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SUSTAINABLE ENERGY BIOMASS ASH ECONOMY

Innovative small-scale biomass CHP module based on a 730 kW_{el} screw-type steam engine

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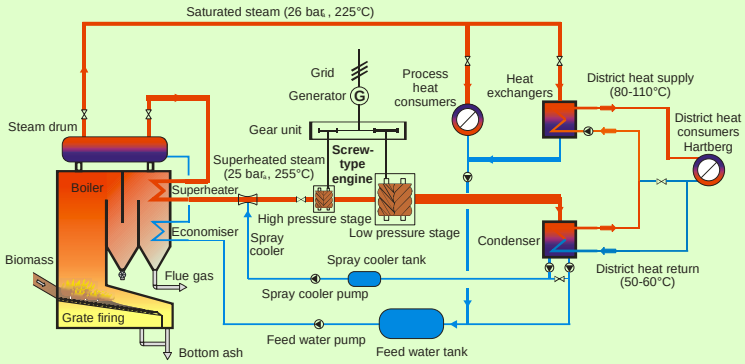
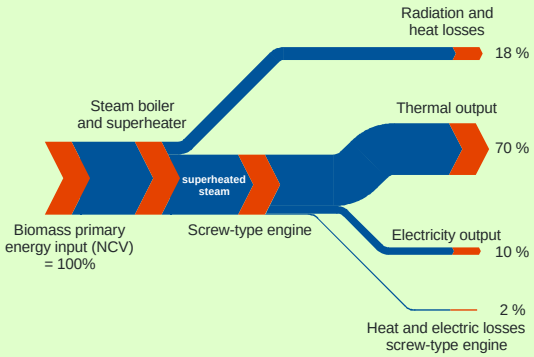


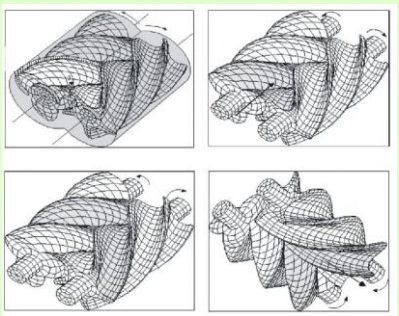
Process flow diagram of the biomass CHP plant Hartberg (Austria)



Energy flow chart of the biomass CHP plant Hartberg (Austria)

Technical description

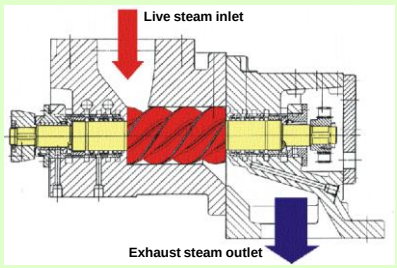
- The screw-type engine cycle is based on the conventional Rankine process. On the contrary to steam turbine processes, the steam is expanded in a screw-type engine (displacement rotary engine)
- The main parts of a screw-type engine are the male rotor, the female rotor and a casing, which together form a V-shaped working chamber whose volume increases during rotation (see figure below)
- The screw-type engine is derived from the screw compressor and is consequently based on comprehensive engine know-how
- Screw-type engines are suitable for biomass CHP plants in the range of 200 to 2,500 kW_{el}, where steam parameters can vary and heavy duty design is needed resulting in low operating and maintenance costs
- The implementation of screw-type engine modules in existing biomass combustion plants is relatively easy



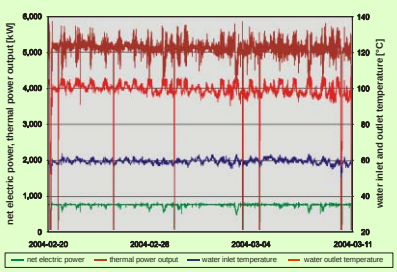
Expansion process within a screw-type engine

Technological evaluation

- Good partial load efficiency over a wide range of load conditions
- Load fluctuations between 30 and 100 % of nominal electric power production are no problem
- The screw-type engine is compact and insensitive to steam quality fluctuations. It can be operated with superheated steam, saturated steam, wet steam and pressurised hot water. Even water droplets in steam do not cause any problems
- The steam cycle and the oil cycle are completely separated by an air-lock system
- The fully automatic operation and easy handling save personal costs



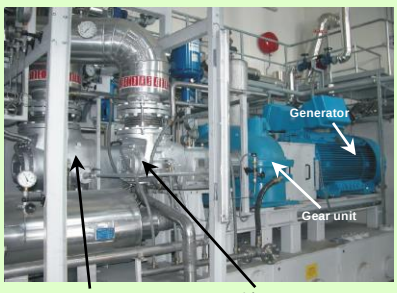
Section drawing of a screw-type engine



Operating data of the CHP plant Hartberg

First demonstration of the new technology

- The technical maturity of the screw-type steam engine has been demonstrated in Hartberg (Austria) within the scope of the European 5th Framework Program (NNE5/2000/467)
- A screw-type steam engine with a nominal electric capacity of 730 kWel was implemented into the steam cycle of the biomass fired district and process heating plant in Hartberg
- Monitoring results achieved:
  - continuous operation since November 2003
  - nominal capacity and efficiency could be confirmed



Screw-type steam engine of the CHP plant Hartberg

Technical data of the screw-type engine process

Steam power input	5,640	kW
Steam flow rate	8.1	t/h
Steam parameters inlet	255 °C / 25	bar_a
Gross nominal electric capacity	730	kW
Net nominal electric capacity	710	kW
Thermal capacity of the condenser	4,800	kW
Steam parameters outlet	100 °C / 1	bar_a
Electric efficiency at nominal load	12.6	%

Funded by

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