TECHNOLOGY FOR PRODUCING ELECTRICITY FROM BIOMASS

BIOMASS-FIRED POWER PLANT

Step TRUTNOV variants

The design variants can be used in a range of power output combinations, three examples are given below:		
1. Electrical power output	500	kW_{el}
2. Electrical power output	1,000	kW_{el}
3. Electrical power output	1,500	kW_{el}
Fuel	Biomass as per local potential	
Fuel efficiency	As per selected type	MJ/kg

Description

Generating electricity from biomass presents an attractive technology in terms of economy for combined heat and power generation. Generally speaking, it is one of the possible variants of using energy of biomass as a renewable source.

The application of biomass boilers and technology to generate electricity - principles:

- combined production of electricity and steam for one's own use
- the use of waste heat for one's own consumption

Three possible solutions for combined production of electricity and heat from biomass - STEP CC (Condensing cycle). Lower power output of sources shall be treated per case.

The quantity of electricity produced	**STEP-CC 500 kW_{el}**	**STEP-CC 1,000 kW_{el}**	**STEP-CC 1,500 kW_{el}**
Step steam boiler			
Installed capacity of the steam boiler (kg of steam per hr)	6,400	2 x 6,400	2 x 6,400
Design pressure of the steam boiler (bar)	16	16	32
Output temperature of saturated steam from the boiler (°C)	202	202	229
Output pressure of saturated steam from the boiler (bar)	15	15	29
Electricity generation technology (PM, T)			
Input temperature of saturated steam into the technology (°C)	192	192	227
Input pressure of saturated steam into the technology (bar)	12	12	26
Output temperature of saturated steam from the technology (°C)	112	112	112
Output pressure of saturation steam from the technology (bar)	0.5	0.5	0.5
The total electric power output on terminals (kW)	335	670	1,000
Electricity generation technology (CC)			
Input temperature of saturated steam into the technology (°C)	112	112	112
Input pressure of saturated steam into the technology (bar)	0.5	0.5	0.5
Output temperature of water from the technology (°C)	70	70	70
Total electric power output on terminals (kW)	250	500	500
Total electric power output on terminals (kW)	585	1,170	1,500

Biomass-fired power plant technology includes

Steam biomass-fired boiler with a steam heat exchanger

The boilers are made of two main separate units - a combustion chamber with a hydraulic grate including new walls, and a steam heat exchanger manufactured by Step TRUTNOV. The drum of the steam boiler generates saturated steam, its rated pressure being 16-30 bar. The boilers are designed with errand-type operation once per 4 hours or as per local circumstances.

Combustion

The boiler combustion system is controlled by an I&C system regulated by computer on the basis of achieved sensed and measured quantities of the heating medium, data from the flue gas oxygen sensor, temperature and vacuum in the heating chamber.

Removal of ashes

Ash is transported out of the boiler in its bottom part by a hydraulic conveyor positioned across the boiler, spontaneously falling into a bulk conveyor from which it is unloaded into the container. There is a vacuum generating in the ash lines, so there is no leakage of dust.

Electricity generation technology (steam turbine, steam engine)

The technology set to produce electricity from biomass making use of saturated steam at the given input parameters is supplied as a fully assembled unit on a transport frame, which consists of a steam turbine/engine, generator, and accessories with all piping connections including insulation.

CC unit for converting residual energy of steam into electrical energy

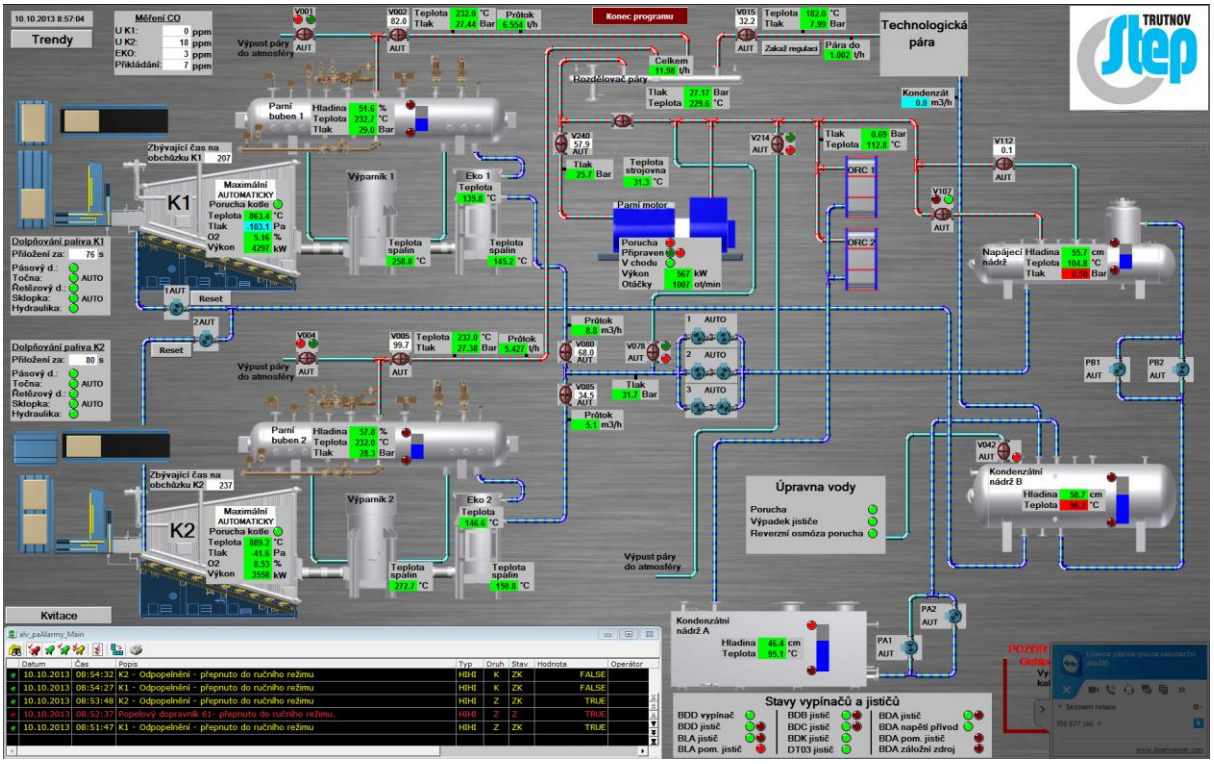
The CC unit technology is used for utilising the residual heat to generate electricity. The residual steam going out from the engine/turbine is applying the residual low-pressure steam to produce additional electric power, i.e. serves as a steam condenser. Thermal energy that cannot be used any further is cooled in outdoor air-cooled condensers.

Machinery

The machinery part of the boiler room and water treatment unit consist of the following technologies: fuel management equipment with a device feeding biomass into the boiler/boilers; complete steam biomass-fired boiler; electricity generation technology (steam turbine/engine) supplied on a transportable frame; Condensing Cycle to utilise the residual energy of the steam for converting into electrical energy; water feed technology and pressure vessel for degassing feed water; condensate management; interconnecting steam and condensate piping; water treatment equipment; valves, feed and circulation pumps; and other equipment necessary for the boiler room and engine room to operate.

Electricity generation technology - control system and electrical part

The control system and the operator workstation are connected to each device from the controlled and monitored technology, the system thus providing oversight of other autonomous control systems.
The control system is interconnected with the control systems of steam boilers, the steam engine/turbine generator, the CC unit generator, and with the operator workstation via industrial Ethernet, communicating with the remainder of the self-contained controller systems via digital inputs and outputs.



Flue gas extraction and purification

Flue gas cleaning takes place in separators designed to achieve compliance with emission limits applicable at the site of the boilers for the power plant.