



HTSCROLL PROJECT

HIGH-TEMPERATURE AND DOUBLE-STAGE SCROLL EXPANDER FOR COGENERATION APPLICATION

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SUMMARY

Decentralized cogeneration systems are associated with high efficiencies of energy conversion and low emission rates. They also allow a high security of electricity supply and flexibility of operation. This project proposes an alternative for micro-cogeneration based on a new concept of a double-stage and high-efficient scroll expander unit within an Organic Rankine Cycle (ORC) to produce electricity from relatively low temperature heat sources. The scroll system operates at around 250°C allowing the use of renewable energy sources like biomass, thermal solar and geothermal. And the heat recovered at the ORC condenser can be used for space heating and domestic hot-water production.

During the year 2008, the construction, assembly and operational tests of the expander have been carried out for each stage. A circuit of compressed air have been expressly design and used for testing each expansion stage of the expander in terms of pressure, sealing and rotational operation. According to the results, a few modifications have been performed on some parts of the expander for the optimisation purpose, and the machine is now ready for performance testing. The generator is already tested on a separate bench and shows good performance results.

Considering the steam test bench (steam cycle installation), all the equipments have been specified and built under the supervision of ENEFTech. Both the heating and cooling systems have been implemented and tested successfully. The electric panel, the control and monitoring systems are fully operational. However startup testing already performed within the steam test bench (without the expander) showed difficulties on the control and separation of the steam generation circuit and the lubrication oil circuit. In cold startup conditions, condensing water appeared in the oil circuit which generated instabilities in the cycle. Many efforts are now pursuing for avoiding and/or evacuating the condensing water in the oil circuit. According to those instabilities of the cycle, the performance of the expander cannot be yet characterized and ENEFTech proposes new modifications on the water/oil separation system, which would simplify considerably the installation.