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Renewable energy sources

BIOMASS

Getting heat from biomass is gaining importance at the global level. Biomass accumulates solar energy through photosynthesis. Biomass from water and carbon dioxide using solar energy produces glucose with oxygen being released. For glucose production it takes approximately 0.8 kWh / mol (energy per unit mass). During the combustion of glucose in a closed system, is being released approximately 0.78 kWh / mol (energy per unit mass). In the process of the combustion is being linked a carbon from the fuel with the oxygen and in the case of complete combustion is being generated COâ,,.

Biomass consists of numerous, wide variety of products of plant and animal life such as branches, twigs, bark and wood chips from forestry and wood industry, straw, corn, sunflower stalks, remnants of grapes and olives, cherries bones and bark of apple from agriculture, animal droppings and remains of livestock, municipal and industrial waste, etc..

Among the different types of wood biomass has the widest application. Well-designed forest complexes represent a sustainable source of energy because they can be renewed as can be seen from the cycles of carbon cycle in nature. If the logging and timber volume are in sustainable relation than the accumulation of COâ,, cannot exist as a result of burning wood. Only in this case all, combustion carbon dioxide formed, spent on the growth of new biomass.

Picture 1. Only compliance logging and growth leads to CO2 neutrality

Wood mass only one part of the substances with biological origins collectively called biomass and potential renewable energy sources. We distinguish the wood intended solely for heating and density that is technological waste and can be used as fuel (crust, odds and ends, sawdust, etc.). It is indicative that 35 to 40% of density intended for further processing remains as waste. For some specific products (flooring) that amount increases to 65%. This is a big waste of energy potential.

Characteristics of biomass

Each biomass has properties that define how it is used as fuel, especially when it comes to burning.

The most important characteristics of biomass:

â€¢ The moisture content

â€¢ Ash content

â€¢ Contents of volatile compounds

â€¢ Chemical composition

â€¢ Firewood value

â€¢ Density

Biomass and the impact on the environment

Raw biomass contains very few substances that are harmful to the environment.

Sulfur (S) and chlorine (Cl) are present in very small amounts (they convert to SOâ‚‚ and HCl in the com bustion process, which is a component of acid rain).

Nitrogen: oxides of nitrogen (NO and NOâ‚‚, expressed in total as NOx) also cause acid rain. During the com bustion form two types of nitrogen oxides. Thermal NOx occurs at temperatures above 950 °C from the n itrogen contained in the air for combustion. NOx generated from the nitrogen contained in fuel, produces compounds at lower temperatures. The amount of NOx can be limited by selecting lower combustion temperature.

Volatile hydrocarbons CxHy: These compounds can burn if you spend enough time in the hot combustion zone (minimum of 2 s). In a well-constructed fire-box the emission of these compounds is very small. However, in a poorly constructed fire-box emissions of CxHy can be significant.

Energy from the biomass

After centuries of using fossil fuels, today a global picture is changing, and renewable sources are increasingly regarded as one of the key factors of future development strategies. Among other renewable sources, in the near future from biomass are expected particularly important contributions. All relevant energy statistics show non-negligible share of biomass in heat and electricity, and most recently in traffic. At the level of the European Union the continuous increase in energy production from biomass is predicted, with a significant share of the energy balance were identified and a number of other consequences of using energy from biomass.

Reasons and benefits of using biomass

The use of biomass provides employment (creation of new and existing jobs), increase local and regional economic activity, achievement of additional income in agriculture, forestry and timber industry through the sale of biomass-fuel. In addition, instead of outflows due to the purchase of fossil fuels established cash flows in the local community (investment-income-tax). Impact on employment and above socio-economic aspects are the biggest advantage of using biomass compared to fossil fuels, but also to other renewable energy sources. Developed countries of the European Union and the world are aware of these positive effects and therefore significantly help projects using biomass energy.

In 2010 the member countries of the European Union total supply of wood mass was about one billion m^3 with 70% of timber comes from the woods, and 30% of the biomass comes out of them. According to the European Commission, 57% of the total amount of timber was used for the production of wood material and 43% for energy.

Results show that Montenegro has significant potential for biomass utilization. The greatest potential is in the forestry sector, which is half the current production of natural resources. Total energy is estimated at 4,200 GWh.

References:

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http://ec.europa.eu/energy/renewables/studies/bioenergy_en.htm

The energy potential of biomass in Montenegro

WIND ENERGY

Wind represents air masses movement that occurs due to differences in the density of air, whereby the flow naturally occur from place of higher density to place of lower density and continues until the density is equalized. Wind speed and direction depends on the results of all the forces affecting the air.

Large wind energy potential for electricity generation in major European countries started to be used during the 90-ies of the 20th century and the growth of this form of energy use is estimated at 100% annually.

The main reasons for this are:

- Immense amounts of energy

- The possibility of converting into electricity using a wind turbine

- Wind turbine price drop and associated equipment in proportion to the increasing use of wind energy

- Less of land occupation

In 2010 on the global level were installed 39.4 GW of new wind generation, which means that the total installation is 200GW. The total value of equipment installed for energy production from wind turbines is 40 billion. On first place comes China with 44.7 GW and is being followed by the USA and Germany with 40.2 GW to 27.2 GW, than Spain (20.7 GW) and India (13.1 GW). With nearly 19 GW of new installations China has a share of around 50% of all new installations in the market. The total installed capacity at the end of 2010 amounted to 440 TWh of electricity or about 2.2% of global demand.

In European Union production capacities were in the time period between 1995 and 2005 increased on 32% annually. The total wind installations have given the EU contribution to the 9259 MW and reached a total installed capacity of 84 074 MW. According to current data of the European Union is planning to do in 2030 to 100GW of installed capacity to cover 10% of today's electricity needs.

Technology of the wind energy

Conversion of wind energy into electrical energy is done by wind. Wind turbine converts the kinetic energy of the moving air (wind) with the rotor blades (blades), the transmission mechanism and generator of electricity. The energy generated from wind depends on the medium wind speed in a way which is proportional to wind speed cubed. Wind turbine cannot transform the entire kinetic energy of the wind that flows through the area to cover rotor.

The characteristics of wind turbines

For power generation today is being mostly used a horizontal axis turbine with one, two or three blades, while the vertical axis wind turbine is still under development. According to previous data of modern wind turbines are starting to generate electricity even with the wind speed of 2.5 m/s and stopping for security reasons at a speed of 25 m/s. For these reasons it is not always possible to use wind energy. Wind turbine can provide economical power production, an annual average wind speed of 6 m/s.

In order to determine the exact wind speed necessary to make measurements over one or more years at different heights due to the fact that the wind speed increases with distance from the ground. Due to the large variation in strength during labor, consumers who are connected to the wind turbine must have an additional source of electricity, wind power and the ability to surrender the excess energy in the electricity grid. For smaller systems the excess energy can be stored in batteries or used for space heating.

Categorization of wind turbines

Wind turbines can be divided into:

Little (to 30 kW)

Medium (30 - 1 500 kW)

Large (> 1 500 kW)

The investment ranges from 1 500 to 3 000 EUR / kW for small, 700 to 1 100 EUR / kW for medium and 1 500 EUR / kW for large wind turbines.

Small wind turbines are suitable for power generation in remote areas and facilities (cottages, lighthouses, etc...) especially fot the telecom and signaling devices on boats and pump water.

Wind turbines of medium and high power are more effective and more economical than smaller ones however lesser wind turbines have a lower cost and power can be used on site (e.g. for pumping water) or electricity generation.

Smaller wind turbines can be combined with the photovoltaic cells to cover variations in insolation and wind speed.

Factors that cause a permanent drop in price of wind generating system are:

- The trend of building larger turbines
- Lower infrastructure costs
- Increasing the efficiency of wind turbines
- Reducing the cost of raw materials which are produced by wind turbines

According to environmental experts wind farms could adversely affect:

- The fauna of birds
- Fauna of bats
- Sea Animals (off shore)
- Landscape (landscape destruction)
- People (the noise made â€‹â€‹by wind turbines)

The potential for using wind energy in Montenegro

According to previous measurement, Montenegro has wind energy potential of 100 MW, counting only the windiest areas (coastal environment and Niksic), where the wind speed is around 7 m / s.

If we take into account the areas with high potential, this value is reaching nearly 400 MW.

References:

GEOTHERMAL ENERGY

The most common use of geothermal energy is achieved by using heat transfer fluid, usually hot water or a mixture of hot water and steam, with the contents of various additives (gases, salts, minerals, etc...). Thermal energy of the geothermal source is being used for heating or electricity where the use of geothermal energy depends on the operating temperature of the fluid.

APPLICATION OF GEOTHERMAL ENERGY FOR POWER GENERATION

The geothermal fluid in the form of hot water or steam, with the temperature above 120 °C, converts its l atent heat into mechanical work or electricity.

Depending on the thermodynamic properties of geothermal fluids, there can be several technological processes for converting heat into electricity. The choice of process depends on the amount of fluid, pressure and temperature, proportions of hot water and steam, gas content, terms of scale and corrosion.

The basic processes of electricity generation from geothermal sources

The simplest process (water vapor as the fluid)

Water vapor under the pressure of a geothermal spring comes to the turbine blades and after short adiabatic expansion at atmospheric pressure of 1 bar, instead of the condenser pressure of 0.04 bar releases to air. This is the simplest and most economical process for electricity generation from geothermal sources.

Clausius â€“ Rankine process

A mixture of water, water vapor and large particles coming from the production wells enters into the centrifugal separator with a bundle of thin sheets for drying and separation of steam. Thus obtained dry saturated steam is fed into a steam turbine together with the accompanying gases such as carbon - dioxide (COâ,,), and sulfur - dioxide (SOâ,,). For cooling of the condenser is being used the same water that has already pas the working process, but before that it is being cooled in the cooling tower. Accompanying gases with two-speed compression with inter stage cooling firstly raise the atmospheric pressure and then discharge into the environment.

Flash process

Residual hot water, which is separated in the separator, can be partially converted back into steam, using the so-called "flash-separator", under lower pressure. Thus obtained additional vapor is being brought into the turbine, and the process goes on in the same way as the Clausius-Rankine cycle.

The binary process

It applies in cases of medium temperature geothermal sources, and also contains large amounts of undesirable side-gases. In this process, the geothermal fluid in the heat exchanger gives off heat the secondary highly volatile fluid that drives the turbine blades and the geothermal fluid goes back into the ground through the injection well. Binary cycle using helium as the working medium, can also work on the Stirling-cycle with the use of low temperature engines.

Stirling process

Plants for converting geothermal heat into electricity are holding, in the output fluid, a significant amount of heat (Qiz), due to the relatively high outlet temperature (Tiz) in relation to ambient temperature (To), and therefore the efficiency of such plants is relatively small compared to the heat capacity of the geothermal fluid. Cost-effectiveness of the process of converting heat into electrical energy increases with increasing operating temperature and flow rate of geothermal fluid.

Cost of generated electricity in geothermal power plants depends on the temperature of geothermal wells, fluid flow yield and cost of drilling. According to current data cost-effective are steam power plant of 135 MW and geothermal power plants on hot water of 55 MW.

In addition there has been used the small geothermal power plants capacity of 5 to 10 MW (for use in

remote, inaccessible areas, or as a start-up plant in development of geothermal sources) and very small plants with 100 to 1000 kW (independent binary units for modular use in remote areas, which are very cost-effective and flexible).

Benefits of using geothermal energy in the electricity-consumption:

ECOLOGICAL - Producing electricity from geothermal sources are being conserved non-renewable fossil fuels. Reducing fossil fuel use is being reduced their harmful emissions that damages the atmosphere.

SPATIAL - Geothermal power plants take up less space per megawatt produced, than other types of power plants. For geothermal installations are not required river embankments or logging, so there is no ore tunnels, open pits, waste and oil spills.

RELIABILITY - Geothermal power plants are designed to work for 24 hours a day, almost the whole year. There are no disruptions of production due to bad weather, natural disasters or political influence, which may prevent the transport of other fuels.

ADAPTIBILITY - Geothermal power plants are mostly modular constructions, with more installed units, which are being included when there is increased need for electricity.

ECONOMY - No need for spending money to import fuel for geothermal power plants since they are being built at geothermal sources. Money saved remains to citizens of particular area.

CONTRIBUTION TO DEVELOPMENT - Geothermal projects provide opportunities for developing countries and energy growth, but without the pollution. Even the facilities installed in remote areas can raise living standards by bringing electricity to households that are far from "electrified" population centers.

Direct use of heat energy

Geothermal water and its heat, is now mostly being used worldwide directly, which means no conversion to another form of energy, and less for electricity generation. Direct use of geothermal energy can be used for various purposes, depending on the temperature range. Most commonly it is being used for space heating - geothermal energy is either directly or through a heat exchanger (depending on the purity of the geothermal fluid) being lead to the heat consumers. For the purposes of additional heating or consumption in peak hours there have been used the heat pump or conventional fuel boilers.

Direct use of geothermal energy for heating, industrial processes or for any other purpose always consists of a system with three basic components:

- The production wells for supplying of hot water to the surface

- Mechanical system including pumps, heat exchangers and control elements in order to lead the heat to the space or process

- Injection well for receiving cooled geothermal fluid

Indirect hot water heating system makes the heat exchanger transfers its heat circulating to the second round, with a fluid or city water. Geothermal water, having surrendered their heat is being conducted into the heat exchanger and through the injection pump is being returned to the reservoir through the injection well.

The advantages of using geothermal energy in its original form (directly):

The benefits listed in utilizing geothermal energy for electricity generation are also valid here: the environment, accommodation, reliability and adaptability, but in this case they does not apply to plants, only to the geothermal wells and fluids.

Other advantages are:

ECONOMY
â€“ Consumers with direct usage of geothermal energy are reducing energy expenditure. Savings depend on the application, a cost reduction can be even 80% compared to prices of other fuels. The original way of using geothermal heat requires higher initial investment, but has lower operation costs, and provides independence of the price and lack of other fuels on the market.

Agriculture â€“ in agriculture geothermal energy could be used for various methods of greenhouse heating (he ating radiator area, radiator heating and air, land, soil heating and/or air blowing, etc...) either directly or through a heat exchanger at lower water heating of space. Geothermal water of lower temperature and mineralization can be successfully used for irrigation and/or heating of arable farming in agriculture.

The surfaces of the greenhouse can be of various materials: fiberglass, glass, plastic and foil, using part of

the solar energy to raise the temperature. It is not enough in all conditions (egg at night), which means that geothermal energy could be used as an additional source of heat that can be regulated. Greenhouses are for convenience and advantages usually made of plastic sheeting.

The use of thermal energy in greenhouses is reducing production costs, which amounts to 35% of the total production cost.

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