

MODELLING, EXPERIMENTATION AND SIMULATION OF A REVERSIBLE HP/ORC UNIT TO GET A POSITIVE ENERGY BUILDING

O. Dumont*, C. Carmo[†], S. Quoilin* and V. Lemort*

*Thermodynamics Laboratory, University of Liege,
Allée de la découverte, 17, 4000 Liege
Belgium
e-mail: olivier.dumont@ulg.ac.be

[†]Department of energy technology, Aalborg university
Fredrik Bajers Vej 5, 9100 Aalborg
Denmark
e-mail: cca@et.aau.dk

ABSTRACT

This paper presents an innovative building comprising a heat pump connected to a solar roof and a geothermal heat exchanger. This heat pump is able to invert its cycle and operate as an ORC (Fig. 1). The solar roof is producing large amount of heat throughout the year. This allows covering the building annual heating needs and, furthermore, electricity is produced thanks to the surplus of heat produced by the roof in the HP/ORC reversible unit. This paper is focusing on three main points: sizing, experimentation and simulation of the reversible unit. First, an optimal sizing of the components and fluid R134a shows promising performance with a net electrical energy produced over one year reaching 4030 kWh. Following that, a prototype has been build and has proven the feasibility of the technology. Finally, a dynamic simulation code including the building, the ground heat exchanger, the thermal energy storage, the solar roof and the reversible HP/ORC unit is developed and allows to perform a sensivity analysis. Annual results show that this technology allows to get a Positive Energy Building.

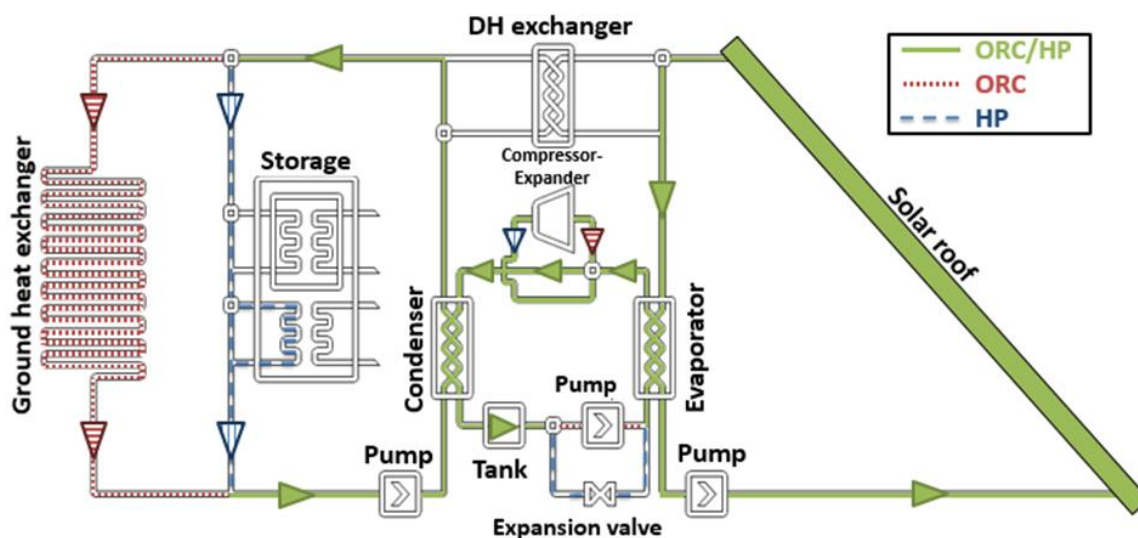


Figure 1: Hydraulic scheme of the HP/ORC reversible unit