NOWADAYS TECHNOLOGICAL POSSIBILITIES OF BIOMASS APPLICATION

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ABSTRACT

The renewable sources have a high priority in national energy concept. However it is important to know that these types of energy cannot fully cover the whole demand of energy given by the primary sources and nuclear energy. Nevertheless it is essential to implement the renewable sources to our power system. The most promising source in the conditions of the Czech Republic is the biomass.

KEYWORDS

Biomass, Combined heat-electricity generation, Biofuels, Bioenergy

1. INTRODUCTION

One of the important renewable sources is the biomass, which is the biodegradable part of products, waste and lefts from agriculture, forests and similar industries then product which are grown for this purpose and also the biodegradable part of communal waste. There are several types of biomass that are used, such as wood and the wooden waste, cereal straw, biogas, liquid biofuels and special plants grown for the energetic purpose. In the Czech Republic the biomass should be in the front interest and should take the first place in the renewable sources with the power generated from water.

The fuel which is directly or indirectly produced from biomass is called biofuels. As well as energy generated prom biomass is also called bioenergy.

2. LEGISLATION IN THE CR

When the Czech Republic joined the European Union it agreed to increase the percentages of energy generated from renewable sources according to the principals of coordinated energy politics (Directive 77/2001 ES). This directive was implemented into our legislative system in 2005 as a "Law to support of the production of electricity from renewable sources" in the collection of law Nr. 66 as Nr.180/2005 Sb. There were also some notice that are related to his law, such as ERÚ Nr.475/2005 Sb., where is the issue of how to support the renewable energy, MŽP Nr.482/2005 Sb., which settles the types and ways how to use the biomass, ERÚ Nr.502/2005 Sb., which clears up the amount of electrical energy, which could be burn at the process when there are biomass as well as other non-renewable sources.

3. COMBINED HEAT AND ELECTRIC ENERGY POWER BIOMASS GENERATION

There are lots of possibilities how to convert biomass to heat and electricity. The election how to choose the best one depends on the availability of the biomass, price, reliability, efficiency, environmental impact and other parameters. Many technologies are in the state of development, demonstation or testing. This paper is focused on the combined heat and electricity biomass generation (KVET).

KVET means combined heat and electricity biomass generation. As we can see from the title it deals with the high potential heat energy used to generate the electricity and then also used to cover the necessary heat. Limited possibility how to transfer heat to mechanical energy is given by the second thermodynamic law, which says that it is not possible to produce a periodically working machine, which would just take the heat from the energy store and transfer it to the mechanical movement equal to the amount of heat taken. This kind of machine needs at least two heat stores with different temperatures. The machine would take the heat from the heat store with higher temperature, transfer it to the mechanical energy and the rest of the heat is led to the low temperature heat store.

Every cogeneration unit has several basic parts:

- Drive units;
- Electrical alternator including red connection device;
- Boiler or heat exchanger including distribution network connection;
- Operative and control systems.

Nowadays the most common use for the cogeneration unit is in combustion turbine, combustion engine and steam-gas units. With the development of technologies we can see also the Stirling engine, steam engine and micro turbines. As a source of a cogeneration unit we can use the renewable energy sources. This can be used thanks to a device like biomass gasifier, units for fast pyrolisys and devices of biogas.

Table 1 – Comparison of various KVET types according to the power unit

Type of KVET	**Ratio of output elect./heat**	**Electrical efficiency %**	**El. output KVET MW**
micro turbine	0,25 - 0,33	20 - 30	0,03 - 0,1
fuel cell	0,33 - 0,8	20 - 35	0,001 - 0,5
Stirling engine	0,12 - 0,33	12 - 30	0,001 - 0,1
combustion engine	0,7 - 1,0	32 - 42	0,001 - 10
combustion turbine	0,5 - 0,8	23 - 38	2 - 100
steam turbine	0,24 - 0,34	12 - 15	0,15 - 100
gas-steam	0,5 - 1,5	35 - 44	5 - 200 a více
ORC	0,15 - 0,2	15 - 18	0,4 - 1,5
steam engine	0,16 - 0,25	8 - 12	0,1 - 2,0

Areas where can be KVET used:

- Small cogeneration units used mainly for heating a small number of objects;
- Cogeneration unit of smaller factories;
- Big cogeneration units used to produce the vapour;
- Big units connected to heat centrals and others which covers the heat demand of a system;
- Centralized heat supply system;
- Cogeneration unit using varios types of renewable sources of various outputs.

4. UNIT WITH MICROTURBINES

Cogeneration units with micro turbines are modern and fast developing technology with outputs around 20 – 300 kW. Electrical efficiency of these units is nowadays between 20 - 30% and may be used as a basic, top or back up power sources as well as sources in tri-generation (generation of power, heat and cold). The advantage of this kind of unit is its compactness, low maintenance, high load dynamics, reliability, low emission and high temperature of combustion gases and therefore higher temperature of heat output.

The reliability of micro turbine is high because of the composition. There is just one moving part – high speed rotation shaft (1000 and more revolution/s) of turbine rotor, compressor and generator. The shaft is normally located in air bearing. This is the difference from ball bearing used in classical turbine. In micro turbine can be used liquid and gasified fossil fuels. Nowadays there is a biogas and

waste dump gas turbine and there is a research going on in the usage of methanol, ethanol, metylester, pyrolisys oil and others.

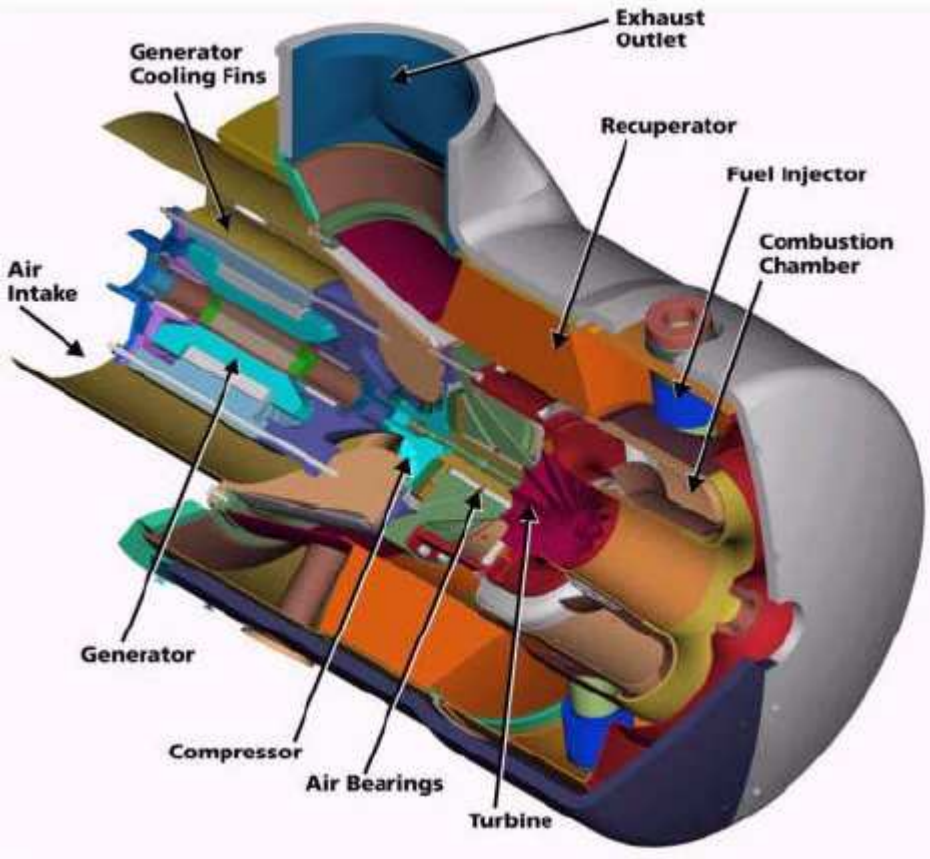

Figure 1 – Electromagnetic emissions at 11.5 kV, horizontal polarization antenna

The following examples show the results of the electromagnetic emission of corona discharge at inception voltage 6.5 kV and a maximum voltage 11.5 kV, as compared with electromagnetic background laboratory. All the measurements I have performed 3 times and the resulting waveform is the arithmetic mean.

The disadvantage of micro turbine is the price around 900 – 1200 EUR/kW. Nevertheless there is a research going on and in the next ten years the cost decrease is expected. The price should be around 500 EUR/kW and the electrical efficiency should rise up to 40% and there should e further emission decrease. The well known producers are Capstone and Turbec Company.

5. CONCLUSION

Biomass is a promising power source that can be used in many technologies. In a near future the best way how to use the biomass are the technologies of gasification, combined electric and heat generation, anaerobic digestion of agricultural waste including green biomass and biodegradable parts of communal waste combined with the bio gas cogeneration. In the future far away there is a big potential in micro cogeneration, which is based on Stirling engine or new technologies such as Steam Cell.

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