ENERGY USE OF BIOMASS FOR CENTRAL AND LOCAL HEATING AND ELECTRICITY GENERATION

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ABSTRACT

The object of this paper is to describe the energy use of biomass for central and local heating and electricity generation. First, there are mentioned the basic information about the biomass of the cultivation, processing and utilization for the production of electricity and heat. The second part presents two methods of heating, the central and local heating, ways and differences between them. The practical examples are focused on the usability of West Bohemia (Pilsen). In conclusion, there are compared and evaluated prices of the produced heat.

1. USE OF BIOMASS FOR CENTRAL A LOCAL HEATING

In the Czech Republic, there are in operation about 100 boilers. Their power is 200 kW - 10 MW, including reconstruction boilers for coal. Smaller boilers with an output from 20 to 100 kW are for single family homes, smaller buildings or local heating. In the Czech Republic, there are installed about 40 to 50 thousand of small boilers.

1.1. Biomass

Biomass is the amount of plant matter that grows on a particular area for a period of time. In our country it's all about wood waste (chips, sawdust), straw, grain, maize and mustard. The burning of biomass produces only as much carbon dioxide, the number of plants in a given area consumed on photosynthesis and consume in the next cycle. This means that the biomass burning contribute unlike fossil fuel (coal, gas, oil) to the greenhouse effect. Moreover, the ash can be used as fertilizer.

The most popular distribution of biomass:

- Dendromass (wood biomass)
- Fytomass (botanical source and farm crops)
- Organical biomass
- Biological decomposable waste

Biomass can be obtained in two ways. We distinguish mainly residual (waste) biomass - wood waste from forestry and pulp and paper, wood and furniture industry, residues from primary agricultural production and landscape maintenance, municipal biowaste and waste from the food industry - a targeted growth of biomass - energy crops and fast - growing trees that are grown on special plantations for this purpose.

Figure 1 – Types of biomass

Biomass is primarily used for energy purposes. Biomass energy can be obtained in several ways:

Group	Technology	Products	Outputs
	Combustion		Heat, electrical energy
Chemical conversion	Gasification	Oil, fuel, tar, methane, ammonia, methanol	Heat, electrical energy, fuel
	Pyrolysis		
Chemical conversion in aqua	Esterification	Bio - fuel,	Fuel
	Liquefaciton	Oil	
Biological conversion	Anaerobic digestion	Biogas, methane	Heat, electrical energy, fuel
	Alcoholic fermentation	Ethanol	Fuel
	composting		Heat

Table 1 – Use of biomass

1.2. Central heating

Central heating involves heating a large sized area. In this work we will focus more closely on the area of West Bohemia, specifically the city of Pilsen. Pilsen is heated by Plzeňská teplárenská a.s.
Plzeňská teplárenská, a.s. is the largest energy producer in the city of Pilsen and the Pilsen region. Manufactures and supplies heat for heating and hot water for more than 40,000 apartments in Pilsen and a large number of commercial, business, administrative and educational entities. The company also manufactures and supplies electrical energy [1]. The electrical energy produced by Plzeňská teplárenská, a.s. on modern equipment for the combined production of heat and electricity. The device consists of one double body turbine with one controlled extraction and one single condensing turbine with two regulated subscriptions. Both of generators make up the fictitious block. Further, the operation of the "green" power block with biomass boiler K7 and TG3. Installed capacity fictitious

block for supply of electricity and ancillary services is 137 MWe installed capacity block K7 + TG3 is currently 13.5 MWe.

Figure 2 – Plzeňská teplárenská, a.s.

For pure biomass combustion is used only K7. The biomass was co-firing with brown coal and other materials that have been certified as fuel in the boilers K4, K5 and K6 in years 2011-2012. Parameters of boiler:

Elementary fuel	Values
Consumption of biomass	11,35 - 14,7 t/h
Calorific of fuel	9,7 - 12,13 GJ/t
Heat contained in the fuel	142,3 GJ/h
Installed boiler capacity	45 t/h
Feed water temperature	145 °C
Thermal performance	34,79 MW_t
Temperature of output steam	495 °C
Press of output steam	6,7 MPa
Efficiency	90,90%

Table 2 – Parameters of boiler K7

Types of biomass used as alternative fuel for boiler K7:

Types of biomass	t/year
Wood chips	190 764
Pellets	45 768
Brewing draff	1 920
Palm nuts	2 168

Table 3 – Types of biomass

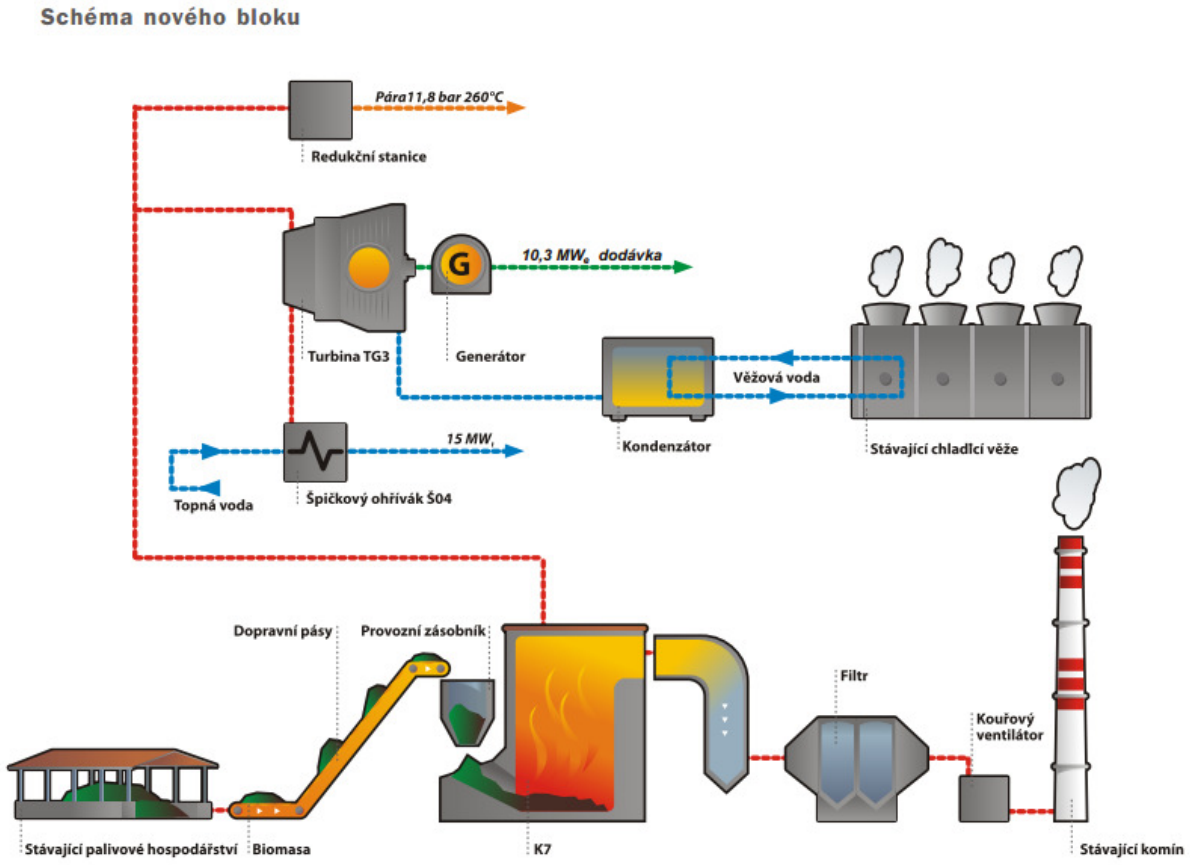

Figure 3 – Block K7 + TG3

1.3. Local heating

This type of heating is used in smaller villages and households themselves. Among the local heaters belong fireplace, classical, steel, ceramic and cast iron stoves and brick kilns. They may be involved in coordination with central heating and is connected to the heater circuit. These heaters have a low running cost and cheap fuel (biomass). The very local heaters can cover the heat demand in periods of transition. Savings can be as high as 30%.

Figure 4 – Biomass boiler

Examples of devices that use biomass in smaller towns Pilsen region:

- Třemošná, PPS – full-time heating, wood, boiler 105 kW
- Nový dvůr, ŠVP Sklárna – ecological education, wood chips, boiler 1000 kW
- Chotěšov, CPZ s.r.o. – heating of manufactory, wood waste, boiler 500 kW
- Holýšov, ZDP – heating of saw-mill, sawdust, boiler 200 kW
- Hostouň, Pila – torrefaction of wood, wood waste, boiler 2500 kW

Examples of heating houses, flats

The chart compares the annual cost of heating and hot water. For the most common methods of heating are taken into account all the essential items that make up the cost of producing heat in the Czech average four-person household, who live in an apartment with an area of 70 m2 and has an annual energy consumption for heating and hot water 36 GJ = 10 MWh (1 GJ = 277, 8 kWh). When comparing electricity tariffs were used ČEZ Etarif and natural gas tariff RWE January 2013 (7.5-15 MWh). The scope of the final price of heat in the cheapest and most expensive alternative suppliers of electricity for storage heating from 742 to 796 CZK / GJ for heaters is 777 to 822 GJ for natural gas condensing boiler is the price range of 668 to 887 CZK / GJ and atmospheric boiler to 685 to 922 CZK/ GJ.

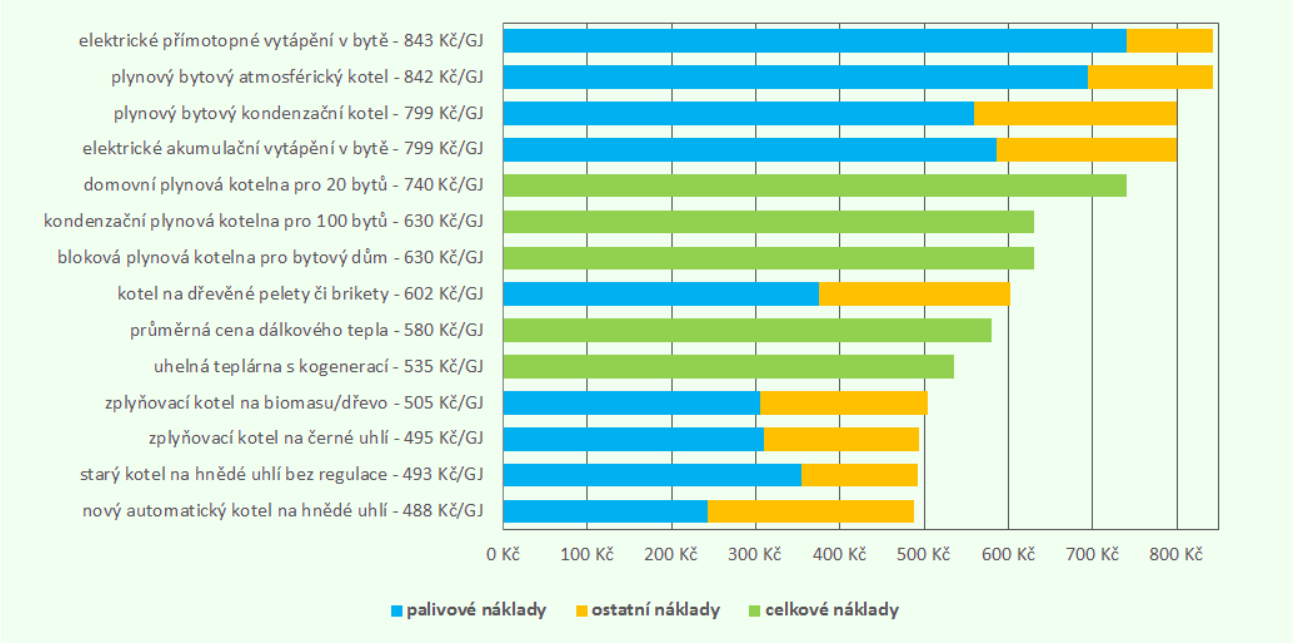

Figure 5 – Purchase price of energy at different sources [2]

2. CONCLUSIONS

They were given basic information about biomass. It also describes several ways of partitioning of biomass into specific groups, information on the cultivation and use. The paper describes the main differences between the central and local heating. The sources of information were mainly the websites of the energy companies in West Bohemia. Price comparison ways to obtain energy can be seen from the Picture 5.

REFERENCES

[1] http://www.pltep.cz/ - from day 10th July 2014
[2] http://www.naseteplo.cz/?id=1025 – from day 10th July 2014
[3] http://www.biom.cz – from day 10th July 2014

ACKNOWLEDGEMENT

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ANNEX - MAP OF BIOMASS PRODUCTION IN WEST BOHEMIA