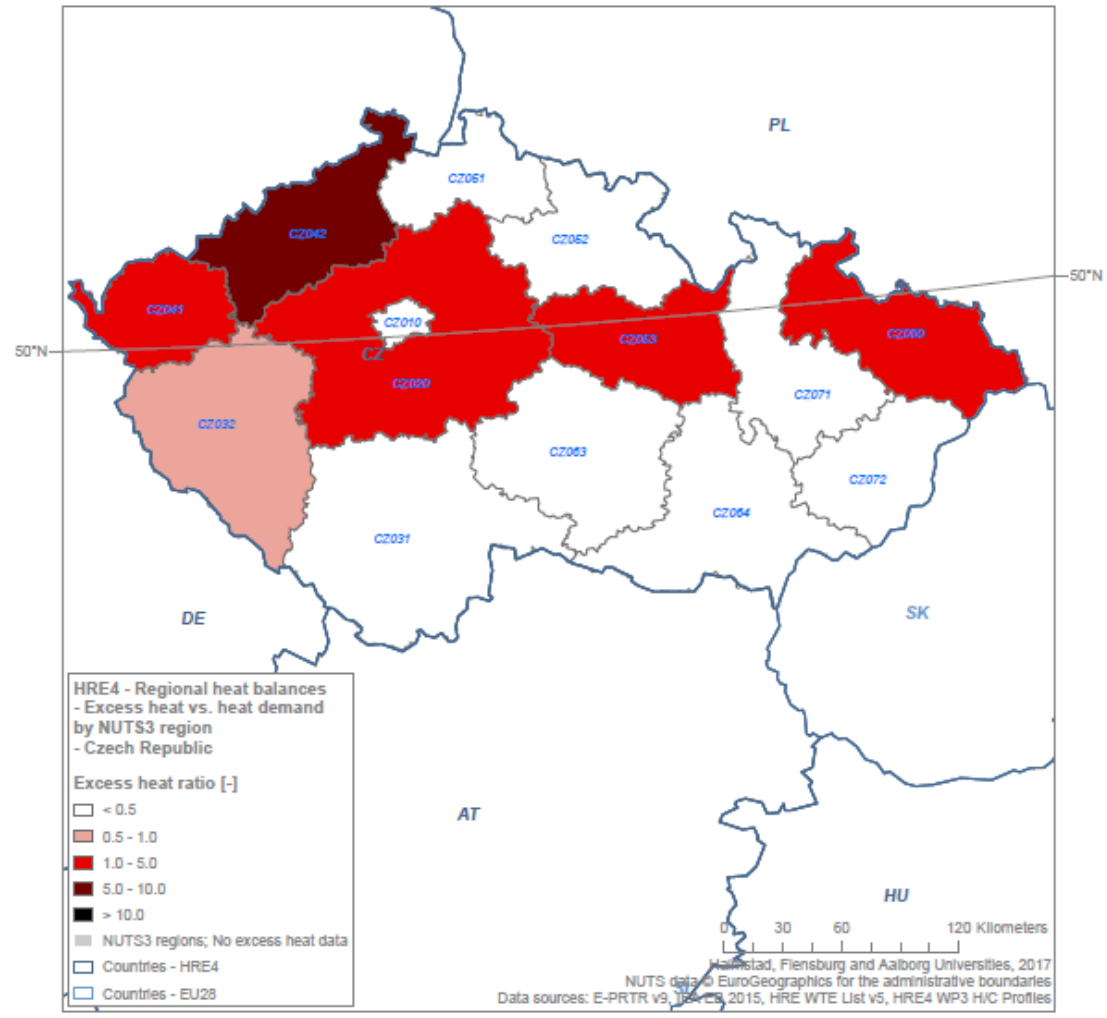

Figure 4: Map of regional heat balances – Excess heat vs. heat demand in the Czech Republic

As the European Union Directive on Energy Efficiency (2012/27/EU) set the goals of increasing energy efficiency and lower energy dependence on sources, the new supporting schemes were announced in the Czech Republic. The European subsidies to increase energy efficiency are under Operational programs in the currently ongoing program period 2014-2020 (MIT, 2017).

The investors (who will not gain the financial support from operational programs) have a possibility to use bank concessional loans in the "ENERG" program (Czech-Moravian

Guarantee and Development Bank, 2017).

Although there is a financial support for waste heat utilization projects in the Czech Republic and there is a huge potential of energy savings in the area, there are barriers which decrease investor´s willingness to act. Huge amount of the regulations, long administrative processes in the public services and sometimes also the technological issues are the main barriers. Third party providers are rarely allowed to use the current network, which also prevents utilizing of a significant amount of waste heat. As the local energy concepts are the obligation just for regions, statutory cities and the capital city of Prague can´t often see and use the waste heat potential.

Current legislation, especially regarding feed-in tariffs, is associated with many regulatory restrictions. This means, that e.g. supplying waste heat into the existing networks may be interpreted as changing installation's parameters and the installations may lose the subsidies as a result.

Some ways of utilizing waste heat require a massive infrastructural investment, which do not show the rate of return that would satisfy the private investors. In such situation, it is needed to provide the minimal required financial support in the form of subsidy, because the social benefits are significant (e.g., improved air quality in the village, lower morbidity). However, the subsidy for a large infrastructural investment is not easy to obtain, despite a large amount of resources in the grant schemes focused on energy savings in the Czech Republic (e.g., OPPIK program).

The situation will not improve unless specific activities focused on the changes in the institutional settings of the waste heat utilization in the Czech Republic are implemented.

Legal framework and subsidies

Energy law (458/2000 Col.) lays down all basic conditions for operation of DH systems, licensing, customer rights, emergency procedures, heat metering and heat price regulation. Heat prices are regulated by Energy regulatory office based on justified costs and reasonable profit. Change of energy carrier (e. g. switching from steam to hot water) has to be announced to customers at least one year in advance by DHS operator. Customers need to adapt technology on their premises to this change on their own costs or quit heat supply contract. Customers can disconnect from DH but need to get building permit. In order to obtain the permit, customers need to show that local heating system is more economically suitable for them. In case of disconnection customer has to cover the cost directly related to disconnection. All the requirements apply only to DHS. There are no transparency requirements for companies offering local boilers or other equipment. Customer protection regarding informed choice of most economically suitable heating solution is almost non-existent.

Operators of DHS with plants included in EU ETS face massive economic discrimination as they have to buy emission allowances while there is no carbon tax imposed on local heating sources. This will be partially rectified by decreasing of VAT on heat from 15 to 10 % effective from January 1st 2020. DH companies are required to measure heat supplied

to customers.

Emission limits

Emission limits are based on EU legislation – Directive 2010/75/EU on industrial emissions (for installations above 50 MW installed thermal input) and Directive 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plants (for installations below 50 MW installed thermal input).

Emission limits for existing Medium combustion plants (below 50 MW installed thermal input) in Czech Republic from 20.12.2018 to 31.12.2024:

O2 content:

Solid fuels: 6 %

Solid biomass: 11 %

Liquid and gaseous fuels: 3 %

COAL	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	100	50	30
SO2 mg/m³	-	-	1,500
CO mg/m³	400	500	300
NOx mg/m³	600	500	500

Table 8: Emission limits for coal firings in Czech Republic

OIL	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	-	50	30
SO2 mg/m³	-	-	1,500[1]
CO mg/m³	80	80	80
NOx mg/m³	200	200 450[1]	200 450[1]

Table 9: Emission limits for oil firings in Czech Republic; 1 for heavy fuel oil

GAS	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
CO mg/m³	50	50	50
NOx mg/m³	100	100	100

Table 10: Emission limits for gas firings in Czech Republic

BIOMASS	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	100	50	30
SO2 mg/m³	-	-	1,500
CO mg/m³	400	500	300 500[1]
NOx mg/m³	600	500	300

[1] It applies in the case of biomass combustion with the exception of the combustion of compacts from such biomass (e.g. biomass pellets)

Table 11: Emission limits for biomass firings in Czech Republic

Emission limits for existing Medium combustion plants (below 50 MW installed thermal input) in Czech Republic from 1.1.2025:

O2 content:
Solid fuels: 6 %
Solid biomass: 11 %
Liquid and gaseous fuels: 3 %

COAL	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	100	50	30
SO2 mg/m³	-	1,100[1]	400 1,100[2]
CO mg/m³	400	500	300
NOx mg/m³	600	500	500

[1]Applies from 1.1.2030
[2] For installations below 20 MW installed thermal input

Table 12: Emission limits for coal firings in Czech Republic

OIL	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	-	50[1]	30[1]
SO2 mg/m³	-	350[1]	350[1]
CO mg/m³	80	80	80
NOx mg/m³	200	200 450[1]	200 450[1]

[1] For heavy fuel oil and similar fuels

Table 13: Emission limits for oil firings in Czech Republic

GAS	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
CO mg/m³	50	50	50
NOx mg/m³	100	100	100

Table 14: Emission limits for gas firings in Czech Republic

BIOMASS	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	100	33	30
SO2 mg/m³	-	133[1]	133[1]
CO mg/m³	400	500	300 500[2]
NOx mg/m³	600	433	433

[1] It does not apply in the case of wood biomass only combustion, for combustion of straw applies emission limit 200 mg/Nm3

[2] It applies in the case of biomass combustion with the exception of the combustion of compacts from such biomass (e.g. biomass pellets)

Table 15: Emission limits for biomass firings in Czech Republic

Emission limits for new Medium combustion plants (below 50 MW installed thermal input) in Czech Republic

New plant = combustion plant put into operation after 19 December 2018:

O2 content:

Solid fuels: 6 %

Solid biomass: 11 %

Liquid and gaseous fuels: 3 %

COAL	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	100	50	20 30[1]

SO2 mg/m³	-	400	400
CO mg/m³	400	500	300
NOx mg/m³	600	500	300

[1] *For installations below 20 MW installed thermal input*

Table 16: Emission limits for coal firings in Czech Republic

OIL	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	-	50[1]	20[1]
SO2 mg/m³	-	350[1]	350[1]
CO mg/m³	80	80	80
NOx mg/m³	200	200	200

[1] *For heavy fuel oil and similar fuels*

Table 17: Emission limits for oil firings in Czech Republic

GAS	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
CO mg/m³	50	50	50
NOx mg/m³	100	100	100

Table 18: Emission limits for gas firings in Czech Republic

BIOMASS	> 0.3 – 1 MW	1 – 5 MW	5 – 50 MW
Dust mg/m³	100	33	13 20[3]
SO2 mg/m³	-	133[1]	133[1]
CO mg/m³	400	500	300 500[2]
NOx mg/m³	600	333	200

[1] *It does not apply in the case of wood biomass only combustion*
[2] *It applies in the case of biomass combustion with the exception of the combustion of compacts from such biomass (e.g. biomass pellets)*
[3] *For installations below 20 MW installed thermal input*

Table 19: Emission limits for biomass firings in Czech Republic

Subsidies

Grant resources in the Czech Republic can be divided into two basic groups according to the source of funds. After the Czech Republic's accession to the European Union, European subsidy programs are offered (mostly partly co-financed from the state budget of the Czech Republic), which are suitably complemented by national subsidy programs (fully covered from the state budget of the Czech Republic).

DHS in the Czech Republic can receive subsidies from the Operational Program Enterprise and Innovation for Competitiveness and Operational program Environment for the modernization of its facilities and increasing the use of renewable energy sources.

Operational Program Enterprise and Innovations for Competitiveness gives the investor a possibility to meet the evaluation criteria in the priority axis 3, specific goal 3.2 “Increase of energy efficiency of the commercial sector”. The main criteria are CO2 emissions reduction and final energy consumption reduction. It offers a funding for small (50 % of eligible costs), middle (40 %) and large (30 %) enterprises (MIT, 2017). There is also a possibility to invest through the specific goal 3.4 “Use of low-carbon technologies in the fields of energy treatment and secondary raw materials usage” or specific goal 3.5 “Increase of the efficiency of the district heating systems”, where the main criteria are energy savings and CO2 reduction as well (MIT, 2017).

Operational program Environment, which is held by the Czech Ministry of Environment, offers the financial support to the potential investors through three priority axes (“Improving the quality of air in towns and cities”, “Waste and material flows, environmental burdens and risks” and “Energy savings”). The subsidy ranges between 35% and 70% depending on specific criteria.

Permissions

Several types of permits are required for the construction and operation of DHS:

1) Decisions on location

2) Building permits pursuant to the Building Act,

3) Permit of operation under the Act on Air Protection or the Act on Integrated Prevention for Operation

The heating plant must be licensed to produce and distribute thermal energy under the Energy Act.Pursuant to Act No 406/2000, a building contractor, housing association or building owner must, during the construction of new buildings or during a major change to an existing building with an energy source with installed heat generation capacity greater than 200 kW, arrange for an energy assessment to assess the technical, economic and environmental feasibility of alternative systems of energy supply, which also include heat supply networks.

Under Act No 201/2012 on air pollution as amended legal entities and individuals are obliged, if it is technically possible and economically acceptable for them, for new buildings and for changes to existing buildings to make use for heating of heat from a heat supply network or a source which is not a stationary atmospheric pollution source.

Standards

In September 2015, DHS Brno successfully passed the certification audit within the implementation of the ISO 14001 standard and received the ISO 14001 Environmental Management System certificate.

In September 2015, DHS Brno also successfully passed a certification audit within the implementation of the ISO 50001 standard and obtained the ISO 50001 Energy Management System Certificate.

In the period from 30 September 2014 to 1 October 2014, DHS Brno successfully passed an audit within the implementation of the ISO 9001 standard and obtained the ISO 9001 Quality Management System certificate, which is one of the management tools of the company.

On 30 May 2014, DHS Brno successfully passed an audit in the implementation of ISO 27001 and obtained the ISO 27001 Information Security certificate. This certificate serves to ensure the protection and safety of all important assets of the company, i.e. information, property and persons.

The National Quality Award in the Start Plus - Successful Company program was awarded to DHS Brno in November 2017. They became the first 100% urban company ever to succeed in this prestigious competition. National Quality Awards have been awarded in the Czech Republic since 1995 and differ significantly from other similar awards. Their evaluation uses the Excellence Model created by the European Foundation for Quality Management (EFQM), which can objectively compare individual companies regardless of size and area of business. National quality awards are awarded in more than eighty countries worldwide.

DHS Brno has undergone strict evaluation in the areas of strategy, strategic, financial and personnel management, customer approach and perception of the company by its surroundings. The award confirms that strategic management processes are well set up in the company and can adapt to market opportunities and eliminate potential threats. In addition, the indicators identified also point to further improvement.

Exploit our DHS services for you in the Czech Republic!

The information found here in this chapter provides you with a first general impression about the DH market in the Czech Republic. If you do not know how your own situation matches up to these national ones, then contact us so we can help you find out. As we have already supported other Czech DH companies, our entire consortium is also happy to offer you our valuable services. We can help converting your ambitious DH ideals into real actions on the ground, by creating meaningful feasibility studies with market-ready scenarios, as well as creating tailor-made business models. Similarly, we are here to help you find your way through the legal framework, and can guide you in navigating through

potential subsidies, permits and standards relevant to you. To find out more about these and many other services we offer (e. g. trainings, achieving investment, strategic planning, …), please contact our consortium (info@keepwarmeurope.eu), or even more directly to our Czech partner **Teplárenské sdružení České republiky**, tscr@tscr.cz, hajek@tscr.cz, vecka@tscr.cz, buganova@tscr.cz.

4. DHS Market in Latvia

General information on the country

In Latvia, consumers' heat supply is provided through centralized heat supply systems, local heat supply and individual heat supply. In Latvia heat energy is produced in boiler houses and CHP plants, while producing electricity. Over the past 10 years, the distribution of heat produced in boiler houses and cogeneration stations has changed significantly. In 2005, 47.1 % of the total produced thermal energy was produced in cogeneration plants, 52.9 % in boiler houses, while the share of thermal energy produced in cogeneration stations in 2015 increased by 27.4 % to 74.5 %. Analysis of the use of biofuel in Latvia shows that it has been very active in the last 10 years. During 2007-2014 total number of coal boiler houses was reduced from 22 to three, while the number of heat sources using natural gas as a fuel was reduced from 296 to 267. The number of biofuel heat sources increased by 2.5 times, and installed capacity in 2014 was three times larger compared to 2007.

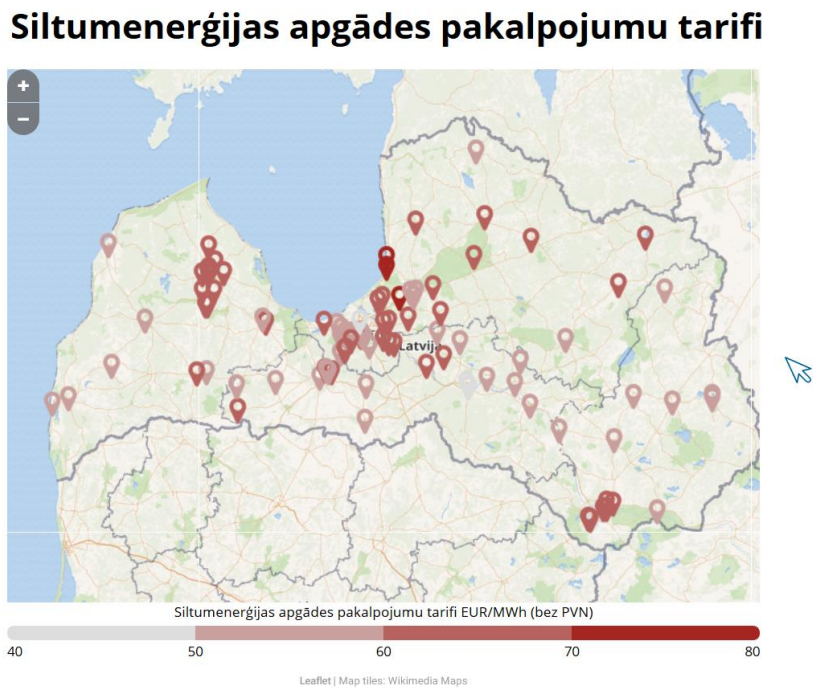

Figure 5: Map of DHS and CHP in Latvia. © Public Services Regulatory Commission

In 2015, heat energy was generated by 618 boiler houses with an installed heat output of 2524.4 MW and 183 CHP plants with an installed electric capacity of 1275.1 MW. Most of the heat generated in district heating systems is produced in Riga. In 2015, 3,598 GWh of thermal energy or 50.9 % of the total produced thermal energy were produced in Riga, 991 GWh (14.0 %) in the surrounding of Riga (Pieriga) region, 698 GWh (9.9 %) in the Latgale region, 684 GWh in the Kurzeme region (9,7 %), in Zemgale region - 612 GWh (8.6 %), Vidzeme region - 489 GWh (6.9 %). The central heating supply customer structure has not

changed in recent years, with central heating accounting for 65-70 %, hot water supply - 30-35 %. The main consumer of heat energy is households. In 2015, 5,862 GWh of thermal energy were consumed in final consumption. The total final consumption of district heating energy for households was 3,917 GWh, for the commercial and public sectors – 1,453 GWh, for industry and construction - 403 GWh and for agriculture - 89 GWh.

Fuelwood and natural gas are fuels, which are mainly used in the production of heat energy from boiler houses. It is essential that the share of local and renewable energy (fuel wood) increases each year, reducing the proportion of natural gas. For example, in 2012, 37.8 % of heat energy was produced from fuel wood, but 58.6 % from natural gas in boiler houses. In 2015, the distribution of fuel has changed significantly - the share of natural gas has decreased by 20.6 %, while the share of fuel wood has increased by 23.0 %. In Latvia, natural gas is used as the main fuel for electricity and heat production in CHP plants. In 2015, 78 % of electricity and 68 % of thermal energy were produced in CHP plants using natural gas.

Talking about prices:

FOSSIL FUEL	PRICE, 2015[1]	
	€/t	€/kWh
Liquefied petroleum gas	0.7 euro/liter	
Electricity		0.165
Coal	144.95	
Natural gas	0.565 euro/m^3	
Wood	36.93 euro/m^3	
Briquettes	130.82	
Granules	152.06	

Table 20: Typical prices for fuels in Latvia

As the district heating systems in cities of Latvia are well developed most part of multi-residential buildings (built in 1960`s- to nowadays) are provided with heat by DHS. Mainly there are one district heat provider in local city or county, so there is no other option for this service. Historically in socialism when heat energy did not cost almost anything, it was provided all year without economic justification, but with renewing of independence of Latvia almost 30 years ago, when transition to market economy started, DHS operates according to market rules, meaning costs justification and appropriate fee setting for provided services. And here problems – negative opinion from older part or poor part of society who faces energy poverty (inability to pay their heat bills) arises. But gradually within different energy efficiency improvement measures for both sides (for consumers with retrofitting of multi-residential buildings and for DHS with retrofitting of their networks, grids, etc.) this negative opinion is diminishing because residents pay for that amount of heat energy, they have really consumed.

[1] CSB, http://data.csb.gov.lv/pxweb/lv/vide/vide__energetika__energ_pat/EPM394.px/table/tableViewLayout1/?rxid=9777f82b-9f68-475c-9a33-a05b0175b0b5

Political opinion in Latvia regarding operation of DHS is positive and supportive – it is regulated field. Latvia`s energy policy is implemented in accordance to the EU energy policy. Heat supply is an important part of the quality of life of the inhabitants of Latvia, taking into account climatic conditions. The heat supply needs to be efficient, affordable and environmentally friendly, and this is one of the energy sectors governed by the state. District heating is organized by municipalities in its administrative territory, as well as it promotes energy efficiency and competition in the heat supply and fuel market.

Use of renewables in DHS

Biomass

Studies of the Latvian State Institute of Forestry “Silava” show that maintaining a prudent long-term forest development level of 12 million m^3 per year, the annual amount of available biofuel in the forest, in the form of logging residues, is 36-43 PJ, of which today an effective use is made of up to 21 PJ, since the wood chip market price is still not high enough, but it is growing currently.

More than 50 energy-efficient biomass boiler houses have been built in Latvia, where wood chip boilers are installed and they produce heat energy in such cities as Balvi, Cesis, Ludza, Tukums, Ventspils, Salaspils, Riga, as well as in other cities and regions.

In Latvia, biomass is a significant source of energy for CHP plants and district heating. Analysis of the use of biofuel in Latvia shows that it has been very active in the last 10 years. 2007-2014 the total number of coal boiler houses was reduced from 22 to three, while the number of heat sources using natural gas as a fuel was reduced from 296 to 267. The number of biomass heat sources has increased 2.5 times, and installed capacity in 2014 has tripled compared to 2007, the total installed chip boiler power tripled to 819 MW. According to the data of the Central Statistical Bureau, the consumption of fuel chips in Latvia in the last eight years (from 2008 to 2016) has increased 3 times, the consumption of wood residues has increased by 1.5 times, while wood consumption has decreased by 1.5 times. In 2017 in Latvia were 615 boiler houses, from which 333 are using biomass as fuel. According to Central Statistical bureau of Latvia in 2017 in Latvia were operating 50 cogeneration stations, in which as fuel is used biomass (chips and wood). In total there are 204 cogeneration stations. For thermal energy (boiler houses using biomass) in Latvia mostly are used such biomass resources as wood chips (40 %), firewood (30 %), wood pellets (20 %), fuel wood (8 %).

Excess/waste heat

Regarding waste derived fuels (WDF) - until now no one DHS is using WDF in DHS. There is ongoing building of regeneration equipment station for waste derived fuels or boiler house, which will use waste as fuel for district heating in the 6th biggest city of Latvia (40,679 inhabitants), named Ventspils Nominal production capacity of the regeneration equipment will be 8 MW for heating and 1.3 MW for electricity.

The cogeneration plant in Jelgava (“Fortum Jelgava”, Ltd.) is expected to use waste mass

next year in the production of heat. Initially, they would be 30 thousand tonnes per year, which would allow the heating tariff to be maintained at the current level and to reduce the amount of waste to be stored in the landfill.

Regarding excess heat and taking into account, that there are small number of industrial plants in Latvia that produce a large amount of heat, there is no separate collection of public information regarding the disposal of the industrial excess heat in district heating. In industrial plants there is a surplus of thermal energy which, in some cases, cannot be used because of too long distance between the plant and district heating plants. The theoretical potential surplus of thermal energy from industry companies close to energy consumers is 10 %.

Solar-thermal energy

Latvia is currently one of the last places in the European Union in the field of solar energy. This is due to the considerable costs of installing systems, both the period of repayment of invested funds, which lasts up to 15 years, and because renewable energy in Latvia has a negative image in relation to mandatory procurement components and support schemes. There are 335 solar microgenerators in Latvia for this moment, with two megawatts of total capacity installed (ten thousand times less than in the European Union). One kilowatt-installed system may produce up to 1,000 kilowatt-hours per year according to the climatic conditions of Latvia.

In Latvia there is one operating DHSusing solar thermal energy. In 2019 construction of one of the biggest sun district heating systems in Eastern Europe and the first such in Latvia – was carried out. There were installed 1,720 sun collectors with total active area 21,595 m^2, heat energy accumulation/storage tank with 8,000 m3 capacity/volume and 3 MW biomass boiler house. In general, a solar collector system, a wood chip boiler and a flue gas condenser are expected to produce 27,579 MWh of thermal energy per year. The company`s “Salaspils Siltums”, Ltd. planned diversification of energy sources in 2019/2020 heating season is: 46 % woodchips boiler, 34 % sun collectors and 3 MW woodchip boiler, 11 % gas boilers, 9 % condenser.

Legal framework and subsidies

Emission limits

There are Rules of Cabinet of Ministers No. 736 of 12.12.2017. of Republic of Latvia, where are determined emission limits for different types and sizes of combustion plants. For example:

NO.	FUEL TYPE	NOMINAL HEAT INPUT (MW)	EMISSION LIMITS (mg/Nm^3)			
			SO_2	NO_x	CO	DUST OR PARTICLES

1.	Gaseous fuels	To 50	35[2]	350	150	5[3]
2.	Liquid fuels	To 50	1,700	400	400	50[4]
3.	Solid fuels	To 10 10 -50	2,500[5] 2,300 [10]	600 600	2,000 2,000	1,000 500

Table 21: Emission limits or existing average capacity combustion plants in Latvia

NO.	FUEL TYPE	NOMINAL HEAT INPUT (MW)	EMISSION LIMITS (mg/Nm³)			
			SO_2	NO_x	CO	DUST OR PARTICLES
1.	Biomass	1-5 MW	200[6]	500	2,000	50
		5-20 MW	200[11]	300	2,000	30
		20-50 MW	200[11]	300	2,000	20
2.	Coal, brown coal, peat and other solid fuels (except biomas)	1-5 MW	400	500	2,000	50
		5-20 MW	400	300	2,000	30
		20-50 MW	400	300	2,000	20
3.	Diesel (gas oil)	1-50 MW	-	200	400	-
4.	Liquid fuels (except diesel)	1-5 MW	350	300[7]	400	50
		5-50 MW	350	300[12]	400	20
5.	Natural gas	1-50 MW	-	100	150	-
6.	Gaseous fuel (except natural gas)	1-50 MW	35[8] / [9]	200	150	-

Table 22: Emission limits for new average capacity combustion plants, applied from 20/12/2018 in Latvia

There are set also emission limits, which shall be applied from 1st January, 2025: for existing combustion plants with capacity from 5 to 50 MW (except gas turbines and engines); for existing combustion plants with nominal heating capacity from 1 to 50 MW, which are gas turbines and engines; and which shall be applied from 1st January 2030: for existing combustion plants with capacity from 1 to 5 MW (except gas turbines and engines).

Subsidies

There use to be available financial sources from the EU funds and and there are available financial means from banks as loans for improvement of DHSs. In the EU 2014-2020 planning period under program “Growth and employment” according to strategic support objective 4.3.1. “To promote energy efficiency and the use of local renewable energy sources in district heating systems” were supported to such activities:

- Reconstruction of DHS`s heat sources in order to increase its energy efficiency and transition to the use of renewable energy sources, covering purchase and installation of equipment;
- Reconstruction and building of heat energy transmission and distribution system in

[2] SO_2 emission limit for liquified gas is 5 mg/m³, low calorie gas, obtained from coke – 400 mg/m³ and low-calorie gas of blast furnace – 200 mg/m³.
[3] Emission limit for dust or particles of blast furnace is 10 mg/m3 and for gas created by metal processing industry – 30 mg/m³.
[4] If ash content of fuel mass is more than 0,06 %, emission limits for dust or particles is 100 mg/m³.
[5] SO_2 emission limit for biomass is 200 mg/m³.
[6] Value does not apply to equipment, where solid wood biomass is burned.
[7] Until 01.01.2015. – 450 mg/Nm³, if fuel oil is burned, which contains from 0,2 % to 0,3 % N.
[8] 400mg/Nm³ in relation to low calorie coke furnace`s gas and 200 mg/Nm³ in relation to low calorie blast furnace`s gas in iron and steel industry.
[9] 100 mg/Nm³ in relation to biogas.

order to decrease energy losses (consumption of fuels per 1 MWh) and in order to decrease consumed amount of fossil fuels (dependence of energy import) and in order to increase efficiency of boiler houses using RES;Reconstruction of cogeneration stations in heat source;

- Building and installation of heat energy accumulation equipment.

Type of support – grant in tune of 30 to 40 % of project eligible costs. Two rounds of calls have been concluded (in 2017 and 2018).

According to EU Energy Directive, Latvia has also introduced a state support mechanism for the promotion of renewable energy - mandatory procurement and guaranteed fees for installed electrical capacity. In Latvia, the costs incurred in supporting the generation of electricity from renewable energy sources or high-efficiency cogeneration are covered by all Latvian electricity end-users in proportion to their electricity consumption, since the price includes OIK (mandatory procurement component). This applies also to cogeneration stations, producing as electricity as heat.

Permissions

In Latvia district heating companies may operate in accordance to requirements contained in license in order to provide safe, regular and stable supplies with heat energy existing and potential energy users - economically justified in the quantity and quality required in accordance with environmental protection conditions. In license are determined operation zone and operation period (license for energy production, transmission and distribution is issued for 20 years, but for energy realisation for 5 years). Licenses are issued by state regulator – Energy Supply Regulatory Board. There is necessary license for entrepreneurship in the supply of heat on following conditions:

1. For the production of heat energy in equipment with a maximum load greater than 1MW;
2. For the transmission of heat energy through pipelines with a diameter greater than 200 mm;
3. For the distribution and sale of heat to any energy user if the volume of sales exceeds 20,000 MWh/year.

The transformation of the energy supply company by extending its existing facilities or installing new objects with a capacity exceeding one megawatt can be initiated upon receipt of a new license or amendment to a valid license. Building of new DHS shall be coordinated with the local municipality in which territory it will operate. The heat supply service is regulated if the total amount of heat is more than 5,000 MWh/year. In turn, small heat supply systems are not regulated in order not to impose an additional administrative burden on heat supply companies and thus not increase heating costs and tariffs. Similarly, heat trading is regulated by the so-called "boundary of ownership" with the user, usually up to the point of entry of the heat pipe in the building. The use of heat in the building is not a regulated service. At present in Latvia in average 240 heat supply services providers are

regulated (the number is variable), and regulated services account for 93 % of the total amount of the heating market. Most of the merchants are thermal energy producers. The regulator determines heat supply end-tariff for users for 58 heat supply companies provided services in different places of Latvia.

Standards

There are elaborated standards of solid biofuels (wood chips, granules, wood) set of properties or a specification – standard LVS EN 14961 and LVS EN ISO 17225 (8 parts), which consist of several parts. The first part describes the general classification of raw materials and the specifications of the products available on the market. This part is flexible and allows the manufacturer or the consumer to choose the appropriate set of product characteristics that corresponds to the production or the desired quality of solid biofuel, as the individual product parameters are not related to each other. It enables the manufacturer and the consumer to agree on a product specification in accordance with each situation. The standard LVS EN 14961-1 defines which product features are normative (compulsory) and informational (voluntary). There are elaborated standards also for terminology: EN 14588 and LVS EN ISO16559a, for fuel quality: LVS EN 15234 (6 parts) and ISO 17588 (in elaboration phase), for samples taking and preparation: LVS EN 14778, LVS EN 14780, prEN ISO 18135, prEN ISO 14780, for physical and mechanical properties: 15 EN standards,13 ISO standards, for chemical properties: 6 EN standards, 7 ISO standards.

Exploit our DHS services for you in Latvia!

The information found here in this chapter provides you with a first general impression about the DH market in Latvia. If you do not know how your own situation matches up to these national ones, then contact us so we can help you find out. As we have already supported other Latvian DH companies, our entire consortium is also happy to offer you our valuable services. We can provide networking services in order to help to get in contact with professional engineering and consulting services` providers for getting assistance in feasibility study or business plan elaboration. Similarly, we are here to help you find your through potential subsidiesrelevant to you. To find out more about these and many other services we offer (e.g. trainings, achieving investment, strategic planning, …), please contact our consortium (info@keepwarmeurope.eu), or even more directly to our Latvian partners **Zemgale regional energy agency** and E-Mail to: zrea@zrea.lv.

5. DHS Market in Serbia

General information in the country

The district heating systems in the Republic of Serbia began to develop more intensively in the second half of the 20th century. In the beginning, coal and oil were used as the primary energy source, and later in the construction of the gas pipelines from 1963, they began to use natural gas.

Most important fuel for household heating in Serbia is wood (34%), while 25.1% of households use heat from district heating (DH) systems (48.3% of urban households), 20.1% electricity, 10.5% coal and 9.6% natural gas. It should be noticed that electricity consumption is mostly by direct conversion to heat (via heaters and furnaces) and not for heat pumps or air condition units.

The total installed capacity of the DH systems in Serbia is 5,821 MW of heat in total, which is supplied by 58 public companies with their heat production plants situated on 255 locations. The average age of the heat production plants is 28 years.

Primary energy sources for heat production in DH plants are currently natural gas (77.7%), heavy and (13.5%) and coal (8.8%). In the last 5 years the consumption of natural gas has gradually increased by 5.5%, mostly at the expense of heavy oil.

Yearly production of heat in DH systems in Serbia is in the order of 7000 GWh, out of which 81% is distributed to domestic households and 19% to the commercial and public buildings. The billing method is based mostly on the m^2 of space being heated.

The total length of the heat distribution network is 2,354 km with an average age of nearly 23 years and has been constantly upgraded and enlarged (increased by nearly 300 km in the last 5 years). Estimated heat losses in the distribution system are around 12%.

The largest DH system is in the capitol city of Belgrade (2,868 MW). The installed capacity of the heat production plants in Belgrade is 49% of the total in Serbia, supplying heat to 49% of total households with 51% of total m^2 of heating space, and with a distribution network which is 31% of the total length of all DH distribution networks in Serbia.

Use of renewable energy sources (RES) and cogeneration of electricity and heat (in CHP units) in DH systems in Serbia has just started recently and is not yet statistically important. The number of plants using wood chips is increasing each year, reaching yearly consumption of nearly 7,700 tones. One newly built CHP unit is in operation, with an installed power of 10 MWe.

In many Serbian strategic documents (energy sector development strategies and implementation and action plans on country, regional and local level) the following is stressed in regard to the DH system: modernization and enlargement of the existing district heating systems with the aim of increasing energy efficiency in generation, transport, distribution and

heat use, reduction of the share of liquid fuel and coal and higher use of RES, and combined production of electricity and heat. Introduction of measuring of heat consumption of end users and applying the tariff system according to the heat consumed is also one of the specified priority actions. The planned cumulative investments in the district heating system by the year 2030 are estimated in the order of 550 million EUR.

Having all of the above in mind, it is not surprising that in our National Sustainable Development Strategy it is stipulated that the reduction of the heating energy has the highest potential for the increase of energy efficiency (even greater than 50%) through improvements in building insulation and decrease in use of electricity for domestic heating.

The following table shows the number of connected households on the district heating system in Serbia in 2017.

ITEMS	YEAR 2017	PERCENTAGE OF CONNECTION (%)
Number of connected households	627.458	-
Number of households-town	1.299.004	48.30
Number of households-other	587.966	-
Total number of apartments	1.886.970	33.25
Total number of households	2.497.187	25.13

Table 23: Number of connected households

When considering the total number of apartments in the Republic of Serbia, it is very important to note that most households use heat energy produced using wood, followed by heat from the district heating system, electricity, coal, natural gas and others.

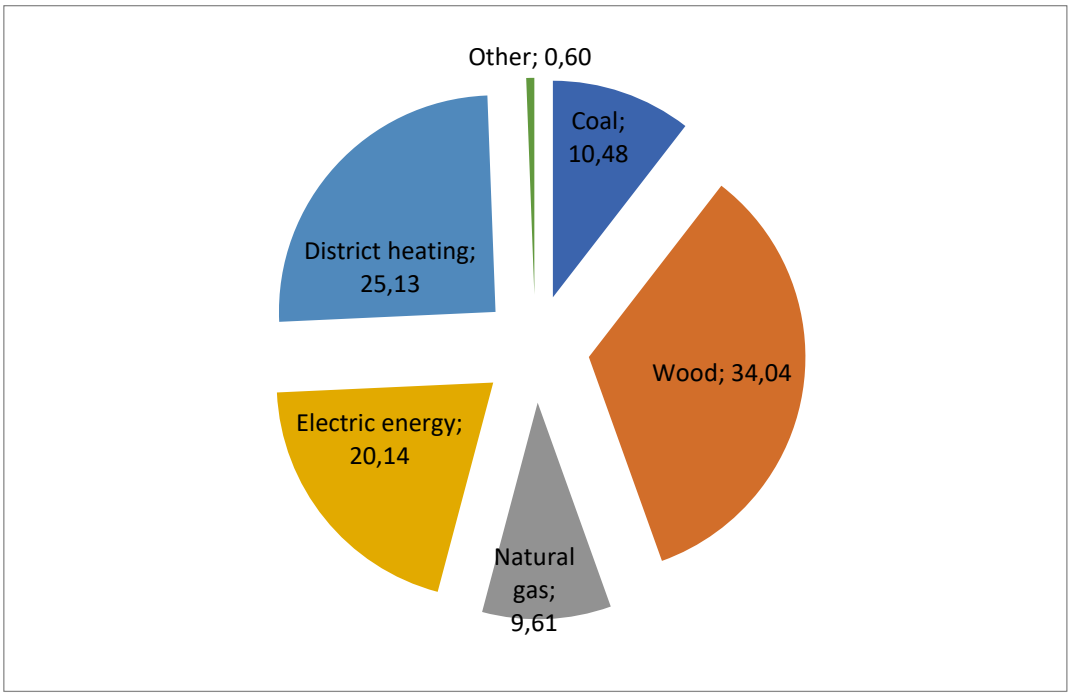

Figure 6: Way of heating in relation to all households in Serbia

The total area in the Republic of Serbia to which the heat energy was delivered to the owners in 2017 was 43.476.141 m2, and the structure according to the tariff groups is shown in Figure

2.

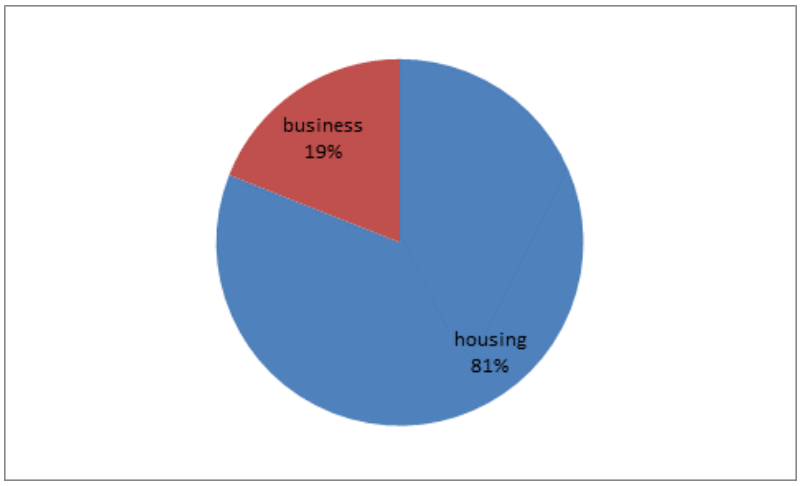

Figure 7: Percentage of customers by tariff groups in the Republic of Serbia

Compared to the European Union countries in the Republic of Serbia, there is still a low share of apartments that are connected to the district heating system. This suggests that further expansion of consumption is possible especially in urban areas.

The development of urban environments and the construction of energy-efficient buildings, the payment of heat energy according to consumption for each housing unit, the possibility of regulating the sale of heat energy in the substation and on each heating body and others should lead to a significant reduction in the final consumption of heat energy. The savings achieved without the construction of new heat sources could represent the energy available to new consumers.

The emissions of CO_2 from the district heating system in the Republic of Serbia in 2017 amounted to 1.551.348 t depending on the quantity of used energy sources. Figure 3 shows the emissions of CO_2 in the district heating systems of Republic of Serbia in the period 2013-2017.

Table 2 shows the emission CO2 for different energy products expressed in kg/GJ of produced energy. It is noted that natural gas has the lowest emission and biomass the highest emission of CO2. Biomass belongs to renewable energy sources and is treated as CO2 neutral. Biomass is considered CO2 neutral because, in its combustion, an emission of CO2 is almost equal to the amount of CO2 the plant binds during its growth through photosynthesis process.

Talking about prices, biomass fuels are quite competitive in Serbia compared to fossil fuels (Table 2). However, for biomass plants it is hard to compete with depreciated fossil plants without any subsidies.

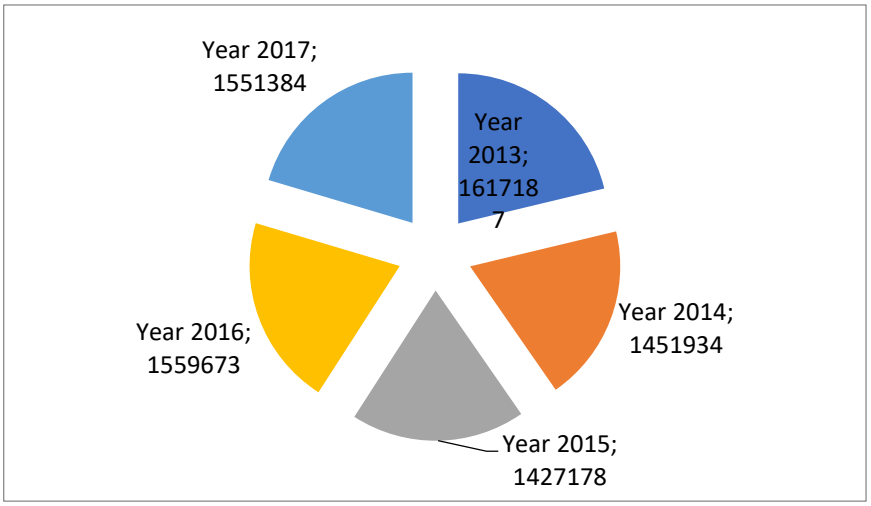

Figure 8: Emissions of CO2 (t) in the district heating systems in the period 2013-2017.

FUEL	EMISSION ($kgCO_2/GJ$)
Biomass	109,60
Peat coal	106,00
Hard coal	101,20
Brown coal	97,09
Lignite coal	96,43
Diesel	77,40
Crude oil	74,10
Kerosene	73,30
Gasoline	71,50
Liquefied petroleum gas	63,10
Natural gas	56,10

Table 24: Emission CO2 for different fuels

FUEL	PRICE	
	€/t	€/kWh(1)
Natural gas	0.41 €/m^3	0.041 € / kWh
Heavy Fuel Oil	501 €/t	0.043 €/kWh
Light Oil	0.97 €/l	0.077 €/kWh
Brown coal	62 €/t	0.018 €/kWh
Wood chips (moisture 35%)	55 €/t	0.018 €/kWh
Wood pellets	160 €/t	0.033 €/kWh
Wood logs (moisture 40%) 40%)	90 €/t	0.030 €/kWh
Agricultural biomass - briquette	180 €/t	0.045 €/kWh
Baled biomass	45 €/t	0.012 €/kWh

Table 25: Typical prices for fuels in Serbia

(1) The theoretical price of heat energy, without efficiency rate of utility

Use of renewables in DHS

The heat and power generation development represents a strategic goal of the Republic of Serbia, primarily for the reason of faster economic development and energy security. Since Serbia is quite dependent on the imported fuels, special attention should be paid to the more widespread use of domestic resources, primarily renewable energy sources (RES). In terms of sustainable energy development in Serbia there is a growing need for using the alternative energy sources. Alternative energy sources are, in most cases, renewable: biomass, wind power, solar energy, hydro-power and geothermal energy. A need for the utilization of this kind of energy sources is dictated by the market, on one side, as well as by environmental protection, on the other. The use of RES is as well promoted by market conditions and requirements of the EU Directives.

Biomass

Technically utilizable energy potential of RES in the Serbia is very significant and estimated at over 5.6 million tons of oil equivalent per annum (*Mtoe*) - of which 3.4 *Mtoe* lies in the production of biomass, 1.7 *Mtoe* in the unused potential of hydro-energy, 0.2 *Mtoe* in already existing geothermal sources, 0.1 *Mtoe* in wind power and 0.2 *Mtoe* in solar energy.

The situation in district heating systems in Serbia can be characterized as critical. There are many reasons, but the lack of funds for regular operations due to the high (constantly growing) energy costs, not economical price for delivered heat, lack of high-level billing and more.

Generally, poor technical condition of the system. An investment in the development of district heating was significant during seventies and eighties and in the last decade of XX century was practically reduced to zero. Some modernisation of system has been done recently, mainly on the basis of grants and loans. Boilers fuelled by biomass are almost non-existent in district heating systems in Serbia. Exceptions are heating plant in Sremska Mitrovica uses sunflower seed shells, and one of the heating plants in Belgrade uses pellets and briquettes and wood in Knjaževac. “Belgrade Power Plants" today participate with biomass with 0.44% in total production.

The first project - the switch to the biomass of the biomass furnace supplying school, preschool institution, health centre, cultural centre and municipal administration - was implemented in Priboj municipality, with financial investments of local self-government and technical support of GIZ. Priboj heating plant will first switch to biomass heating and calculate that the annual cost of one million Euros, as much as they are for the oil, will be halved.

Regarding the use of biomass in the region some barriers to greater use of biomass were identified: complex procedures for obtaining required permits for constructing DHS plants, insufficient availability of experience in use of the technology or equipment for use of biomass, and the lack of a developed market for biomass. The neighbouring countries are increasing the demand for pellets, briquettes and wood chips, and almost all domestic production is exported.

Excess/waste heat

In Serbia is considered the possibility of using waste heat from thermal power plants for district heating purposes.

Currently two heat sources are used. The first is the TPP “Nikola Tesla A” with a total thermal power 1,650 MW that supplies with waste heat small town Obrenovac (12,500 consumers, 837,000 m^2 heating surfaces). Obrenovac heating system is by its many indicators, not only specific, but also in several of the largest systems in Serbia. The district heating system of Obrenovac makes over 350 km of network (primary and secondary), over 830,000 m^2 of space, or more than 12,500 consumers. The built capacities are about 180 MW and 130 MW are connected. A special specificity, which does not exist in any other city, makes a large share of individual housing units (family houses) in the total consumption (about 32% of consumers). The permanent commitment of JKP "Toplovod" Obrenovac and the Municipality of Obrenovac is that it does not separate the collective forms of housing from the individual and, in accordance with the possibilities, invest in the expansion of the network in both directions. Of course, it also has its economic cost, because the heating of the indented area of individual housing is higher financial and investment momentum, and the degree of return on investment is far longer.

Thermal source available for district heating of Požarevac and Kostolac are thermal power plants "Kostolac" "A" and "B" with a total power of about 1000 MW. The main heat pipeline Kostolac-Požarevac serves for the transport of boiling water (temperatures of 130/75°C, pressure 16 bar) from the pumping station located at the TPP "Kostolac" to the primary city network in Požarevac. The hot water line consists of steel welded pipes of diameter 660.4x7.1 mm. There are connections for the following places on the main highway: Kostolac, Klenovnik, Ćirikovac and Požarevac. The total consumption of all these consumers is 315 MW. Public utility company in Požarevac heats a total of 9,100 buildings in the own territory, of which 8,300 households, 770 public and commercial objects and 4 industrial buildings. Annually delivers 600 TJ energy to its customers.

Solar-thermal energy

The number of hours of solar radiation in the territory of Serbia is between 1,500 and 2,200 hours per year. Average intensity of solar radiation is from 1.1 kWh/m^2/day in the north to 1.7 kWh/m^2/day in the south - during January, and from 5.9 to 6.6 kWh/m^2/day - during July.

The average value of radiation energy is 1,200 kWh/m^2/year in north western Serbia, up to 1,550 kWh/m^2/year in south eastern Serbia, while in the central part it is about 1,400 kWh/m^2/year.

Serbia has a significantly higher number of hours of solar radiation than most European countries, and the best conditions are in the southeastern part of our country.

The Government of the Republic of Serbia for the first time provided through the subsidies the opportunity for the construction of solar power plants in Serbia by the Decree on incentive measures for the production of electricity from renewable sources and from the

highly efficient combined production of electricity and heat from 2009. Subsequently, the government further increased capacity and reduced the subsidized price through two new regulations from 2013 and 2016.

The currently prescribed quotas of the Government of the Republic of Serbia for solar power are 10 MW, which is divided in the following way:

- 4 MW for solar power plants on facilities, with half of this power envisaged for small solar power plants up to 30 kW, and the other half for solar power plants from 30 to 500 kW;
- 6 MW is prescribed for solar power plants on earth.

The sector in Serbia is not well developed; small number of houses has installed a solar system for hot water production. However, the development of this sector is stagnant.

In Serbia, in this moment, there are no built capacities for the use of solar energy in district heating systems.

Legal framework and subsidies

Legal framework in Serbia related to biomass utilization consists of laws, by-laws, and rule books, which stipulate referent sectors.

- Law on Energy (Official Gazette of the Republic of Serbia No 145/20014) regulates the production and distribution of energy.
- Law on Efficient Use of Energy (Official Gazette of the Republic of Serbia No 25/2013) among other stipulates metering and billing based on the consumption; introduces ESCO, and defines energy service.
- Law on Public-Private Partnerships and Concessions (Official Gazette of the Republic of Serbia No 88/2011 and 15/2016) regulates institutional and contractual PPP, and concessions between public bodies and private partners. According to this Law, tendering procedure in compliance with the Law on Public Procurement is obligatory in the process of establishing institutional and contractual PPP without concessions.
- Law on Public Procurement (Official Gazette of the Republic of Serbia No 124/2012, 14/2015 and 68/2015) prescribes detailed procedures for procurement of goods, procurement of works, and procurement of services.
- Law on Business Companies (Official Gazette of the Republic of Serbia No 36/2011, 99/2011, 83/2014, and 5/2015) defines types of business companies, legal procedures for their establishment and operations.
- Law on Public Companies (Official Gazette of the Republic of Serbia No 15/2016) regulates establishment and functioning of companies founded by state and local governments in order to performing operations of public interest.
- Law on Obligations (Official Gazette of the Republic of Serbia No 29/78, 39/85, 45/89, 57/89, Official Gazette of SUSM No 31/93, and Official Gazette of State

Union of Serbia and Montenegro No 1/2003) regulates contracts and torts.

- Law on Environmental Protection (Official Gazette of the Republic of Serbia No 135/2004, 36/2009, 36/2009; 72/2009; 43/2011 – Decision of CC, and 14/2016) regulates sustainable management of integral system of natural values and environmental protection.
- Law on Environmental Impact Assessment (Official Gazette of the Republic of Serbia No 135/2004 and 36/2009) regulates the impact assessment procedure for projects that may have significant effects on the environment.
- Law on Strategic Assessment of Environmental Impact (Official Gazette of the Republic of Serbia No 135/2004 and 88/2010) stipulates requirements and procedures for impact assessment of specific plans and programmes on the environment.
- Law on Integrated Prevention and Control of Environmental Pollution (Official Gazette of the Republic of Serbia No 135/2004 and 25/2015).
- Waste Management Law (Official Gazette of the Republic of Serbia No 36/2009, 88/2010 and 14/2016).
- Law on Forests (Official Gazette of the Republic of Serbia No 30/2010, 93/2012 and 89/2015) regulates the conservation, protection, planning, cultivation, use and management of forests and forest land on the territory of the Republic of Serbia, including all necessary rules and requirements defining the control over the implementation of provided rules, monitoring, inspection, as well as other issues relevant to forests and forest land and areas. The provisions of this Law are related to forests and forest land in all forms of property.
- Law on Forest Reproductive Material (Official Gazette of the Republic of Serbia No 35/2004, 8/2005 – amendment, and 41/2009).
- Law on Planning and Construction (Official Gazette of the Republic of Serbia No 72/2009, 81/2009 - correction, 64/2010 – Decision of Constitutional Court, 24/2011, 121/2012, 42/2013 – Decision of CC, 50/2013 - Decision of CC, 98/2013 - Decision of CC, 132/2014 and 145/2014). This Law regulates: the conditions and modalities of spatial planning and development, the maintenance and use of building land and the construction of facilities; carrying out supervision over the application of this Law and supervisory inspections; other issues of significance in the development of space, landscaping and use of building land, and the construction of facilities.
- Law on Fire Protection (Official Gazette of the Republic of Serbia No 111/2009 and 20/2015).
- Law on Safety and Health on Work (Official Gazette of the Republic of Serbia No 101/2005 and 91/2015).
- Law on Local Self-Government (Official Gazette of the Republic of Serbia No 129/2007 and 83/2014).
- In order to clearly legally define relations between producers of electricity of renewable energy sources and electro-energetic system of Serbia, on June 13, 2016, the Government of Serbia adopted following Regulations, published in

Official Gazette of the RS No 56/2016:

- Regulation on incentives for production of electricity of renewable sources and of highly efficient combined production of electricity and heating power. (Biomass power plants are registered for up to 8,600 hours, split into three categories: those under 1 MW are entitled to 13.26 euro cents per kilowatt, facilities with more than 10 MW get 8.22 cents, while those in between have a basic incentive of 13.82 cents lowered by the product of 0.56 and the nominal capacity in megawatts).
- Regulation on conditions and procedure for acquiring the status of privileged electric energy power producer, temporary privileged producer, and producer of electric power of renewable sources.
- Other important by-laws related to biomass utilization are following:
- Regulation on the contract for electricity take over Other important regulations are:
- Regulation on incentive of privileged producers of electricity (Official Gazette of the RS No 12/2016).
- Regulation on methodology of determining the price of thermal energy for final users (Official Gazette of the RS No 63/2015).
- Regulation on activities which affect environment (Official Gazette of the RS No 109/2009 and 8/2010).
- Regulation on the types of projects for which environmental impact assessment is obligatory or can be required (Official Gazette of the RS No 114/2008).
- Regulation on requirements for the location (Official Gazette of the RS No 114/2008).
- Rule Books:
- Rule Book on guarantees of origin of electricity production of renewable sources (Official Gazette of the RS No 24/2014).
- Rule Book on energy permits (Official Gazette of the RS No 15/2015).
- Rule Book on unified electronic procedure (Official Gazette of the RS No 113/2015).
- Rule Book on technical requirements for designing, construction, and control of equipment under pressure (Official Gazette of the RS No 87/2011).
- Rule Book on special fire prevention measures in agriculture (Official Gazette of the RS No 27/1984).

In the process of preparing projects in the field of energy efficiency, renewable energy sources and energy in general, it is necessary to get information on the following portals:

Ministry of Mining and Energy of the Republic of Serbia:

http://www.mre.gov.rs/dokumenta-elektroenergetika.php

Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia:

http://www.minpolj.gov.rs/dokumenti/

Ministry of Environmental Protection:

http://www.ekologija.gov.rs/dokumenti/

Ministry of economy of the Republic of Serbia:

http://www.privreda.gov.rs/propisi/

Ministry of Construction, Infrastructure and Transport of the Republic of Serbia: http://www.mgsi.gov.rs/

Energy Agency of the Republic of Serbia: http://www.aers.rs/Index.asp?l=1&a=91

Environmental Protection Agency:

http://www.sepa.gov.rs/index.php?menu=20168&id=18&akcija=showXlinked

Emission limits

Emission limits to use biomass in DHS is regulated by Regulation on Limit Values of Emissions of Pollutants in the Air from Combustion Plant, "Official Gazette of RS" No. 6 of 28 January 2016. Emission limits values are given in the following table.

SIZE CLASSI-FICATION	CAPACITY [MWth]	TYPE OF FUEL	Ref. O2 [%vol]	NOx [mgNO2/m3o]	SO2 [mg SO2/m3o]	PM [mg/m3o]	CO [mg CO/m3o]
large	50 -100	solid biomass	6	300	200	30	250
	100 - 300			250	200	20	250
	> 300			200	200/150(1)	20	250
	50 -100	liquid fuels	3	450	350	50	175
	100 - 300			200	250/200(1)	50	175
	> 300			150	200/150(1)	50	175
	>50	gases other than natural gas	3	200	35	5	100
medium-sized	1-5	Wood & wood residues	11	650/250(2,1)	1700/1000(1)	150/10(1)	300/150(1)
	5-50					50/10(1)	
		liquid fuels	3	250-350	1700/850(1)	50	170/80(1)
		gases other than natural gas	3	200/100(1)	350	10/5(1)	100/80(1)
small	0.05-0.15	wood, briquettes or wood pellets	13	-	-	150/100(1,3) /60(1,4)	4,000/1000(1)
	0.15-0.5						2,000/800(1)
	≥0.5						1,000/500(1)
		liquid fuels	3	250			175
		all gases	3	150	-	-	100

Table 26: Emission limit values in Serbia

(1) new plants, (2) at the combustion in FB,
(3) wood, other then briquettes or pellets of wood, (4) briquettes or pellets of wood

Subsidies

In 2016 a Regulation on substantial measures for electricity production from renewable energy sources and from high-efficient combined production of electric and heat energy producers of electricity was adopted in Serbia. This Regulation sets forth more incentive measures for the production of electricity from renewable sources and of the highly efficient combined production of electricity and heat, the condition for their realization, the duration of the incentive period, the rights and obligations deriving from these measures for privileged producers of electricity and other energy entities as well as other issues in accordance with the law.

Incentives for the purposes of this Regulation are:

1. An incentive period of 12 years starting from the day of the first reading of electricity in the power plant or part of the power plant, after the day of obtaining the status of a privileged electricity producer, unless the duration of the incentive period is otherwise determined by this Regulation or a contract for the purchase of electricity;
2. The incentive purchase price at which the privileged and temporary privileged producers sell the guaranteed electricity to the guaranteed supplier the appropriate amount of electricity produced during or before the incentive period, in accordance with the provisions of this Regulation;
3. Taking over the balance responsibility for the places of handing over the electricity of the privileged electricity producer during the incentive period, and by the guaranteed supplier;
4. The cost of balancing the privileged electricity producer during the incentive period by the guaranteed supplier;
5. Free access to the transmission or distribution system of electricity.

A temporary privileged producer from the date of conclusion of a contract for the purchase of electricity until the start of the incentive period shall be entitled to the incentive measures referred earlier.

The incentive purchase price for the produced electricity is determined depending on the type and the installed power of the power plant, as well as the maximum effective working time for the appropriate type of power plant. The height of the incentive purchase price and the maximum effective operating time of the power plant are shown in the table 9. This Regulation shall be valid until 31 December 2019.

Permissions

The following literature was used for this section: Lepotić Kovačević, B. and Lazarević, B.: Construction of plants and electricity/heat generation from biomass in the Republic of Serbia - Guide for Investors, Belgrade, June 2016 and Lepotić Kovačević, B.: Construction of plants and electricity/heat generation from biomass in the Republic of Serbia - Guide for Investors, Belgrade, February 2013.

RES plants using biomass as fuel are the energy facilities for performing the activities of electricity and/or heat generation. A biomass plant (facility) is a plant using biodegradable matter including: 1) plants, parts of plants and plant residues from agriculture (straw, corn residues, branches, stones, peels), manure from farms, etc., 2) plants, parts of plants and plant residues from forestry, residues after felling of trees, etc., 3) plants, parts of plants and plant residues from fast-growing energy plantations, 4) matter resulting from fisheries and aacquifiers, 5) biodegradable residues from food, wood and related industries, 6) separated biodegradable fraction of municipal waste, 7) by-products of animal origin used in accordance with veterinary regulations, and 8) energy sources produced by a technological process from materials stated in this item.

ITEM	TYPE OF POWER PLANT	INSTALLED CAPACITY P (MW)	ENCOURAGING MEASURES – FEED IN TARIFF (c€/KWh)	MAXIMUM EFFECTIVE WORKING TIME (h)
	Hydro power plants			5,000 in the year of the incentive period
		U	6	
		0.2 – 0.5	9	
			60	
			0	
			50	
	On existing infrastructure	U	6	5,000 in the year of the incentive period
	Biomass power plnats			8,600 in the year of the incentive period
		Up to 1	13.26	
		1	13.82-0.56*P	
2.3		over 10		
	Biogas power plants			8,600 in the year of the incentive period
		0	18.333-1.111*P	
		– 5	5 – 0.370*P	
		o	15.00	
4	Landfill and sewage gas power plants		8	8,600 in the year of the incentive period
5	Wind power plants		20	9000 in the quarter of the incentive period
6	Solar power plants			1,400 in the year of the incentive period
6		On object up to 0.03	14.60-80*P	
6		On object 0.03 – 0.5	1	
6		On land	9	
7	Geothermal power plants		8.20	8,600 in the year of the incentive period
8.	Natural gas CHP power plants			8,600 in the year of the incentive period
8.1		Up to 0.5	8	
8.2		0.5 – 2	8	
8.3		2 - 10	7	
9.	Waste fired power plants		8.57	8,600 in the year of the incentive period

Table 27: Feed in tariff in Serbia

Construction of biomass plants and engaging in the activities of electricity and/or heat generation in such plants are regulated by numerous laws and regulations of the Republic of Serbia. Sources of law of the Republic of Serbia can be divided into two main groups of regulations.

The first group of regulations includes those governing the area of construction of a particular energy facility and the procedure for obtaining the Construction Permit for such a facility, as well as the method of determining the fitness of the facility for use and obtaining of the Operation Permit for it.

The second group of regulations includes those dealing with acquiring the right to engage in electricity and/or heat generation. Until the enforcement of the Energy Law (2011) the electricity generation and combined production of electricity and heat were the activities of public interest. Upon entry of this Law into force the said activities ceased to be the activities of public interest. The consequence is the fact that acquiring the right to engage in these activities became simpler. However, production of heat is still the activity of public interest pursuant to both the Energy Law and the Law on Public Utilities. For this reason acquiring of the right to perform activities of production of heat in a biomass plant is carried out in two steps, i.e.: 1) acquiring the right to perform public utility services of public interest and 2) acquiring the right to perform energy-related activities - obtaining the energy license.

Types of Plants

Biomass plants are facilities for the production of electricity, heat or for combined production, with one or more production units. Combined production means a simultaneous electricity and heat production. Power plants can operate following various technologies, i.e.: various types of boilers, internal combustion engines and gas turbine plants. Pursuant to the existing regulations, plants can be classified according to several criteria, in view of the following regulations:

1. Energy Law,
2. Rulebook on Criteria for Issuing Energy Permit, Contents of the Application and Procedure of Issuing Energy Permits,
3. Law on Planning and Construction,
4. Decree on Requirement for Obtaining Privileged Electricity Producer Status,
5. Decree on the List of Projects for which Environmental Impact Assessment (EIA) Study is Mandatory and the List of Projects for which EIA Study may be required.

The Energy Law defines the plants as follows: 1) plants using renewable energy sources–biomass, 2) plants with the combined heat and power production. Plants with combined production may acquire the status of privileged electricity producer if their installed capacity is up to 10 MW.

Rulebook on Criteria for Issuing Energy Permits, Contents of the Application and Procedure for Issuing Energy Permits to Energy Generating Facilities covers:

1. Electricity generating facilities with rated capacity of 1 to 10 MW,

2. Electricity generating facilities with rated capacity of over 10 MW,

3. Heat generating facilities with installed power of over 1 MW.

Law on Planning and Construction defines the competence for issuing the Construction Permit, i.e.:

1. Plants using renewable energy sources having capacity of 10 MW and more – competence of the ministry for construction issues, or the autonomous province,

2. Plants with combined production having capacity below 10 MW – competence of the local self-government authority.

The Decree on Requirements for Obtaining Privileged Electricity Producer Status and Criteria for Verification of Compliance with Requirements defines the power plants eligible to obtain the status of a privileged power producer, specifically:

1. Plants utilizing biomass (power plants) using biodegradable matter resulting from agriculture, forestry and households, which includes: plants and plant parts, plant residues occurred in agriculture (straw, stover, branches, fruit stones, husk), farm manure, plant residues in forestry (tree felling residues), biodegradable residues in food processing and wood processing industry, which do not contain hazardous substance and separated biodegradable fraction of the municipal waste.
2. Power plants with combined production, simultaneously producing electricity and heat using fossil fuels (coal or natural gas), waste technological gases with organic fraction or fossil fuels combined with some renewable energy source, waste or waste technological gases with organic fraction.

The Decree on the List of Projects for which Environmental Impact Assessment (EIA) Study is Mandatory and the List of Projects for which EIA Study May Be Required makes a distinction between the following plants:

1. Plants having the capacity of 50 MW or more (List I) – the plants for which the Environmental Impact Assessment Study is mandatory and

2. Plants having the capacity of 1 to 50 MW as well as projects implemented in the protected natural resource and the protected surrounding of the stationary cultural asset, as well as in other areas of special purpose (List II) – plants for which preparation of the EIA Study may be requested.

Basic Data on Biomass

When bringing the decision on construction of a biomass power plant, available quantities of biomass or of raw material for the production of biogas must be analyzed in detail. Available quantities of biomass or of raw material for the production of biogas must be considered on a long-term basis, at acceptable and competitive prices. At the same time, characteristics of biomass, or raw materials for the production of biogas should be considered, as well as options for their transport from their point of origin to the biomass power plant. The Feasibility Study

analyzes, in particular, the spatial, environmental, social, financial, market and economic feasibility of investment into the selected solution, elaborated in the preliminary design, on the basis of which decision on the feasibility of investment and initiating the procedure for issuing the Construction Permit is made.

It should be stressed that a significant element for the operation of the biomass power plant is the long-term biomass supply agreement.

Plant Construction Procedure

Regulations on the construction of biomass plants can be classified into three main groups: regulations governing the area of planning and construction of facilities, regulations governing the area of environmental protection and regulations governing the energy field.

The group of regulations governing the area of planning and construction of facilities include: Law on Planning and Construction, Law on the Spatial Plan of the Republic of Serbia, their pertaining by-laws and others.

The group of regulations governing the area of environmental protection includes: the Law on Environmental Protection, the Law on Waters, the Law on Forests, the Law on Environmental Impact Assessment, the Law on Integrated Pollution Prevention and Control, the Law on Air Protection, secondary regulations adopted on the basis of the above laws, as well as other regulations governing environmental protection, as well as protection and use of natural assets.

The group of regulations governing the energy sector includes: the Energy Law, secondary regulations to that law, Strategy of Development of the Energy Sector of the Republic of Serbia and the Programme of Implementation of the Strategy of Development of the Energy Sector of the Republic of Serbia and other above mentioned regulations referring to issuance of the energy permit, connection of the structure to the grid and the like.

It is necessary to stress here the importance of regulations in the area of fire protection, both in the stage of preparation of design documentation and construction of the plant and in the stage when the plant starts performing its activity, because some kinds of biomass are considered very inflammable.

In order to construct and utilize any structure in the Republic of Serbia, and even the structure of a biomass power plant, it is necessary to meet the following requirements: 1) To obtain the Energy Permit; 2) To obtain the Location Permit; 3) To obtain the Construction Permit; 4) To construct the structure, and 5) To ensure the technical inspection of the structure and to obtain the Operation Permit.

Construction of facilities formally, starts with the obtaining of the Construction Permit, and it is carried out on the basis of the Construction Permit and the technical documentation, under the conditions and in the manner stipulated in the Law on Planning and Construction.

The rulebook setting the procedures and conditions of issuing the energy permit stipulates as one of the prerequisites for issuing the energy permit obtaining the Information on Location or

Location Permit. It can be derived from the above that the procedure for obtaining the energy permit can be carried out before or after obtaining the Location Permit.

Within the Construction Permit procedure, elaboration of the Environmental Impact Assessment Study can be requested for the biomass plants having bigger capacity than 1 MW, and for the capacities exceeding 50 MW it is mandatory. For the plants of capacity exceeding 50 MW Integrated Permit is to be obtained

It should be stressed that there is a priority ban of construction of power generating facilities in protected areas, pursuant to the Law on Protection of Nature and the Decree on Protection Regimes, depending on the protection level: 1) in the areas of the protection regime of the I level no plants can be constructed; 2) in the areas of the protection regime of the II level – no thermal plants can be constructed, except the biogas plants of the capacity up to 1 MW in total; 3) in the areas of the protection regime of the III level – no plant can be constructed, except the biogas plants of the capacity up to 5 MW in total.

Selection of the Location

The first step of a potential investor is certainly selection of the location. This step must also be related to the analysis of the raw material potential (biomass or raw materials for production of biogas), which will be used for generation of electricity/heat in the biomass plant.

The second step of the investor is verification as to whether the valid planning documents envisage construction of an energy facility on the selected location. The application for the Information on Location shall be submitted for the desired location, for the purpose of obtaining the data on the possibilities and limitations with respect to the construction on the reviewed cadastral lot in line with the valid planning document.

The Information on Location, in addition to the name of the applicant, the number of the cadastral lot, and the place where it is located, shall also contain26 the data on: 1) planning document based on which it is issued; 2) zone in which it is located; 3) use of the land; 4) regulation and building lines; 5) Codes of Construction; 6) requirements for connection to the infrastructure; 7) need to prepare a detailed urban plan or urban design27; 8) cadastral lot, or whether the cadastral lot fulfills the requirements for the building plot with the instructions on the required procedure for forming the building plot; 9) engineering and geological conditions; 10) special requirements for issuing the Location Permit (list of requirements). The Information on Location shall enable the person, to whose name it is issued, to gather all the special requirements (requirements for protection of cultural monuments, requirements for preservation of the environment, etc.) and technical requirements (the place and method of service connections of the structure to the infrastructure lines, as well as their capacities) prior to issuing of the Location Permit.

Energy Permit

Energy Permit accompanies the application/request for issuance of the Construction Permit. Energy Permit is one of the prerequisites for issuing the Construction Permit. In order to obtain the energy permit, it is necessary to meet the criteria for construction of power generating

facilities stipulated in the Energy Law and the Rulebook on Criteria for Issuing Energy Permits, Contents of the Application, and Procedure for Issuing Energy Permits.

The energy permit for construction of facilities having capacity of 1 MW and more, for electricity generation and for the combined heat and power production shall be issued by the Ministry in charge of energy issues, while the energy permit for the construction of facilities for heat generation will be issued by the relevant local self-government unit. For electricity generating power plants of a capacity below 1 MW and for heat generating power plants of a capacity below 1 MW, issuing of the energy permit has not been envisaged, which means that, for such facilities, the Construction Permit shall be issued, without the procedure for issuing the energy permit.

The Rulebook on Criteria for Issuing Energy Permits, Contents of the Application, and Procedure for Issuing Energy Permits specifies the Application Form for the energy permit, separately for construction of the energy facility for electricity generation, and separately for construction of an energy facility for heat generation. Depending on the capacity of a plant, the application for the energy permit for construction of the energy facility for electricity generation shall be submitted, specifically: for rated capacities from 1 MW to 10 MW – Form O-1, or for rated capacities of over 10 MW – Form O-2. The application for the energy permit for construction of an energy facility for heat generation of a capacity exceeding 1 MW shall be submitted by filling in the Form O-8.

The Energy Permit shall be issued for a period of three years and its validity may be extended at the request of the holder for maximum one more year/. The Energy Permit is not required, in terms of the Energy Law for energy facilities constructed on the grounds of granted concession for the construction of an energy facility.

Requirements for Connection

Prior to issuing the Location Permit, it shall also be necessary to obtain the requirements for connection to the electricity grid and to the heat distribution network. If the investor fails to obtain the above requirements on his/her own, the authority in charge of issuing the Location Permit shall obtain them *ex officio* prior to issuing the Location Permit.

Within the procedure for preparation of the urban development planning document, the Location Permit or of the main design for construction of the facility, at the request of the investor or of the competent authority, the energy entity to whose system the power producer's facility is to be connected, shall issue the requirements for connection of the producer's facility to the electricity grid. The requirements for connection shall define the possibility for connection of the producer's facility to the electricity grid, or define the electric power and technical requirements needed for preparation of the main design for construction of the facility.

Location Permit

The Law on Planning and Construction prescribes that the Location Permit is a document containing all requirements and data needed for preparation of the technical documentation (preliminary and main design), in line with the valid planning documents. The Location Permit is enclosed to the request for issuing the Construction Permit (which makes it a prerequisite

for the issuance of Construction Permit). Location Permits for the construction of plants for power generation from renewable energy sources, as well as for combined heat-and-power plants having capacity of 10 MW and over, shall be issued by the ministry in charge of civil engineering affairs, or by the Autonomous Province.

Location Permit for combined heat and power plants of the capacity up to 10 MW is issued by the competent authority of the local self-government unit (town, municipality) of the territory where the structure will be constructed, except if it is constructed in the protected environs of outstanding cultural assets, and of cultural assets registered in the List of the World Cultural and Natural Heritage and of structures in protected areas in compliance with the act on protection of cultural assets, as well as of structures within the boundaries of a national park and of structures within the boundaries of protection of a protected outstanding natural asset which are within the jurisdiction of the ministry in charge of civil engineering affairs, or by the Autonomous Province

The documentation necessary to obtain the Location Permit for construction of a plant is specified in the Law on Planning and Construction and the Rulebook on the Contents of the Information on Location and on the Content of the Location Permit.

The Law on Planning and Construction stipulates that the building plot shall be formed prior to submitting the application for the Location Permit.

Forming the Building Plot

A building plot is a part of the construction land, with access to a public traffic area, which has been constructed or is envisaged for construction by a plan. For construction, or installation of infrastructure, electric power and electronic structures and equipment, a building plot of smaller or larger area than the one foreseen in the planning document for that zone can be formed, provided the existence of the access to the structure, or equipment, enabling maintenance and elimination of defects or access in case of average/damage. Article 10 of the Law on Forests sets the rules for changing the use of forest land in case that the selected location for the construction is on the forest land.

If necessary, prior to submitting the application for the Location Permit, the Allotment/Re-allotment Plan, i.e. the plan forming the building plot shall be prepared. The re-allotment plan implies the plan forming one or more building plots on a number of cadastral lots while the allotment plan implies the plan forming a number of building plots on a single cadastral lot.

Thereafter, the application for undertaking the allotment, or re-allotment, shall be submitted to the Authority in charge of affairs of state survey and cadastre (RGA – the Republic Geodetic Authority).

Water Requirements, Water Approval and Water Permit

The Law on Waters makes distinction between the general and special uses of waters. The Water Requirements shall be issued within the procedure for preparation of the technical documentation for construction of new facilities, which may have a permanent or a temporary

impact on the changes in the water regime, or which may threaten the objectives concerning the environment.

The right to the special use of waters shall be acquired by the Water Permit. Special use of waters may be realized on the grounds of concession and exercised in compliance with the agreement governing the concession. This Law defines the following water documents; 1) Water Requirements, 2) Water Approval, 3) Water Permit, and 4) Water Order. Water documents shall be issued by the ministry (the Ministry in charge of water resources management). If the structure is located in the territory of the Autonomous Province, then such documents shall be issued by the competent authority of the Autonomous Province (the Provincial Secretariat for Agriculture, Forestry and Water Resources Management in Novi Sad) and, if the structure is located in the territory of the City of Belgrade, such documents shall be issued by the competent authority of the City of Belgrade (the Water Administration).

Prior to issuing the Water Requirements (which are an element of the Location Permit, and are necessary for preparation of the design documentation – the main design), it is necessary to obtain the Opinion of the Republic organization in charge of hydro meteorological affairs (the Republic Hydro Meteorological Service - RHMS) and the Opinion of the public water-management enterprise (Public Water-Management Enterprise Srbijavode – for the territory of the Republic of Serbia except for the Autonomous Province of Vojvodina, i.e. of the Public Watermanagement Enterprise Vode Vojvodine – for the territory of the Autonomous Province of Vojvodina, or of PWC ''Beogradvode'' in Belgrade, for structures and works in the territory of the City of Belgrade).

The Opinion of the Republic Hydro Meteorological Service shall be obtained on the basis of the submitted application. The opinion of the public water-management enterprise shall be obtained after submitting the application for the opinion. After obtaining the Opinion of RHMS and the Opinion of the public water-management enterprise, and other attachments defined by regulations, on the prescribed form O1 - the application for Water Requirements shall be submitted.

The competent ministry for water resource management or the defined competent authority (the Provincial Secretariat, the Water Administration) shall issue the Decision on Issuing the Water Requirements. The Main Design shall be prepared based on this Decision. The obtained Decision Issuing the Water Requirements shall be one of the elements of the Location Permit.

Once the Location Permit has been obtained, one shall proceed with the preparation of the design documentation – the conceptual or the main design of the plant. In order to proceed with the following stage – obtaining of the Construction Permit, it is necessary, *inter alia*, to obtain the Water Approval on the specified design documentation. The Water Approval shall establish that the technical documentation – the Main Design, has been prepared in compliance with the Water Requirements. The application for issuing of the Water Approval shall be submitted on the prescribed form O3.

The Water Approval shall cease to be valid if, within two years from the date of its obtaining, the application for the Construction Permit is not submitted to the competent authority. The decision establishing expiry of validity of the Water Approval shall be handed down by the authority which has issued the Water Approval.

Once the structure has been constructed, and prior to obtaining the Operation Permit, it is necessary to submit the application for the Water Permit to the Ministry in charge of water resources management, or to the competent authority. The Water Permit is required for the exploitation and use of waters and natural and artificial watercourses, lakes, and ground waters, for treatment and discharge of waters and other substances into natural and artificial watercourses, lakes, ground waters, and public sewers, in case of increase of the capacity of the already existing structure – for the increase of the quantity of in-taken and discharged waters, changed nature and quality of discharged waters, as well as for other civil works that impact water regime.

This Permit shall be issued for a period of maximum 15 years so that, maximum two months prior to its expiry, its validity should be extended if there is an issued Decision on Water Permit. The right acquired on the basis of the Water Permit may not be assigned to any third party without the consent of the issuing party, and this right shall terminate: upon expiry of the validity thereof, by waiver of the right, and by failure to exercise the right without justified reasons for over 2 years. The application for issuing the Water Permit shall be submitted on the prescribed form O6.

Environmental Impact Assessment

Environmental impact assessment is a very important element in the process of construction of a plant. Within the procedure for obtaining the energy permit, it is necessary to make a study of possible impacts on the environment including the proposed measures for protection of the environment.

Should the competent authority find it necessary, as an element for issuing the Construction Permit, it shall be necessary to make the Environmental Impact Assessment Study for the plant. Environmental impact assessment for a biomass plant, including the proposed measures for environmental protection, shall be made when making the Environmental Impact Assessment Study for a biomass plant. Depending on its presence on either of the lists of projects of the Decree on the List of Projects for which the Environmental Impact Assessment Is Mandatory (List I) and on the List of Projects for which the Environmental Impact Assessment May Be Requested (List II), making of the Environmental Impact Assessment Study for a biomass plant is either mandatory or may be requested.

The projects of power generating plants (electricity, heat, steam...) in facilities of over 50 MW are on List I of this Decree – which means that, for such facilities, making of the Environmental Impact Assessment Study is mandatory. Power generating plants (electricity, heat, steam...) in facilities of a capacity from 1 to 50 MW are specified in List II of the Decree - which means that, for such facilities, making of the Environmental Impact Assessment Study may be requested. The scope of such impact depends on the location of the facility, on the capacity of the facility, on the concrete environment of the facility, etc.

Making of a Study is not required for the plants of a capacity below 1 MW, except in case of an electric power plant to be constructed in a protected natural good and protected environs of an immobile cultural good and in other areas of special use.

The application concerning the need to assess the impact shall be submitted in the prescribed form, in compliance with the Law on Environmental Impact Assessment and the Rulebook on Contents of the Application for the Need to Assess the Impact and Contents of the Application for Determining the Scope and Contents of the Study of Environmental Impact Assessment Study.

If it is decided that the impact assessment is required for the reviewed plant of over 1 MW, the same Decision may determine both the scope and contents of the impact assessment study. If it is established that impact assessment is not required, the competent authority may specify minimum requirements for environmental protection in the Decision.

More detailed procedure for elaboration of the Environmental Impact Assessment Study for a biomass plant is regulated by the Law on Environmental Impact Assessment and by the bylaws under this Law. This Law stipulates that the concrete impact assessment study for a biomass plant is an integral part of the documentation, which shall be submitted with the application for the Construction Permit or with the report on commencement of the project implementation (construction, execution of works, change of technology, change of activity, and other activities).

Maximum within one year from the date of receipt of the final decision on the scope and contents of the impact assessment study, the project owner shall submit the Application for the approval of the impact assessment study. The impact assessment study (3 copies in paper and 1 in electronic form) and the decision of the competent authority from the previous stage of the procedure shall be submitted with the application. The public authority shall ensure public insight in, the presentation of, and public debate on the study.

The Law on Environmental Impact Assessment also regulates the procedure for updating the Environmental Impact Assessment Study due to the lapse of time. It is necessary to point to the fact that the validity of the Decision on Approval of the Impact Assessment Study shall be two years, within which time period the project owner shall commence the construction of the plant. Upon expiry of this deadline, the competent authority may hand down the decision on the making a new Impact Assessment Study or on updating the existing one.

The Law on Environmental Protection stipulates that the Ministry in charge of environment shall issue the preliminary consent on the approval for the use of natural resources or assets. This consent shall verify fulfillment of requirements and measures of sustainable use of natural resources, or assets (air, water, land, forests, geological resources, plant and animal life) and environmental protection in the course and after termination of engaging in the activity.

Integrated Permit

The Law on Integrated Pollution Prevention and Control stipulates requirements and procedures for issuing the Integrated Permit for plants and activities that may have negative impact on health of people, environment or material goods, types of activities and plants, all aimed at pollution prevention and control. The Integrated Permit shall be issued by the authority in charge of issuing the permit for construction of a plant. It is necessary to note that the Integrated Permit is not required for every biomass plant, but only for those thermal plants with heat capacity above 50 MW. The application shall be submitted to the competent authority

on the Form 1 prescribed in the Rulebook on Contents, Appearance and Manner of Filling in the Application for Issuing of the Integrated Permit.

After the applicant has submitted a proper application (which he/she has possibly supplemented at the request of the competent authority), the competent authority shall notify authorities and organizations in the areas of: agriculture, water resources management, forestry, planning, construction, transportation/traffic, energy, mining, protection of cultural goods, nature protection, etc. as well as the authorities of local self-government on the territory of which the activity is planned, or the plant is located and interested public on receipt of the application.

Technical Commission formed by the same competent authority shall review the application of the operator and the attached documentation, the draft permit, opinions of other authorities and organizations and interested public, as well as opinions obtained in the procedure of exchange of information and consultations on cross-border impact. The Technical Commission shall make a report, which it shall submit to the competent authority. The competent authority shall decide on the issuing of the permit on the basis of the application of the operator, the attached documentation, the report and evaluation of the Technical Commission, as well as the obtained opinions of other authorities and organizations and interested public. The competent authority shall decide by the decision on the issuing of the permit, or on rejecting the application for issuing of the permit.

The Permit shall establish requirements for the operation of the plant and engaging in the activity and obligations of the operator depending on the nature of the activities and their impact on the environment. The Permit shall contain the requirements that are related to: 1) application of the best available techniques or other technical conditions and measures; 2) measures from the environmental impact assessment study or the study of assessment of current state of the environment; 3) limit values of emissions of polluting substances established for the given plant; 4) measures of protection of air, water, and land; 5) measures related to the management of waste generated during the operation of the plant; 6) measures for reduction of noise and vibrations; 7) measures related to efficient utilization of energy; 8) requirements for monitoring of emission with: specified methodology, defined frequency of measurement, defined rules for interpretation of measuring results, as well as with the established obligation to submit data to the competent authority; 9) measures for prevention of accidents and elimination of their consequences; 10) reduction of pollution, including cross-border pollution of the environment; 11) measures envisaged for commencement of operation, for instant stopping in case of a disruption in the functioning of the plant, as well as for termination of operation of the plant; 12) undertaking of measures of environment protection after termination of activities aimed at avoidance of the risk from pollution and bringing the location back in a satisfactory state; 13) manner and frequency of reporting and volume of data contained in the report, which is to be submitted to the competent authority in line with the regulations; 14) results of revision of requirements and obligations established by the permit; 15) other specific requirements.

The issued permit shall be subject to repeated review (hereinafter referred to as: revision) minimum twice during its validity. The procedures of revision shall be initiated by the competent

authority *ex officio* or at the request of the operator. The competent authority shall initiate the procedures of revision *ex officio* in cases prescribed by the law.

Technical Documentation

Construction of facilities is carried out on the basis of the Construction Permit, according to the technical documentation for the construction of the structure. Technical documentation is a set of designs that are prepared for the purpose of: establishing the concept of the structure, elaboration of requirements, the method of construction of the structure, and for the requirements of maintenance of the structure. Technical documentation is prepared on the basis of the Location Permit, which contains all the requirements and data required for preparation of the technical documentation. The energy permit shall not be submitted with the application for the Construction Permit for construction of a biomass plant of up to 1 MW, because the energy permit is not issued for them.

According to the Law on Planning and Construction, the technical documentation for construction of a structure shall consist of: 1) General design; 2) Concept design, 3) Preliminary design; 4) Design for construction permit, 5) Design for performance of works, 6) As-built design. As-built design of a structure pertains to the technical documentation, which shall be prepared after construction of the biomass plant, prior to obtaining the Operation Permit.

Prior to the commencement of preparation of the technical documentation for construction of the structure referred to in Article 133, paragraph 2 of the Law on Planning and Construction, for which the Construction Permit shall be issued by the competent ministry, or by the Autonomous Province, the preliminary work shall be carried out, based on the results of which the preliminary feasibility study and the feasibility study shall be made.

A General Design shall contain the data on: 1) macro location of the structure; 2) general layout of the structure; 3) technical and technological concept of the structure; 4) method of providing the infrastructure; 5) possible variants of spatial and technical solutions from the aspect of fitting in the space; 6) natural conditions; 7) environmental impact assessment; 8) engineering, geological, and geotechnical characteristics of the terrain from the aspect of establishing the general concept and justifiability of construction of the structure; 9) exploratory works for preparation of the preliminary design; 10) protection of natural and immovable cultural assets; 11) functionality and rationality of the design. The general design is part of the preliminary feasibility study.

Preliminary design is prepared for the purpose of constructing the biomass plant if the construction permit for it is to be issued by the ministry in charge of construction, or the competent authority of the autonomous province and it is subject to technical control by a review commission. The preliminary design determines the following: purpose, location, shape, capacity, technical-technological and functional characteristics of the plant, organizational elements and appearance of the plant. The preliminary design is an integral part of the Feasibility Study.

The general design and the preliminary design, the pre-feasibility study, and the feasibility study for the facilities referred to in Article 133 of the Law on Planning and Construction shall

be subject to review (expert supervision) by the committee, which shall be formed by the minister in charge of civil engineering affairs.

Design for construction permit is developed in order to acquire the construction permit. The design for the construction permit shall contain the statement by the chief designer, the responsible designer and the person in charge of technical control confirming that the design is prepared in compliance with the location requirements, the applicable regulations, and the professional rules. Additionally, the design for the construction permit shall contain the fire-fighting and protection study. This study shall be prepared by a person holding the relevant license issued in compliance with the regulations on fire fighting and protection

Design for performance of works shall be prepared for the purposes of performing the construction works. The design for the performance of works is a set of designs harmonized among themselves determining the structural-technical, technological and operational characteristics of the facility with equipment and installations, the technical-technological and organizational solutions for the construction of the facility, the investment value of the facility and conditions of plant maintenance. The design for performance of works shall include the statement of the chief designer and statements of the responsible designers confirming that the design has been prepared in compliance with the location requirements, the construction permit, the design for the construction permit, the applicable regulations and professional rules. For structures which, according to the law, require fire fighting and protection consent for the technical documentation, prior to the issuance of the operating permit it is necessary to obtain the consent for the design for performance of works within the integrated procedure.

As-built design is developed for the purposes of obtaining the operating permit, the operation and maintenance of the biomass plant. The as-built design of the constructed plant is the design for performance of works with the amendments occurring in the course of construction of the structure. In case there have been no deviations from the design for performance of works in the course of construction of the structure, the investor, the person who has exercised the supervision, and the contractor shall corroborate and certify, on the design for construction permit, that the as-built state is equal to the designed state. The as-built design shall not be subject to technical control, except when it is prepared for the purposes of legalization of the structure.

Besides, Pre-feasibility Study and Feasibility Study may also be prepared. The Prefeasibility Study comprises the General Design and the Feasibility Study comprises the Preliminary Design.

Construction Permit

After completion of the review of the main design and getting a positive report on the completed review or verification of the accuracy on the actual design, the application for the Construction Permit shall be submitted. The application shall be submitted to the Ministry in charge of construction activities for the construction of the structure for power production from renewable energy sources, as well as for the construction of plants with combined production of power of 10 MW and more. The application for the issuance of Construction Permits for the structures listed in the Article 133 of the Law on Planning and Construction which are completely

constructed within the territory of the Autonomous Province shall be submitted to the Autonomous Province.

For the combined heat and power production plant of a capacity below 10 MW, the application shall be submitted to the competent authority of the local self-government unit, except if it meets other conditions from the Article 133 of the Law on Planning and Construction.

The Construction Permit shall be issued in the form of a decision. An integral part of the decision shall be the Main Design. The Construction Permit shall particularly contain the data on: 1) investor; 2) structure the construction of which is being permitted (including the data on the overall dimensions, capacities, surface area, estimated cost); 3) cadastral lot on which the structure is to be constructed; 4) existing structure which will be demolitioned or reconstructed for the new construction; 5) period of validity of the Construction Permit and the deadline for completion of construction, 6) documentation based on which it is issued.

The Construction Permit shall cease to be valid if construction of the structure is not commenced within two years as of the date of legal validity of the decision.

Construction of a Structure

Construction of a structure can be started on the basis of valid decision on the issuing of Construction Permit and upon information on the commencement of works from the Article 148 of the Law on Planning and Construction. The investor shall notify the authority, which has issued the Construction Permit and the competent building inspector on the commencement of construction of the structure 8 days prior to the commencement of execution of works.

If the Construction Permit has been issued by the Ministry, or by the Autonomous Province, the notification shall also be submitted to the building inspectorate the territory of which includes the location of the structure, for which the report on commencement of execution of works is submitted.

The report shall contain the date of commencement and the deadline for completion of construction, or of carrying out of the work.

Technical Inspection of the Structure and Operation Permit

Fitness of a structure for use shall be established through technical inspection. Technical inspection of a structure shall be carried out upon completion of construction of the structure, by submitting the Application for the technical inspection to the ministry in charge of civil engineering affairs, or to the local self-government, or to a the unit of local self-government (depending on the competent authority, which has issued the Construction Permit). The Commission shall issue the Report/Finding of the Commission for technical inspection. Minutes shall be taken of the technical inspection, which shall be signed by the members of the commission.

If, for the purpose of establishing of the fitness of a structure for use, previous tests must be performed and checking of installations, equipment, plants, stability or safety of the structure, equipment, and plants for environmental protection, equipment for fire protection or other tests, or if that is stipulated in the technical documentation, the commission for technical inspection,

or the entity who has been assigned to carry out the technical inspection, may propose to the competent authority to allow setting of the facility into trial operation, provided it has established that the requirements for that have been met. The decision on approval of launching the facility into trial operation shall specify the duration of the trial operation, which may not exceed one year, as well as the obligation of the investor to monitor the results of the trial operation and, upon the expiry of the trial operation, to submit the data on its results to the competent authority.

A facility may be used if the Operation Permit has been previously obtained. The authority in charge of issuing the Operation Permit is the authority in charge of issuing the Construction Permit. Application shall be submitted to the Ministry in charge of construction affairs for a generating facility using renewable energy sources, as well as for combined heat-and-power plants of a capacity of 10 MW and over.

Application for issuance of Operation Permits for the construction of structures specified in the Article 133 of the Law which are completely constructed in the territory of the Autonomous Province shall be submitted to the competent authority of the Autonomous Province.

As to the plant of the capacity below 10 MW, the application shall be submitted to the competent authority of the local self-government unit, except if it fulfills other conditions from the article 133 of the Law on Planning and Construction.

The Operation Permit shall be issued when it is established that the facility or a part of the facility, which can be independently used – is fit for use. The Operation Permit shall also contain the warranty period for the facility and certain types of works specified in a special regulation.

It should be indicated that the holder of the right – the owner of the constructed facility is obligated to submit an application for registering the assets and the property right in the Real Estate Cadastre.

Connection the plant to the energy network

After obtaining the operation permit it is necessary to connect the plant to the power transmission/distribution network and the network for distribution of thermal energy. In case of commissioning the plant into trial run, the connection of the plant to the energy network shall be done before obtaining the operation permit.

Connecting the Power Plant to the Electrical Grid

Once the Operation Permit and the right to engage in the activities of public interest have been obtained, it is necessary to connect the power plant to the electricity grid. The electricity producer's facility shall be connected to the electricity transmission or distribution system under the terms and conditions and in the manner stipulated in the Energy Law, Decree on conditions of Electricity Supply and the Transmission or Distribution Grid Code, and in compliance with the standards and technical regulations concerning the criteria for access to and use of power plant facilities, equipment and installations.

The facility of the electricity producer shall be connected to the transmission or distribution system on the basis of approval of the connection by the competent system operator. The approval for connection is issued by means of a decision, within the administrative procedure, on the request of a legal or natural person whose facility is to be connected. This decision defines, among other things, the conditions that the applicant, the electricity producer is obligated to fulfill in order to have the production facility connected to the system.

The competent energy entity shall issue a positive decision, provided all requirements have been fulfilled, based on the technical report, calculation of the costs of and other available documents. Decision on the approval of the connection of the facility to the transmission or distribution system contains specifically: 1) point of connection to the system; 2) method and technical conditions of the connection; 3) approved power, i.e. capacity; 4) energy metering point and method; 5) deadline for connection and 6) costs of connection.

Validity of the Decision on approving the connection is maximum two years from the date of its issuance. At the request of the applicant, the validity of the Decision can be extended. The request for extension of the validity period s to be submitted not later than 30 days before the expiry of the validity set by the same Decision.

Connecting the Plant to the Heat Distribution Network

A plant shall be connected to the heat distribution network in accordance with the provisions of the Energy Law and special regulations, if they have been adopted. In case of the facility simultaneously producing heat and electricity, it does not have to be connected to the heat distribution network if the heat is used for its own needs.

Connection of the facility to the heat distribution system is carried out on the basis of the same provisions of the Energy Law as for the connection of a facility to the electricity transmission or distribution system. If an energy entity is engaged in the activities of generation of heat and/or electricity within one facility, such entity should be connected both to the district heating pipeline and to the electric power system and operationally managed in the way a power generating facility is managed.

Connection of the facility to the heat distribution system is carried out on the basis of the approval of the energy entity for heat distribution and supply, to the system of which the facility is connected, provided that the equipment and installations of the facility to be connected meet the conditions prescribed by the law, technical and other regulations governing the conditions and manner of exploitation of these facilities.

Costs of connection shall be borne by the applicant. The costs of connection are determined in compliance with the regulations set by the local self-government unit governing the manner of rendering the public utility services. The heat distributor is obligated to connect the facility of the heat producer to the system within the time and under the conditions set by the approval of connection.

Procedure for construction of biomass plants - flow chart

Procedure for construction of biomass plants producing heat on the territory of the Republic of Serbia, Separate procedure for acquiring the right to produce heat from biomass plant and Cited legislation are given in the Tables 8 to 10. Also, technical documentation for the construction of the structure and Cited legislation are given in the Tables 11 and 12.

Standards

In parallel with the development of production of different types of biofuels there was an ongoing process of developing relevant standards in order to test their quality and other parameters relevant to final consumption. In this respect the first standards for wood fuels were developed in Germany, Austria and Sweden. The national standards of these countries were the basis for the development of uniform European standards for wood fuels within the European Committee for Standardization. In January 2010 standards marked EN 14961/1-5:2010 (Solid biofuels - Fuel specifications and classes) for wood fuels were adopted at the European level. Intensive development of trading in certain wood fuels, primarily wood pellets, in recent years resulted in the fact that ISO developed standards for wood fuels applicable to production and trading at global level. The European Committee for Standardization, and consequently the Serbian Institute for Standardization, adopted these standards in 2015, meaning that Europe, and Serbia, adopted new wood fuel standards marked SRPS EN ISO 17225/1-5:2015. This group of standards includes standards for all types of wood fuels individually:

SRPS EN ISO 17225/2015: Solid biofuels - Fuel specifications and classes,

SRPS EN ISO 17225-1:2015 Solid biofuels - Fuel specifications and classes - Part 1: General requirements (ISO 17225-1:2014),

SRPS EN ISO 17225-2:2015 Solid biofuels - Fuel specifications and classes - Part 2: Graded wood pellets (ISO 17225-2:2014),

SRPS EN ISO 17225-3:2015 Solid biofuels - Fuel specifications and classes - Part 3: Graded wood briquettes (ISO 17225-3:2014),

Procedure for construction of biomass plants producing heat on the territory of the Republic of Serbia		
STEP	COMMENT	LEGISLATION
I. SELECTION OF LOCATION		
1. Verification if the valid planning document envisages the construction of energy generation unit.	Directly from the local self-government unit whose territory includes the selected location get the valid planning document for perusal	(a), (b)
2. Application for information on location requirements (possibilities and limitations).	Submitted to the authority in charge of issuing the location requirements	(a), (b)
II. OBTAINMENT OF THE ENERGY PERMIT		
1. Making the environmental impact assessment study (mandatory for capacities > 50 MW, may be requested for capacities < 50 MW, not necessary for capacities < 1 MW)	Submitted to relevant entity which issues the construction permit	(c), (d), (e), (f), (g)
2. Application for the energy permit	Submitted to relevant entity which issues the construction permit, usually along with application for the construction permit	(h)
III. OBTAINMENT OF THE INTEGRATED PERMIT		
All necessary documents already prepared from previous steps	Issued by the relevant authority which issues the construction permit, only for capacities > 50 MW	(i), (j)
IV. OBTAINMENT OF THE CONSTRUCTION PERMIT		
1. Formation of Technical documentation (1) general design; 2) concept design; 3) preliminary design; 4) design for construction permit, and 5) design for performance of works, and 6) as-built design)	Preliminary feasibility study (including general design) and the Feasibility study (including preliminary design)	(a), (k), (l), (m)
2. The technical review of the design	If Ministry in charge issues the construction permit it nominates commission for review, otherwise the Investor nominates the person who shall perform the technical review.	(a)
3. Application for the construction permit	To the Ministry in charge (for capacities > 10 MW) or the unit of local self-government (for capacities < 10 MW)	(a), (n)
V. CONSTRUCTION		
All activities regulated by the Law on Planning and Construction, (Official Gazette of the Republic of Serbia, No. 72/2009)		
VI. TECHNICAL INSPECTION AND OBTAINMENT OF OPERATION PERMIT		
1. Submission of the request for technical inspection	To the Ministry in charge (for capacities > 10 MW) or the unit of local self-government (for capacities < 10 MW)	(a)
VII. CONNECTION TO THE HEAT DISTRIBUTION NETWORK		
All activities regulated by the Energy Law (Official Gazette of the RS, No. 145/2014) and specific regulation of the local self-government unit related to the manner of performing public utility services of heat production and distribution		

Table 28: Procedure for construction of biomass plants producing heat on the territory of the Republic of Serbia

Separate procedure for acquiring the right to produce heat from biomass plant		
(A) Entrusting of the right to perform public utility activity.	Decision of the assembly or contract with the local self-government unit	(o)
(B) Activity of public interest acquired through a concession.	Contract with relevant government authority	(p)
(C) Investing in a public (utility) company or company performing utility service	Approval of the Founder of the Public (utility) company	(o), (q), (r)
Obtainment of License to perform energy activities	Issued by the unit of local self-government.	(s)

Table 29: Separate procedure for acquiring the right to produce heat from biomass plant

Cited legislation		
(a)	Law on Planning and Construction	Official Gazette of the Republic of Serbia No 72/2009, 81/2009 - correction, 64/2010 – Decision of Constitutional Court, 24/2011, 121/2012, 42/2013 – Decision of CC, 50/2013 - Decision of CC, 98/2013 - Decision of CC, 132/2014 and 145/2014
(b)	Regulation on requirements for the location	Official Gazette of the RS No 35/2015, No 114/2008
(c)	Law on Energy	Official Gazette of the Republic of Serbia No 145/2014
(d)	Law on Environmental Protection	Official Gazette of the Republic of Serbia No 135/2004, 36/2009, 36/2009; 72/2009; 43/2011 – Decision of CC, and 14/2016
(e)	Law on Environmental Impact Assessment	Official Gazette of the Republic of Serbia No 135/2004 and 36/2009
(f)	Law on Strategic Assessment of Environmental Impact	Official Gazette of the Republic of Serbia No 135/2004 and 88/2010
(g)	Regulation on the types of projects for which environmental impact assessment is obligatory or can be required	Official Gazette of the RS No 114/2008
(h)	Rule Book on energy permits	Official Gazette of the RS No 15/2015
(i)	Law on Integrated Prevention and Control of Environmental Pollution	Official Gazette of the Republic of Serbia No 135/2004 and 25/2015
(j)	Rulebook on the process of electronic implementation of the integrated procedure	Sl. glasnik RS", br. 113/2015, 96/2016 i 120/2017
(k)	Rulebook on Content, Method and Manner of Development and Performing Control of Technical Documentation According to Class and Intended Use of the Structure	Official Gazette of the RS No 23/2015, 77/2015, 58/2016, 96/2016
(l)	Rulebook on the content and extent of the preliminary work, pre-feasibility study and feasibility study	Official Gazette of the RS, No. 1/2012
(m)	Rule Book on unified electronic procedure	Official Gazette of the RS No 113/2015
(n)	Rulebook on Content and Method of issuing the Construction Permit	Official Gazette of the RS No 93/2011, No 103/2013 - CC
(o)	Law on Utility Services	Official Gazette of RS No. 88/2011, 104/2016
(p)	Law on Public-Private Partnerships and Concessions	Official Gazette of the Republic of Serbia No 88/2011 and 15/2016
(q)	Law on Public Companies	Official Gazette of the Republic of Serbia No 15/2016)
(r)	Law on Companies	Official Gazette of the Republic of Serbia No 36/2011, 99/2011, 83/2014, and 5/2015
(s)	Rulebook on license for carrying out energy activities and certification	Official Gazette of the Republic of Serbia“, No. 87/2015

Table 30: Cited legislation

Technical Documentation				
Document		Main goal	Basic regulation	Basic content
A	General Design	For the purpose of making a preliminary feasibility study	(a), (b), (c)	- consideration of resource and spatial capabilities, - disposition and general concept, - basic functional, - technological and technical characteristics, - exploitation conditions and basis for economic analysis, - analysis of variant solutions and sele
B	Concept design	For the purpose of obtaining the location conditions and as part of the urban project for the purposes of urban-architectural development of the site	(a), (b), (d)	- display of the planned conception, - necessary data for determining location conditions
C	Preliminary design	For the purposes of developing a feasibility study and for obtaining the approval for the performance of works	(a), (b), (c), (d), (e)	- a set of mutually agreed projects, - data on the purpose, position, form, capacity, etc., - technological and technical characteristics, - indicative proof of the fulfillment of the basic requirements of the project
D	Design for construction permit	For the purpose of obtaining a building permit	(a), (b)	- a set of mutually agreed projects, Additional Elements (General and Conceptual Design): - dimensioning of the main elements, - basic selection of materials, installations and equipment, - indicative demonstration of the fulfillment of the basic requirem
E	Design for performance of works	For the purpose of building and performance of works	(a), (b)	- a set of mutually harmonized projects necessary for the performance of works of all types, Additional elements (Construction Permit Project): - investment value of the facility and maintenance conditions, - all details
F	As-built design	For the purpose of obtaining the use permit, use and maintenance of the facility	(a), (b)	The same structure and content as in the Execution Project, but according to the embodied state

Table 31: Technical documentation for the construction of the structure

Cited legislation		
(a)	Law on Planning and Construction	Official Gazette of the Republic of Serbia No 72/2009, 81/2009 - correction, 64/2010 – Decision of Constitutional Court, 24/2011, 121/2012, 42/2013 – Decision of CC, 50/2013 - Decision of CC, 98/2013 - Decision of CC, 132/2014 and 145/2014
(b)	Rulebook on Content, Method and Manner of Development and Performing Control of Technical Documentation According to Class and Intended Use of the Structure	Official Gazette of the RS No. 23/2015, 77/2015, 58/2016, 96/2016
(c)	Rulebook on the content and extent of the preliminary work, pre-feasibility study and feasibility study	Official Gazette of the RS, No. 1/2012
(d)	Rule Book on unified electronic procedure	Official Gazette of the RS No. 113/2015
(e)	Regulation on requirements for the location	Official Gazette of the RS No. 35/2015, 114/2008

Table 32: Cited legislation

SRPS EN ISO 17225-4:2015 Solid biofuels - Fuel specifications and classes - Part 4: Graded wood chips (ISO 17225-4:2014),

SRPS EN ISO 17225-5:2015 Solid biofuels - Fuel specifications and classes - Part 5: Graded firewood (ISO 17225-5:2014),

SRPS EN ISO 17225-6:2014 Solid biofuels - Fuel specifications and classes - Part 6: Graded non-woody pellets (ISO 17225-6:2014),

SRPS EN ISO 17225-7:2014 Solid biofuels - Fuel specifications and classes - Part 7: Graded non-woody briquettes (ISO 17225-7:2014).

The first part describes the general classification of raw materials and the specifications of the products available on the market. This part is flexible and allows the manufacturer or the consumer to choose the appropriate set of product characteristics that corresponds to the production or the desired quality of solid biofuel, as the individual product parameters are not related to each other. It enables the manufacturer and the consumer to agree on a product specification in accordance with each situation.

Within these standards are given individual ISO standards for testing of individual characteristics of solid fuels (sampling, humidity, ash, thermal power, etc.). The said group of standards, individual standards from the ISO group are stated, based on which individual characteristics are tested. Thus, for instance, testing of moisture content of wood fuels is performed according to standard ISO 18134/1-2, and testing of net calorific value according to standard ISO 18125. Different other ISO standards are used to test other parameters of different types of wood fuels.

There are also standards relating to solid biofuels in accordance with EU standards:

1. SRPS EN 14780:2017 Solid biofuels - Sample preparation (ISO 14780:2017),

2. SRPS EN 15234-1:2014 Solid biofuels - Fuel quality assurance - Part 1: General requirements,

3. SRPS EN 15234-2:2014 Solid biofuels - Fuel quality assurance - Part 2: Wood pellets for non-industrial use,

4. SRPS EN 15234-3:2014 Solid biofuels - Fuel quality assurance - Part 3: Wood briquettes for non-industrial use,

5. SRPS EN 15234-4:2014 Solid biofuels - Fuel quality assurance - Part 4: Wood chips for non-industrial use,

6. SRPS EN 15234-5:2014 Solid biofuels - Fuel quality assurance - Part 5: Firewood for non-industrial use,

7. SRPS EN 15234-6:2014 Solid biofuels - Fuel quality assurance - Part 6: Non-woody pellets for non-industrial use,

8. SRPS CEN/TR 15569:2014 Solid biofuels - A guide for a quality assurance system,

9. SRPS EN 16214-1:2014 Sustainability criteria for the production of biofuels and bio liquids for energy applications - Principles, criteria, indicators and verifiers - Part 1: Terminology,

10. SRPS EN 16214-2:2014 Sustainability criteria for the production of biofuels and bio liquids for energy applications - Principles, criteria, indicators and verifiers - Part 2: Conformity assessment including chain of custody and mass balance,

11. SRPS EN 16214-3:2017 Sustainability criteria for the production of biofuels and bio liquids for energy applications - Principles, criteria, indicators and verifiers - Part 3: Biodiversity and environmental aspects related to nature protection purposes,

12. SRPS EN 16214-4:2015 Sustainability criteria for the production of biofuels and bio liquids for energy applications - Principles, criteria, indicators and verifiers - Part 4: Calculation methods of the greenhouse gas emission balance using a life cycle analysis approach.

Exploit our DHS services for you in Serbia!

The information found here in this chapter provides you with a first general impression about the DH market in Serbia. If you do not know how your own situation matches up to these national ones, then contact us so we can help you find out. As we have already supported other Serbian DH companies, our entire consortium is also happy to offer you our valuable services. We can help converting your ambitious DH ideals into real actions on the ground, by connecting with experts for the preparation of meaningful feasibility studies with market-ready scenarios, as well as creating tailor-made business models. Similarly, we are here to help you find your way through the legal framework, and can guide you in navigating through potential subsidies, permits and standards relevant to you. To find out more about these and many other services we offer (e.g. trainings, achieving investment, strategic planning, …), please contact our consortium (info@keepwarmeurope.eu), or even more directly to our Serbian partner **VINČA INSTITUTE OF NUCLEAR SCIENCES, Laboratory of Thermal Engineering and Energy** - gzivkovi@vinca.rs, mica@vinca.rs, 140@vinca.rs.

6. DHS Market in Slovenia

General information in the country

In 2017, in Slovenia supply of heat was provided from 93 distribution systems by 55 heat suppliers in 64 Slovenian municipalities. Heat distributors supplied 106,292 consumers and delivered 1,963.2 GWh of heat. Consumption from recorded distribution systems was in 2017 higher by 2.34% than the year before, and in comparison, with 2015 by 6.7% - excluding own consumption of heat producers.

The downward trend in the number of consumers of heat connected to district heating has stopped, since in 2017 the number of consumers increased by 5.4%. This is certainly the result of reliable and cost-effective supply, which among other things enable consumers to lower the costs of regular maintenance of their own heating system.

For heat supply, producers of heat with their own production and heat producers that supply heat to distribution systems generated 2466.1 GWh of heat. At the same time 939.8 GWh of electricity, or 838.0 GWh at the busbars of the cogeneration processes for heat supply were produced. The share of heat generated to supply distribution systems from cogeneration accounted to 86.8% of all generated heat.

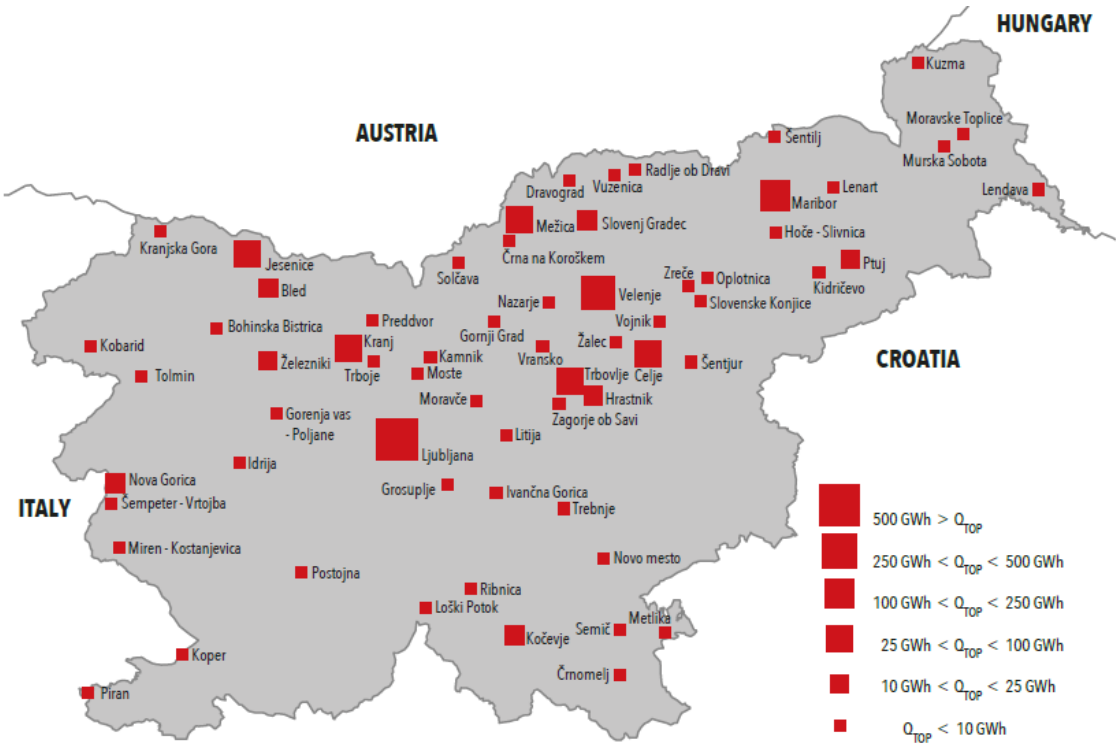

Figure 9: Map of DHS in Slovenia (size by yearly sold heat) © Agencija za energijo

The primary energy source of heat production for the supply of heat distribution systems

was also in 2017 coal with a 56.02% share, followed by natural gas with 26.5% share. Oil and oil derivatives were represented with almost 1% share, while renewable sources in the structure of primary energy products reached a 12.8% share.

Talking about prices, biomass fuels are quite competitive in Slovenia compared to fossil fuels. However, for biomass plants it is hard to compete with depreciated fossil plants without any subsidies.

FUEL	€/KWH
Oil	0.09 – 0.10 €
Gas	0.07 – 0.09 €
Coal	0.05 €
Wood chips	0.022 €
Wood pellets	0.064 €
Wood logs	0.027 €

Table 33: Typical prices for fuels in Slovenia

The general opinion of the society about DHS is very positive. The downward trend in the number of consumers of heat connected to district heating has stopped, since in 2017 the number of consumers increased by 5.4%. This is certainly the result of reliable and cost-effective supply, which among other things enables consumers to lower the costs of regular maintenance of their own heating system.

Use of renewables in DHS

Biomass

Slovenia is with 55% of area cowered with forest one of the most wooded countries in Europe. There is 0.56 ha of forest land per capita. The forest area has grown considerably (180,000 ha) in the last 40 years. The problem lies in the process of abandoning agricultural land. Growing stock has increased for 45% in the last 40 years but production of raw wood has decreased (for 23%) in the last 10 years. After the denationalization (not yet finished) more than 65% of all forests in Slovenia will be owned by private owners.

A detailed analysis of wood biomass potentials was done by the Slovenian Forestry Institute. According to this study, potentials of wood biomass in Slovenia are 450,000 dry ton of wood biomass per year from forests. In the long run we can count with 1m^3 of wood biomass per ha of forest. Important source of wood biomass for energy purposes is thin wood from thinning in early stages of forests. To develop and high-quality forests, regular thinning is necessary. This means that forest management results in large amounts of thin wood. Most of this wood is still remaining unused in the forest, which is ecologically desired, but economically inadmissible. 120,000 tons of dry wood biomass per year from abandoned agricultural land and 361.000 tons of dry wood waste per year from wood processing industry. The majority of this potentials are already used for energy purposes. Wood biomass directly from forests is mainly used by forest owners. Wood wastes are on the

contrary used directly in industry for production of process steam or electricity. Largely unused are potentials from abandoned agricultural land.

Biomass accounts for 56 % of total heat energy used in Slovenian households.

According to the Slovene Energy Agency (National report on the Energy sector in Slovenia) biomass as energy source presents only 12.69 % of total energy sources used in DHS.

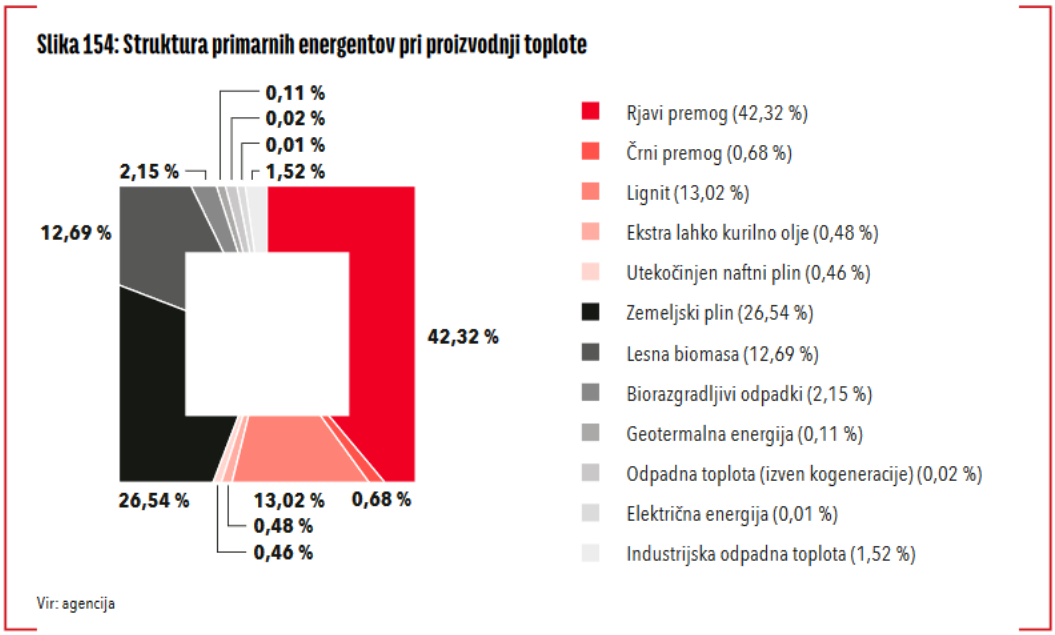

Figure 10: Struktura primarnih energetov pri proizvodnji toplote

According to the same report, 43 CHP on biomass is included in national support scheme for RES. Since most of Slovenian DHS use CHP technology share of biomass as primary energy are around 9.81 %

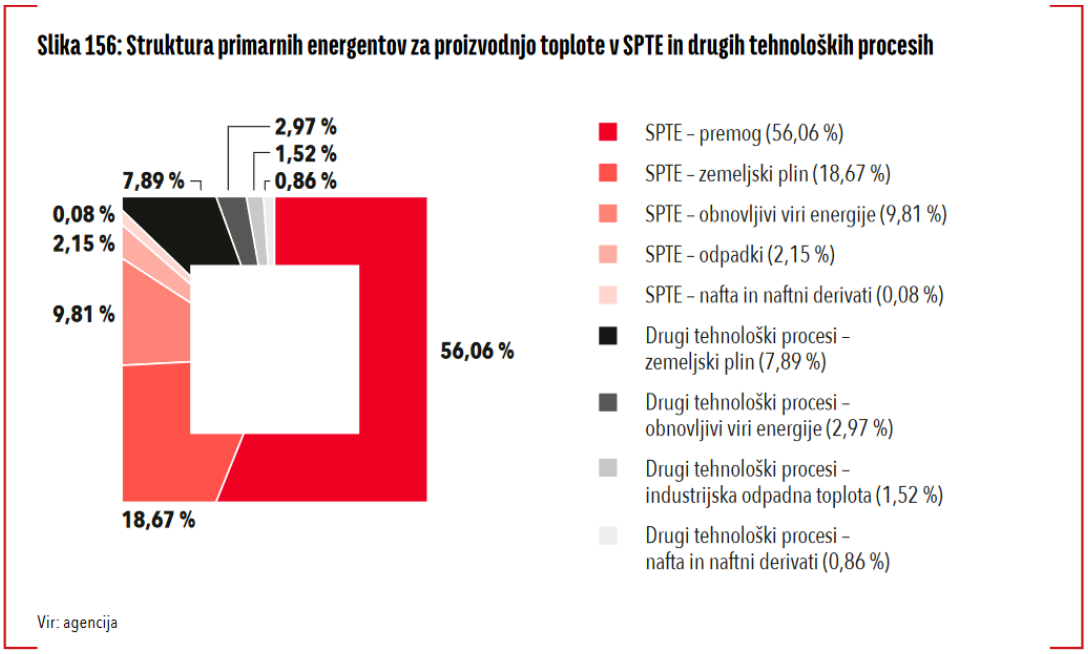

Figure 11: Struktura primarnih energetov za proizvodnjo toplote v SPTE in drugih tehnoloskih procesih

The largest consumers of wood fuels are households with a total consumption of 1.24 million tons recorded for 2015 (Energy balance of the Republic of Slovenia 2015). In the last ten years, there is an increasing interest in the production and use of various wood fuels. Consequently, by increasing the consumption of wood fuels also the supply increases. The Country Market Statement 2014 reports that in 2013 and 2014, the domestic demand of pellets increased, which led to increased import. The monitoring of manufacturing and foreign trade shows that the production of pellets in Slovenia failed to follow market opportunities (Slovenia Country Market Statement 2014).

Slovenia is characterized by a fragmented structure of forest land. Owners with larger plots are mostly in the south and north of the country. Due to denationalisation, the ownership of forests in the past years has changed considerably. 79% of forests are privately owned, the remaining 21% of forests are public (owned by the state or municipalities) (Forest Report 2016).

Large and undisturbed forest land owned by the state provides good professional management. Private forest estates are mostly small, with an average area of only 3 hectares, and these are further divided into several separate parcels. For the vast majority of owners of small estates, forests are not economically important.

Due to such fragmentation, the supply of wood biomass for larger systems can be uncertain. The vast majority of forest owners do not want to bind themselves in the long term and provide adequate quantities and quality of wood biomass. They rather adopt to current market condition

The use of biomass is well accepted in the society, especially in rural areas and in smaller towns, while in the bigger cities are some problems due of the fine dust emissions (PM particles). The political opinion on using biomass is positive, as mentioned, biomass in Slovenia is most important RES, and there are set of national policies that promote sustainable use of biomass.

Excess/waste heat

In 2017, consumption of heat was 2.34% higher than a year before. 55 heat suppliers in 64 Slovenian municipalities provided supply of heat from 93 distribution systems. As much as 86.76% of heat for the supply was produced by cogeneration of electricity and heat.

In Slovenia, only in the municipal waste incinerator in Municipality of Celje heat is produced from biodegradable waste, and in the area of former ironwork Ravne na Koroškem (SIJ Metal Ravne, d.o.o.) waste heat from industrial processes is used for heat distribution. Heat, produced from biodegradable waste covered 2.15%, and waste heat from industrial processes 1.5% of all generated heat for the supply of distribution systems.

The use of excess/waste heat is accepted in the society. Although it is not that well known in the society yet. The political opinion on using excess and waste heat is positive. Politicians decide on awarding of subsidies. They know that it is necessary to use heat efficient to reach climate and energy goals and therefore understand the need to utilize

excess/waste heat.

Excess/waste heat maps are not yet available but are foreseen in the near future (this is one of the goals of ongoing research project steered by Ministry of Infrastructure).

Best practices

Mentioned project of waste heat exploitation in DHS Petrol – Ravne na Koroškem is one of the awarded best practice example of good cooperation of industry with huge waste heat potential and local DHS operator. Volume of waste heat utilisation is increasing and is foreseen to become one of the key heat sources in the future.

Permissions

There is no special permission needed, although normal heat regulation should be followed for implementation. Setting of heat pricing and other contract details between both partners could be one of the challenges due to limited experiences in this topic.

Subsidies

Eco fund is providing up to 20% investment subsidies and soft loans for the waste heat utilisation projects. Waste heat utilisation is also eligible measure within energy saving obligation of energy suppliers, which can provide additional economic benefits for the implementation.

General acceptance

Public acceptance is growing with the successful project implementation and dissemination of their benefits. Political opinion is positive and awareness on the potential and benefits is growing, resulting in policy goals and supporting instruments.

Solar-thermal energy

Solar thermal sector is not high on the agenda among sectors to be developed or supported in Slovenia.

There are only isolated cases of its implementation in DHS, only slightly more popular is among households. But on the other hand there exist some testing/demonstration solar thermal fields, involving new solar thermal technologies, e.g. solar thermal fields at Jožef Stefan Institute – JSI and at Slovenian National Building and Civil Engineering Institute – ZAG in Ljubljana where they are used as support to space heating in winter and for cooling (in combination with adsorption chiller) in summer. In Slovenia there is currently only one DHS with integrated solar thermal collectors (Vransko).

Subsidies and incentives

Incentives for installation of solar-thermal collectors are ensured by the public tenders provided by Eko sklad (Slovene environmental public fund) for households as part of the programme intended for co-financing the new investments in the use of renewable energy sources and increased energy efficiency of residential buildings, where an installation of a

solar heating system belongs among appropriate measures. In case of DH systems there is only solar hot water preparation system subsidized but only if the use of solar energy as an additional energy source contributes to improving the economy of the entire DHS, which has to run on RES. Financial resources for these subsidies are ensured by Cohesion Fund.

General acceptance

In general, there is positive attitude towards solar-thermal energy in Slovenia, although an extent of use and installation trends does not reflect this. Solar collectors are known as rather simple and efficient way of using solar energy where household demands for domestic hot water can be ensured (in combination with heat storages), particularly during the summer, late spring or early autumn. It is much less used as support to space heating during winter. However, these solutions are in the vast majority used in households, only exceptionally as energy source for DHS.

Political will

Solar-thermal energy doesn't belong to top priority means of heat supply. There is lack of its strategic positioning in relevant policies or other active support and development of solar thermal solutions and projects at somewhat larger scale. Installation of solar heating system is currently listed among investments which can receive incentives as part of the national programme to increase use of RES and EE in buildings. It is expected that in Slovenia much more attention at national level will be given to geothermal energy.

Best Cases

In general, the use of solar thermal energy is well developed, in district heating systems it is only used in a one project. Characteristic of thermal solar plant as part of DHS are:

- The maximum solar peak power of the system is up to 420 kW.
- »Low-Flow« principle was connected to the solar energy receivers.
- The desired amount of energy would require approx. 1.500 m² SSE, only 842,3 m² was realized.
- 100 m³ storage tank.

Other Renewable energy sources

One of likely the most attractive heat sources is geothermal, particularly in regions where geological conditions enable successful and safe exploitation of heat from the ground. There are investigations under preparation to estimate the potential and create a map of corresponding areas with high potential.

There is also limited biogas potential existing, mainly as fuel for CHP plants (cogeneration of heat). Biogas is mainly produced on farms or on municipal waste(water) treatment plants/centres, where it is produced from the biological part of mixed municipal waste and separately collected biodegradable waste.

Analysis of the potential of geothermal energy exploitation for densely populated areas in Slovenia has been prepared in 2018. It considered factors and restrictions regarding exploitation of geothermal energy both from technical and economic aspects. Estimation of shallow geothermal energy potential shows that this source of heat could play an important role in the future. Currently in Slovenia one DHS with geothermal energy (city of Lendava) is operating.

Currently there is one example in Slovenia (Rakičan) where biogas is used as CHP plant fuel where generated heat is then supplied to a nearby small thermal grid. In Regional Waste Management Centre Ljubljana (RCERO) the biogas produced is used for generation of electricity and heat energy needed for the operation of the regional centre.

Legal framework and subsidies

The umbrella law governing the field of thermal energy distribution is the Energy Act. The Energy Agency in the field of district heating supply issues general acts for the exercise of public authority, gives approvals to system operating systems.

District heating and cooling systems must be energy efficient in accordance with the criteria of the first paragraph of Article 322 of the Energy Act (EZ-1, Official Gazette RS 17/14, 81/15). In doing so, heat distributors must ensure that heat is provided annually from at least one of the following sources:

- At least 50% of the heat produced from renewable energy sources
- at least 50% excess heat
- at least 75% of the heat from cogeneration
- at least 75% of the heat combination referred to in the first three indents

Distributors of heat with a system power exceeding 10 MW must provide:

- a system for controlling the operation of the district heating or cooling system, which enables optimal thermal and hydraulic operation of the system;
- implementation of measures to optimize the operation of the district heating or cooling system.

In accordance with the second paragraph of Article 322 of the EA-1, the Agency publishes a list of energy efficient heat distribution systems for the previous year. The list of energy efficient distribution systems is made on the basis of the fulfilment of the criteria of the first paragraph of Article 322 (EC-1) and analyses of data on the sources of energy used, cogeneration and excess heat in the heat distribution systems, which the Agency obtains from distributors and heat producers within their annual reporting (first paragraph of Article 311 EC-1).

Below are the relevant articles and paragraphs of the Energy Act

Article 1 (Content of law)

This law lays down the principles of energy policy, the rules of operation of the energy market, the ways and forms of performing utilities in the field of energy, the principles and measures for achieving security of energy supply, for increasing energy efficiency and saving with energy and for greater use of energy from renewable sources, determines the conditions for operation of energy installations, regulates the powers, organization and operation of the Energy Agency (hereinafter: the Agency) and the competences of other bodies performing tasks under this Act.

Unless otherwise defined in the relevant part of the law, the terms used in the law have the following meaning:

36. "efficient district heating and cooling" means a district heating or cooling system using at least 50% of energy from renewable sources, 50% of excess heat, 75% of heat from cogeneration or 75% of a combination of such energy and heat;

Article 5 (goals of the law)

The objectives in the field of energy supply and use are in particular:

- secure energy supply,
- ensuring effective competition in the energy market,
- competitiveness in carrying out non-market activities,
- efficient energy conversion,
- reducing energy use,
- energy efficiency,
- energy efficiency,
- increased production and use of renewable energy sources,
- the transition to a low-carbon society using low-carbon energy technologies,
- the provision of energy services,
- ensuring social cohesion,
- protecting consumers as final consumers of energy,
- ensuring effective control over the implementation of the provisions of this Act.

Article 319 (types of energy services and energy efficiency improvement measures)

(1) The types of energy services and energy efficiency improvement measures for achieving energy savings that may be included in their programs by taxpayers referred to in the preceding Article are in particular:

- measures for the efficient use and increased use of renewable energy sources in the production of heat in the public and service sectors and in industry and households,
- energy efficiency measures in buildings,
- transport energy efficiency measures,

- measures to increase the efficiency of district heating systems,
- energy audit programs.

(2) In the regulation referred to in the third paragraph of Article 318 of this Act, the Government shall specify the types of energy services and measures for improving energy efficiency.

Article 320 (evaluation of actions and programs)

In preparing, implementing and evaluating measures and programs to improve energy efficiency and the use of renewable energy sources, the methods prescribed by the Minister shall be followed to determine the energy savings and the amount of energy from renewable energy sources achieved through individual energy efficiency and renewable energy use measures. for energy.

Article 322 (compulsory use of renewable energy, cogeneration and excess heat in district heating systems)

(1) District heating and cooling systems must be effective. Heat distributors must ensure that heat is provided annually from at least one of the following sources:

- at least 50% of the heat produced from renewable energy sources,
- at least 50% of the excess heat,
- at least 75% of the heat from cogeneration, or
- at least 75% of the heat combination referred to in the first three indents.

(2) The Agency shall verify the obligations referred to in the previous paragraph on the basis of the reports referred to in Article 311 of this Act. The Agency shall by May 1 for the previous year announce which district heating systems are energy efficient.

(3) Notwithstanding the first and second paragraphs of this Article, the values referred to in the first paragraph of this Article may also be achieved in several networks in the territory of the same local community, if so determined by the local energy concept.

In accordance with the Energy Efficiency Directive (2012/125 / EC), a Comprehensive Assessment of the Potential for High Efficiency Cogeneration and Effective District Heating and Cooling (Article 14, Annex VIII) is required. The obligation is defined in Article 360 of the Energy Act (EZ-1), which stipulates that the ministry responsible for energy should make a comprehensive assessment of the potential for use of high efficiency cogeneration every five years and efficient district heating and cooling, including a description of heating and cooling and forecasting changes in these needs over the next 10 years, identifying heating and cooling needs that can be met by high-efficiency cogeneration, the share of high-efficiency cogeneration, and an estimate of expected primary energy savings, measures to increase the energy efficiency of infrastructure for district heating and cooling and increasing the share of cogeneration.

Emission limits

The emission limits are defined in national legislation by “Decree on the emission of substances into the atmosphere from small combustion plants” (Official Gazette No. 46/19) and “Decree on the emission of substances into the atmosphere from medium-sized combustion plants, gas turbines and stationary engines” (Official Gazette No. 17/18 and 59/18). Decree is also related with the European MCP-Directive (EU 2015/2193), which regulates the emission limits for medium combustion plants.

COAL	< 1 MW	1 – 50 MW
Dust mg/m³	40	22
SO2 mg/m³	1,000	1,400
CO mg/m³	500	160
NOx mg/m³	400	325

Table 34: Emission limits for coal firings in Slovenia

OIL	< 1 MW	1 – 50 MW
CO mg/m³	150	80
NOx mg/m³ (heat oil extra light)	1,110 - 185	180
Dust mg/m³	-	50

Table 35: Emission limits for oil firings in Slovenia

GAS	< 1 MW	1 – 50 MW
CO mg/m³	100	80
NOx mg/m³	60 - 120	100
Dust mg/m³	-	5

Table 36: Emission limits for gas firings in Slovenia

BIOMASS	< 1 MW	1 – 50 MW
Dust mg/m³	40	30
SO2 mg/m³	1,000	1,500
CO mg/m³	500	225
NOx mg/m³	400	375

Table 37: Emission limits for biomass firings in Slovenia

Financial Incentives and Subsidies

Most investments in public infrastructure in Slovenia are financed from public funds, ie from state and municipal budgets. The following can be identified as alternative methods of financing the budget:

- Private equity that can be included in a project under the PPP institute;
- EU Funds: Cohesion Fund, European Regional Development Fund (ERDF), European Social Fund;

In October 2014, the EC and the Republic of Slovenia concluded a Partnership Agreement for the implementation of the European Funds in the period 2014-2020, which allows Slovenia access to the joint EUR 4.174 billion of which:

- € 3,312 billion from European cohesion policy (€ 3.068 billion from ERDF, ESF, KS and Youth Employment Initiative - YEI; € 159.8 million for Connecting Europe Facility - CEF; € 64 million for European Territorial Cooperation; EUR 21 million from the European Aid to the Most Deprived Fund),
- EUR 837.8 million from the EAFRD;
- € 24.8 million from the EMFF.

Slovenia has prepared three operational programs for the implementation of European funds:

- OP for the implementation of the European Cohesion Policy 2014-2020 (last valid version December 2017) - under the authority of the Government Office for Development and European Cohesion Policy (SVRK),
- Rural Development Program 2014-2020 - under the responsibility of the Ministry of Agriculture, Forestry and Food (MAFF),
- OP for implementation of the EMFF in the Republic of Slovenia (RS) for the period 2014-2020 - under the competence of the MAFF

The European Commission has identified 11 thematic objectives within which Member States can finance European Cohesion Policy actions and contribute to the joint achievement of the objectives of the EU 2020 Strategy. a total of EUR 636 million of EU funds is available, of which the most relevant for the purpose of this task is:

Supporting the transition to a low-carbon economy in all sectors: EUR 226 million in EU funding for sustainable energy, which is primarily targeted at efficient use of energy in the public sector, energy renovation of public sector buildings, efficient use energy in households (CTN, energy poverty), building smart grids and generating electricity from renewable sources

The current drawdown for grants is:

Ministry for Infrastructure - Call for proposals for the co-financing of district heating from renewable energy sources for the period 2019-2022. The subject of co-financing is financial incentives intended for investments in new district heating systems (hereinafter referred to as DH RES) and DH RES micro-systems. Investors expanding the existing DH RES system or building a new wood biomass boiler as a source for the existing grid are also eligible for financial incentives.

Eco Found – Slovenian Environmental Public Found (The transition to renewable energy sources, efficient use of energy, waste management, wastewater treatment, sustainable

mobility and public awareness are challenges for the Eco Fund.)

Wood biomass combustion plants: Credit - The incentive right is granted to purchase and install or replace an old combustion plant that provides heat to the building's central heating system.

Wood biomass combustion plants: Subsidy - The incentive right is granted for the purchase and installation or for replacement of an old combustion plant providing heat to the building's central heating system with a new wood biomass firing plant.

Permissions

Building permit and plant operation permit are required. The Building Act is a matter of the respective national legislation and the execution of the operating license is based on the trade regulations. The approval procedure is carried out by the responsible national Energy Agency. Depending on the size and location, the district heating plant needs other permits.

Exploit our DHS services for you in Slovenia!

The information found here in this chapter provides you with a first general impression about the DH market in Slovenia. If you do not know how your own situation matches up to these national ones, then contact us so we can help you find out. As we have already supported other Slovenian DH companies, our entire consortium is also happy to offer you our valuable services. We can help converting your ambitious DH ideals into real actions on the ground, by creating meaningful feasibility studies with market-ready scenarios, as well as creating tailor-made business models. Similarly, we are here to help you find your way through the legal framework, and can guide you in navigating through potential subsidies, permits and standards relevant to you. To find out more about these and many other services we offer (e.g. trainings, achieving investment, strategic planning, …), please contact our consortium (info@keepwarmeurope.eu), or even more directly to our Slovenian partners Jožef Stefan Institute, jure.cizman@ijs.si and KSSENA, nejc.jurko@kssena.velenje.eu.

7. DHS Market in Ukraine

General information in the country

The annual consumption of natural gas for heating purposes both in district heating and individual installations during recent years varies in the range of 11-12 billion m³, which is almost 40% of total natural gas consumption in Ukraine. District heating companies consume on average approximately 6 billion m³ of natural gas per year, while the remaining part is consumed by individual boilers in residential sector. [10].The consumption of natural gas has been reduced significantly over the last decade but there is still a significant potential to achieve energy savings both in buildings sector and in district heating systems.

Ukraine has well-developed district heating sector in terms of geographical coverage but it is characterized by outdated equipment, low energy-efficiency, and declining customers base.

Most multi-apartment buildings and some private buildings in cities and towns are connected to the district heating networks. However, during last decade there was a tendency of switching of individual apartments in multi-apartment buildings from district heating to individual natural gas fired boilers. Also newly constructed multi-apartment buildings are often equipped with individual natural gas fired boilers and not connected to DHSs. Besides, there are examples of the whole cities abandoning DHSs and switching to the individual boilers (Uzhgorod, Nikopol, Marganets, etc.).

The weighted average efficiency of heat energy generation by Ukrainian district heating companies is 89 %.[11] Hot water is used as heat carrier and the typical temperature schedule is 110 °C for the supply pipe and 60 °C for the return pipe for the designed minimum temperature of minus 22 degrees Celsius. The actual operating temperatures are significantly lower. Control of heat energy supply is performed by adjusting supply temperature.

The total DH network length is about 21,000 km, and the average losses in the networks make up to 16% according to the State Statistics Service of Ukraine. However, according to market operators, the real losses in some spots can reach up to 50 % and need an immediate repair or replacement. Taking into account generation efficiency, this brings overall efficiency of district heating systems below 75%.

The main energy resources for district heating is natural gas. There are examples of district heating systems using heat from coal fired thermal power stations and nuclear power plants. There is also a limited number of biomass based, waste heat and other renewable energy sources heat energy generation in district heating networks. The share of renewable energy

10 Estimated based on the data of the Naftogaz of Ukraine (Source: https://www.naftogaz.com/www/3/nakweb.nsf/0/8B3289E9F4B2CF50C2257F7F0054EA23?OpenDocument&Expand=8&) and State Statistical Service of Ukraine; 58.5% of natural gas consumption in residential sector is used for heating purposes (Source: http://www.ukrstat.gov.ua/operativ/operativ2019/energ/st_kn_sposh_energ_dom/st_kn_sposh_energ_dom_17u.htm)

11 National Commission for State Energy and Public Utilities Regulation, https://www.slideshare.net/NKREKP/05052016-61901840/6

sources, mostly biomass, in district heating in Ukraine is about 8%.

In 2016, the Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine estimated that modernization of heat production system and networks could result in reducing natural gas consumption by 2.4 billion m^3, including 1.1 billion m3 savings from boilers modernization and 1.3 billion m^3 savings from pipelines replacement. The investment requirements were estimated at the level of USD 6 billion[12].

Since that, natural gas consumption by district heating companies has been reduced significantly (see Fig. 12) mainly due to the reduced heat energy consumption by residential sector. The reduction were caused by a combination of factors including improved billing of heat energy consumption, energy efficiency measures in buildings, and termination of hot water supply services in many cities.

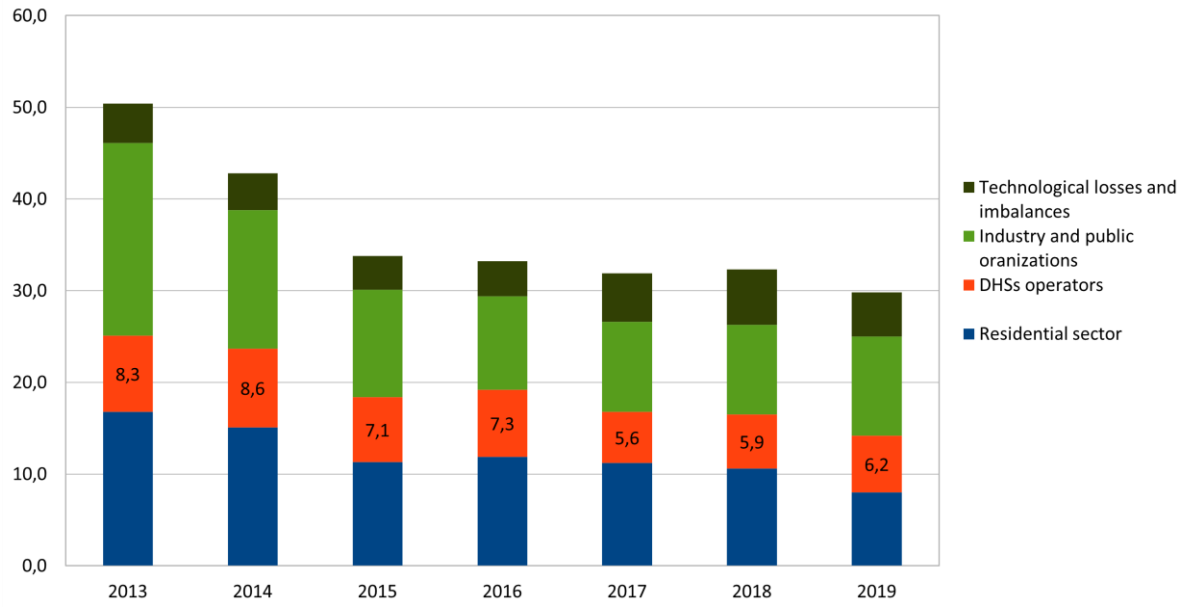

Figure 12: Natural gas consumption in Ukraine in 2014-2018 in billion cubic meters.[13]

Still, there is a significant potential to improve energy efficiency of the district heating systems via modernization of generation capacities and grid replacement. The overall average efficiency of the system could be increased from the current level of about 75 % to at least 85 % (e.g. average generation efficiency of 92% and average heat losses of 8%) resulting in natural gas savings exceeding 0.5 billion cubic meters and carbon emission reductions of approximately 1 million tonnes of CO_2e per year.

Overall there are over 1,600 heat supplying companies in Ukraine. There are both fully centralized and decentralized district heating systems with several separate grids within the city. The primary grids between boiler houses and substations and the secondary grid between

12 Heating in housing and utilities sector: Status and Prospects, https://www.slideshare.net/ZubkoGennadiy/heating-in-housing-and-utilities-sector

13 Prepared based on the data of Naftogas of Ukraine. Please, refer to http://www.naftogaz.com/www/3/nakweb.nsf/0/034458756BA248DAC2257F4900445E5F?, http://www.naftogaz.com/www/3/nakweb.nsf/0/8B3289E9F4B2CF50C2257F7F0054EA23?OpenDocument, and http://www.naftogaz.com/www/3/nakweb.nsf/0/00B62B682AA8CA37C22583900050DAF0

substations and buildings are usually operated by district heating companies, while the tertiary grid within the buildings and end-user's installations are usually under the responsibility of building owners (co-owners).

District heating covers 40 % of the population, which is approximately 5.5 million of households. As of 2017, the size of heating supply market was about UAH 15 billion (EUR 500 million).[14]

Many customers disconnected from the district heating systems and switched to individual natural gas fired (both in private houses and individual apartments in multiapartment buildings) or biomass boilers (in private houses). This led to a significant reduction in energy demand and imbalances in the systems. In newly constructed buildings natural gas boilers are often installed in individual apartments or on a building level.

Initially, most of the district heating systems were designed to provide both heating and domestic hot water supply but due to economic reasons in many cities the customers terminated the use of hot water from the DHSs and switched to individual electric boilers further reducing heat energy demand.

During recent years many district heating companies, municipal authorities and buildings co-owners install individual heating units to switch from direct system, where heat carrier flows through the tertiary grid, to indirect systems, which have better heat supply control options for final consumers. Individual heating units could also ensure hot water supply for the final consumers.

Overall, the district heating systems of Ukraine could be characterized as transitioning from the second generation to third generation with stepwise replacement of black steel pipes with pre-insulated pipes and lowering the operational temperatures. The 4th generation DH systems has reduced heat supply temperatures of 70°C and lower and integrate various heat sources, such as waste heat from industry, CHP plants burning waste, biomass power plants, geothermal and solar thermal energy systems, large scale heat pumps, waste heat from cooling purposes (e.g. from the acclimatization of data centres) and other energy sources. The transition to the 4th generation is a future challenge for Ukraine but some pilot projects could be implemented in a mid-term perspective.

Use of renewables in DHS

The share of renewable energy in district heating systems is increasing with biomass being the main renewable source used for heat energy generation.

Biomass has been traditionally used for heating and cooking purposes in residential sector in Ukrainian villages. Following the increase in natural gas prices and introduction of policy measures to support renewable energy projects (green tariff for renewable electricity generation, tariff incentives for renewable heat energy generation, subsidies for the installation of biomass boilers in residential sector, etc.), the share of biomass has been increasing in the

14 Heating in housing and utilities sector: Status and Prospects, https://www.slideshare.net/ZubkoGennadiy/heating-in-housing-and-utilities-sector

energy balance of Ukraine. Examples of biomass to energy projects include biomass-based CHPs, medium size boiler houses, and smaller-scale heating appliances.

According to SAEE, during 2014-2017 about 2 GW of biomass based heat energy capacities were commissioned in Ukraine (CAPEX – EUR 460 million). New biomass heat energy generation capacities created additional demand of approximately 1 million tonnes of solid biomass fuel (fuel wood, wood chips and biomass pellets).

In 2019 biofuel ensured 3.8 % (3,362 thousand tonnes of oil equivalent) of total primary energy supply and 4.2 % of final energy consumption (2,087 thousand tonnes of oil equivalent) in Ukrainian energy balance[15].

BIOMASS AND WASTE USE	2015		2016		2017		2018		2019	
	1,000 toe	% of total	1,000 toe	% of total	1,000 toe	% of total	1,000 toe	% of total	1,000 toe	% of total
Final energy consumption by residential sector	1097	52%	1506	53%	1678	55%	1814	57%	1855	55%
Final energy consumption by other sectors	186	9%	217	8%	214	7%	134	4%	233	7%
Use by power stations and CHPs for energy generation	538	26%	260	9%	277	9%	149	5%	178	5%
Use by heating stations for energy generation	37	2%	557	20%	553	18%	776	24%	790	23%
Use by other enterprises for transformation purposes	243	12%	291	10%	324	11%	336	10%	307	9%
Total primary energy supply from biomass and waste	2102	100%	2831	100%	3046	100%	3208	100%	3362	100%

Table 38: Biomass and municipal waste use in Ukraine in 2015-2019

Heat suppliers, both municipal and private, are the most active users of biomass to produce energy. However, in many cases installation of biomass capacities is performed by private investors and new biomass boilers operate in autonomous mode supplying heat energy to specific buildings, lowering the heat demand for the district heating system. According to IFC survey, competition in the heat supplying segment between municipal and private suppliers is intensifying. At the same time, nearly a quarter (23 %) of the surveyed municipal companies have reported cases of clients switching off the heat supply after installing their own biomass boilers. Schools, hospitals, and other social institutions are those most frequently named for discontinuing municipal heat supply and installing their own biomass boilers. Private heat suppliers have been actively entering the biomass-to-energy market. They install and operate

15 Energy balance of Ukraine does not provide a separate figures for biomass only, but the share of waste is assumed to be very low.

boilers generating heat, which is delivered to clients (schools, hospitals, and small commercial companies).[16]

Raw wood, unprocessed wood waste (sawdust, wood chips), and wood pellets are the most commonly used types of biomass to produce energy by municipal heat suppliers. The usage of agricultural waste is quite rare. Raw wood and unprocessed wood waste are used by 32 % of the companies surveyed by IFC and wood pellets are utilized by 21% of the companies. The key reason for choosing this kind of biomass is its accessibility compared to other options. Heat suppliers obtain raw wood, wood waste, and wood pellets either from forestry enterprises or from private companies.[17]

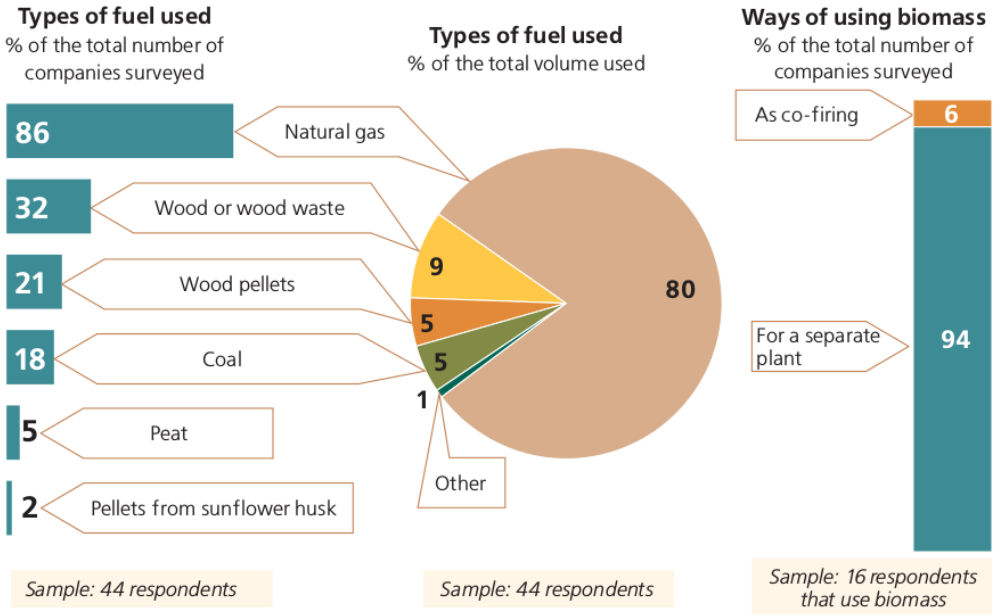

Figure 13: Use of biomass by heat supplying companies. Source. IFC Survey

Thus, during last 5 years there is a strong tendency to increase biomass use for energy generation, supported by state policies and regulations and the growth is likely to continue.

Biomass trading market is characterized by high volatility of biomass prices, lack of biomass quality standards, and biomass supply reliability risks.

Assisting in the creation of competitive biomass market is defined as one of the key measures for achieving the strategic goals of the Energy Strategy of Ukraine. It is expected that the introduction of electronic trading platform for biomass fuels will significantly decrease the price variability and will provide additional incentives for further market development. The draft law On Amending of Certain Legislative Acts of Ukraine for the Development of Biofuel Trading

16 IFC, https://www.ifc.org/wps/wcm/connect/bbd559804c61c9cf81659daccf53f33d/IFC_Survey+Findings_Biomass+to+Energy_in+Ukaraine_2015_Eng_web.pdf?MOD=AJPERES

17 https://www.ifc.org/wps/wcm/connect/bbd559804c61c9cf81659daccf53f33d/IFC_Survey+Findings_Biomass+to+Energy_in+Ukaraine_2015_Eng_web.pdf?MOD=AJPERES

has already been prepared and is being reviewed by the Ministry of Regional Development and Construction[18].

18 https://www.kmu.gov.ua/ua/news/elektronna-torgivlya-biopalivom-neobhidnij-instrument-dlya-rozvitku-prozorogo-ta-konkurentnogo-rinku-virobnictva-energiyi-ne-z-gazu-v-ukrayini

Legal framework

Construction and operation of DHS shall follow general procedures on design documentation development, obtaining construction permit, commissioning of the facility and receiving applicable permitting documents.

Permitting process

DH modernization projects are usually implemented on the land sites already in use by a district heating company, however, in some cases, land acquisition via land lease or land purchase agreements could be required. Spatial planning restrictions defined in planning documentation (city's general plan, area zoning plan or detailed area plan), as well as by relevant environmental and sanitary requirements should be considered during the planning process.

The preparatory works for the implementation of modernization projects include the development of project design documentation and receiving required approvals and permits.

Project design documentation

Development of a project design documentation is performed based on the input data for project design, which include city-planning conditions and restrictions, technical conditions, and terms of reference for project design.

In case of construction works, engineering studies could be required to collect information about a project site (geological conditions, soil characteristics, groundwater levels, existing infrastructure, etc.). The scope of work (engineering and geodesic works, geological surveys, topographic surveys, hydro-meteorological surveys, environmental surveys, etc.) depends on available information on the project site and specifics of site location.

Class of consequences (responsibility) characterizes the level of potential danger for the health and lives of people, as well as material or social losses related to the termination of exploitation of the object or loss of its integrity. Class of consequences defines a number of project design stages and permitting procedures required for a particular project. Class of consequences is defined by design documentation developer based on construction norms, standards, and other regulatory documents[19]. The correctness of the definition of the consequences class is validated during the review of the projects, if such review is obligatory in accordance with the law.

Preparatory works could be performed based on the submission of the Notification of the Preparation Work Start to the relevant state architectural and construction control authority before issuance of construction permit. Preparatory works include works on preparation of the land site, fencing of the construction site and demolition works, engineering studies, installation of temporary structures required for construction works, construction of approaching roads,

19 National Standard of Ukraine ДСТУ-Н Б В.1.2-16:2013 Definition of the class of consequences (reliability) and category of complexity of the construction objects, https://docs.google.com/file/d/0B6RpAgaD6t-iS21oazNTTXVuaUE/edit

supply of construction materials, installation of temporary engineering networks, removing of engineering networks and trees.[20]

CLASS OF CONSEQUENCES (responsibility)	RIGHT TO COMMENCE CONSTRUCTION WORKS
1	After the Notification on the beginning of construction works execution is registered by state authority responsible for architectural and construction control[21]
2-3	After issuing of construction works execution permit by state authority responsible for architectural and construction control

Table 39: Documents providing a right to commence construction works

Project design documentation is developed by the qualified company under service agreement and based on the city-planning documentation, state construction norms and input data for project design.

The input data for project design, including city-planning conditions and restriction, technical conditions and terms of reference, should be provided to the design documentation developer by a project owner.[22] Terms of reference for design documentation development should be prepared by a project owner considering the requirements of the state construction norms A.2.2-3:2014 «The structure and content of project design documentation for construction»[23]. Terms of reference should be approved by a project owner based on the design documentation developer acceptance. Terms of reference for design documentation development define substantiated requirements of a project owner to planning, architectural, engineering and technological solutions for construction of the facility, its main parameters and cost. Terms of reference incorporate the requirements of city-planning conditions and restriction and technical conditions received by a project owner.

The title of the project in the design documentation should correspond to the terms of reference, reflect the type of construction (new construction, reconstruction, capital repair, etc.), its location and should not change during all stages of project design documentation development.

The number of stages of project documentation development depends on the class of consequences (responsibility) of the project as defined by a project owner and project design documentation developer.

CLASS OF CONSEQUENCES	APPLICABLE PROJECT DOCUMENTATION DEVELOPMENT STAGES

20 Resolution of the Cabinet of Ministers of Ukraine #466 dated 11.04.2011 On Some Issues on Preparation and Construction Works Execution, http://zakon0.rada.gov.ua/laws/show/466-2011-%D0%BF

21 Such projects are also allowed to be constructed by contractors without construction licenses.

22 Order of the Ministry of Regional Development, Construction and housing and utilities infrastructure №45 dated 16.05.2011 On the Approval of the Order on the Development of Project Design Documentation for Construction, http://zakon0.rada.gov.ua/laws/show/z0651-11

23 State Construction Norms A.2.2-3-2014. The structure and content of project design documentation for construction, http://www.afo.com.ua/doc/DBN_A.2.2-3-2014.pdf

(responsibility)	1 stage	2 stages	3 stages
1	Detailed Documentation (РП)	Feasibility Study (TEP) and Detailed Documentation (РП)	Not applicable
2	Not applicable	General Design (П) and Detailed Documentation (Р)	Feasibility Study (TEO) General Design (П) and Detailed Documentation (Р)
3	Not applicable	Not applicable	Feasibility Study (TEO) General Design (П) and Detailed Documentation (Р)

Table 40: Project documentation development stages

Project owner and project design documentation developer could agree to change the number of stages, if such decision is substantiated.

Expert review of the project design documentation is obligatory for the following projects[24]:

1) classified as projects of average CC2 or significant CC3 classes of consequences (responsibility) - analysis of conformability of project design documentation with sanitary and epidemiological norms, environmental and work safety regulations, energy efficiency requirements, fire, technological, nuclear and radiological safety requirements, norms of strength, reliability, durability of buildings and structures, their exploitation safety and engineering infrastructure;

2) projects, which are executed at the territories with complex engineering and geologic conditions and anthropogenic conditions – analysis of conformability of project design documentation with state norms of strength, reliability, durability of buildings and structures;

3) projects financed using state budget funds, funds of state and municipal organizations and enterprises, as well as loans provided under state guarantees, if their cost exceed UAH 0.3 million – analysis of project budget;

4) projects subject to environmental impact assessment in line with the Law of Ukraine On Environment Impact Assessment.

Project owner could make the decision to held expert review of the project design documentation or separate volumes of project design documentation for other types of projects. Expert review of the project design documentation is performed by qualified organizations based on the service agreement with a project owner or project design documentation developer.

Project design documentation should be approved by a project owner. Approval of the feasibility study or general design documentation is the basis for the development of next stage of the project design documentation. Approval of project design documentation should be executed after performing the expert review and conducting environmental impact assessment

24 Article 31 of the Law of Ukraine On Regulation of Urban Construction Activities, http://zakon5.rada.gov.ua/laws/show/3038-17/

procedure in line with the Law of Ukraine On EIA (if such procedures are applicable). The approval of project design documentation by state authorities or local government bodies is not required.[25]

Construction Permits

The permits required for the beginning of the construction (construction works, connection of the facility to the engineering infrastructure systems), the respective permitting procedures, as well as further construction control requirements and commissioning procedures depend on the class of consequences (responsibility) of the construction object.[26]

The notification on the beginning of construction works execution is submitted personally, by mail or via electronic system[27] to the relevant authority of state architectural and construction control based on the location of the project site not later than 1 day before the start of construction or preparatory works.

Construction permit application could be submitted by a project owner or its authorized representative in person, by mail or via electronic system to the relevant authority of state architectural and construction control based on the location of the project site.

Construction works execution permit is issued by the relevant state authority responsible for architectural and construction control free of charge during 10 working days after the registration of application.

The application should be accompanied by the following documents:

- copy of the documents certifying land ownership or use rights, or copy of the superficies agreement;
- project design documentation developed and approved in accordance with the legislation in force;
- copies of the documents on appointment of the persons responsible for construction works execution, designer and technical supervision;
- information about the license allowing construction works execution and qualification certificates;
- results of environmental impact assessment (if applicable).

If the relevant state authority responsible for architectural and construction control does not issue construction works execution permit or denial in issuing during 10 working days, a project owner could address central execution authority on state architectural and construction control for making arrangements to issue a permit or denial during 10 working days. If the permit or denial is not issued during this term a project owner has the right to start construction works on the 10th working day from the day of registration of the appeal to central execution authority on state architectural and construction control. In this case the permit is treated as issued.

25 Resolution of the Cabinet of Ministers of Ukraine #560 dated 11.05.2011, http://zakon0.rada.gov.ua/laws/show/560-2011-%D0%BF

26 http://zakon.rada.gov.ua/laws/show/3038-17

27 Via https://e-dabi.gov.ua/

The reason for denial in construction permit issuance could include the following: a) submission the application without all necessary documents; b) non-compliance of the submitted documents with the legal provisions; c) identification of false information in the submitted documents. A project owner could re-submit the application after addressing the issues, which caused the denial in permit issuance.

Registered declaration on the beginning of construction works execution and construction works execution permit remain valid till the end of construction.[28] The forms of the applications, notifications and permits are approved by the Cabinet of Ministers of Ukraine.[29] Notification on the beginning of construction works execution and construction works execution permit could be cancelled by the state authority responsible for architectural and construction control in case if violations of the requirements of city-planning documentation, city-planning conditions and restrictions, design documentation, state construction norms or other regulations have been identified during inspections.

Construction activities at the facilities assigned CC2 and CC3 classes of consequences (reliability) should be performed by companies having the respective licenses for construction and assembling works, assembling engineering infrastructure and construction of transport infrastructure.[30]

Environmental Permits

There are 3 major environmental permits that potentially could be required for a district heating project:

- air pollution permit,
- special water use permit,
- waste management permit.

In addition, development of environmental and social action plan (ESAP), stakeholders' engagement plan and certification in accordance with ISO standards could be required to meet the performance requirements of international financial institutions.

Plant Commissioning

Commissioning of the power plant is performed after completion of construction works, testing of the major power plant components, operational safety inspections, start-up and adjustment operations of the equipment and commissioning tests.

According to the national regulations defining commissioning procedure, the industrial facility being commissioned should have safe conditions for the workers and other people present at the site in line with the legislative acts on occupational health and industrial safety, fire safety,

28 Law of Ukraine On Regulation of Urban Construction Activities, http://zakon5.rada.gov.ua/laws/show/3038-17/

29 Decree of Cabinet of Ministers of Ukraine #466 dated 11.04.2011 On Some Issues on Preparation and Construction Works Execution, http://zakon0.rada.gov.ua/laws/show/466-2011-%D0%BF

30 Resolution of the Cabinet of Ministers of Ukraine #256 dated 30.03.2016 Some Issues on Licensing of Construction of the Objects, which based on the class of consequences are classified as objects with significant or average consequences, http://zakon5.rada.gov.ua/laws/show/256-2016-%D0%BF

environmental and sanitary norms.

The procedure for plant commissioning depends on the class of consequences (responsibility) of the facility being constructed.[31]

CLASS OF CONSEQUENCES	COMMISSIONING PROCEDURE
CC1	Registration of the declaration on operational readiness of the facility by state authority responsible for architectural and construction control
CC2 and CC3	Issuing of certificate by state authority responsible for architectural and construction control based on the act on operational readiness of the facility.

Table 41: Commissioning procedures

Environmental impact assessment

The Law of Ukraine on Environmental Impact Assessment is applicable for thermal power stations (TPP, CHP) and other facilities for electricity, steam and hot water generation with the use of organic fuel and heat capacity of 50 MW or higher.

EIA procedure includes the following stages:

1. publication of a planned activity notice;
2. submission of comments and provision of requirements for the scope of EIA report;
3. development of EIA report;
4. publication of EIA report;
5. public consultations, including public hearings;
6. analysis of the information of EIA report, results of public consultations, and any other information by a competent authority and issuance of Decision on EIA by a competent authority;
7. issuing the decision on the implementation of planned activity (e.g. construction permit) taking into account the Decision on EIA.

The law contains the requirements for the content of environmental impact assessment report and also the procedure, according to which additional requirements for the specific project could be established by permitting authority or via consultations with the public.

Public consultation includes the possibility to provide comments to the EIA report during the public hearings or, in written form, at any time within the duration of public consultation process.

Decision on environmental impact assessment is issued by the Ministry of Ecology and Natural Resources of Ukraine.

The Decision on environmental impact assessment also contains environmental conditions

31 Article 39 of the Law of Ukraine On Regulation of Urban Construction Activities, http://zakon5.rada.gov.ua/laws/show/3038-17/

for the planned activity, including land site and natural resources use conditions, environmental protection measures, environmental monitoring procedures, etc.

The Decision on environmental impact assessment should be considered during issuing construction permits for the specified types of activities and could be the reason of declining in issuing of such permits.

Legal framework for biomass

This section presents a brief overview of key legislative acts governing the implementation of district heating modernization projects in Ukraine.

Law of Ukraine On Electricity Market

The Law of Ukraine On Electricity Market entered into force on 11th of June, 2017 and new markets started operation 1 of July, 2019. The new Electricity Market Law is expected to increase the competition of Ukrainian electricity market due to the introduction of bilateral agreements, day-ahead, intra-day and balancing markets.

The Law foresees the implementation of Energy Community's legal framework (Directive 2009/72/EC, Regulation (EC) No 714/2009, Directive 2005/89/EC).

The green tariff mechanism is continued being used to promote renewable energy generation but the transition towards auction-based system is expected to reduce the cost of renewable energy and limit the impact on final electricity prices.

Currently, the sale of electricity under green tariff is performed based on bilateral agreement between power plant operator and Guaranteed Buyer. In 2020, the Guaranteed Buyer accumulated significant debts to renewable electricity suppliers, which undermined the interest towards new renewable energy projects in Ukraine. .

Electricity from renewable energy sources could also be sold under Bilateral Agreements, on Day-Ahead Market, Intra-day Market and Balancing Market.

The amount of the fixed green tariffs are calculated via the multiplying of the size of the retail tariff for electricity for second-class consumers as of 01.01.2009 (584.60 UAH per MWh according to Decision of National Commission on State Regulation of Energy Sector of Ukraine#1440 from 23.12.2008 (or EUR 53.85 per MWh)) onto the relevant coefficient approved by the Law of Ukraine On Alternative Energy Sources (article 9-1) for each kind of renewable energy source.

Law of Ukraine On Alternative Energy Types

The Law defines the provisions on renewable energy generation support via green tariff. The green tariffs are to be applied till 01.01.2030.

The Law defines biomass as a non-fossil biologically renewable resource of organic origin, which could decay biologically, in a form of products, waste and residues of forest, agricultural (crops production and animal husbandry) and fish production activities, and

technologically connected industries, as well as a part of industrial and municipal waste, which could decay biologically.

The level of green tariff for electricity from biomass and biogas is established at the level of 123.9 EUR per MWh (green tariff coefficient is 2.3).

For the power plants commissioned by 31.12.2024 the level of green tariff could be increased by 5-10% if the equipment manufactured in Ukraine exceeds 30% or 50% of CAPEX respectfully.

For the power plants commissioned by 31.12.2024 the level of green tariff is also adjusted to fluctuations of national currency exchange rate to Euro. Every quarter, at its last meeting, National Commission on State Regulation of Energy and Utilities Sectors calculates the fixed green tariff in national currency using the average official UAH/EUR exchange rate during last 30 days before the meeting.

Law of Ukraine On Heat Supply

The Law governs the operation of heat energy market participants, including tariffs establishment mechanisms.

In 2017 the Parliament of Ukraine introduced amendments to provide tariff incentives for heat energy generation using renewable sources. The tariffs for heat energy for the companies, which generate heat energy using alternative energy sources, including CHPs, power plants and cogeneration units, for the needs of organizations and institutions financed via state or local budgets, as well for the needs of residential sector, are defined at the level of 90% of the current tariff established for the company for the heat energy generated using natural gas for the needs of the respective customer category. If the company does not have an established tariff for the heat energy generated using natural gas, the tariff for heat energy generated using alternative energy sources is defined at the level of 90% of the weighted average tariff for natural gas-based heat energy for the relevant customer category. The calculation of the weighted average tariff for natural gas-based heat energy is performed for each region of Ukraine by State Energy Efficiency and Energy Saving Agency on a quarterly basis. The calculation of the weighted average tariff for natural gas-based heat energy transportation and supply is performed for the whole territory of Ukraine. Based on the information on weighted average tariffs each company calculates the tariff for biomass-based heat energy generation in line with the provisions of the Law of Ukraine On Heat Supply and submits application for tariff approval to the authorized state authorities.

Exploit our DHS services for you in Ukraine!

The information found here in this chapter provides you with a first general impression about the DH market in Ukraine. If you do not know how your own situation matches up to these national ones, then contact us so we can help you find out. As we have already

supported other Ukrainian DH companies, our entire consortium is also happy to offer you our valuable services. We can help converting your ambitious DH ideals into real actions on the ground, by creating meaningful feasibility studies with market-ready scenarios, as well as creating tailor-made business models. Similarly, we are here to help you find your way through the legal framework, and can guide you in navigating through potential subsidies, permits and standards relevant to you. To find out more about these and many other services we offer (e.g. trainings, achieving investment, strategic planning), please contact our consortium (info@keepwarmeurope.eu), or even more directly to our Ukrainian partner: **LLC KT-Energy**, ktomlyak@kt-energy.com.ua.