

The constant increase of energy costs, the depletion of energy resources and the issues linked to global warming require new power generation solutions. It is moreover estimated that 1.5 billion people worldwide lack access to electricity, mainly in remote and isolated areas of least-industrialized countries. Decentralized and environment-friendly technologies are needed to generate electricity in those areas. The present work aims at developing a prototype of Micro Solar Organic Rankine Cycle using two scroll expanders in series, and a field of parabolic trough collectors.

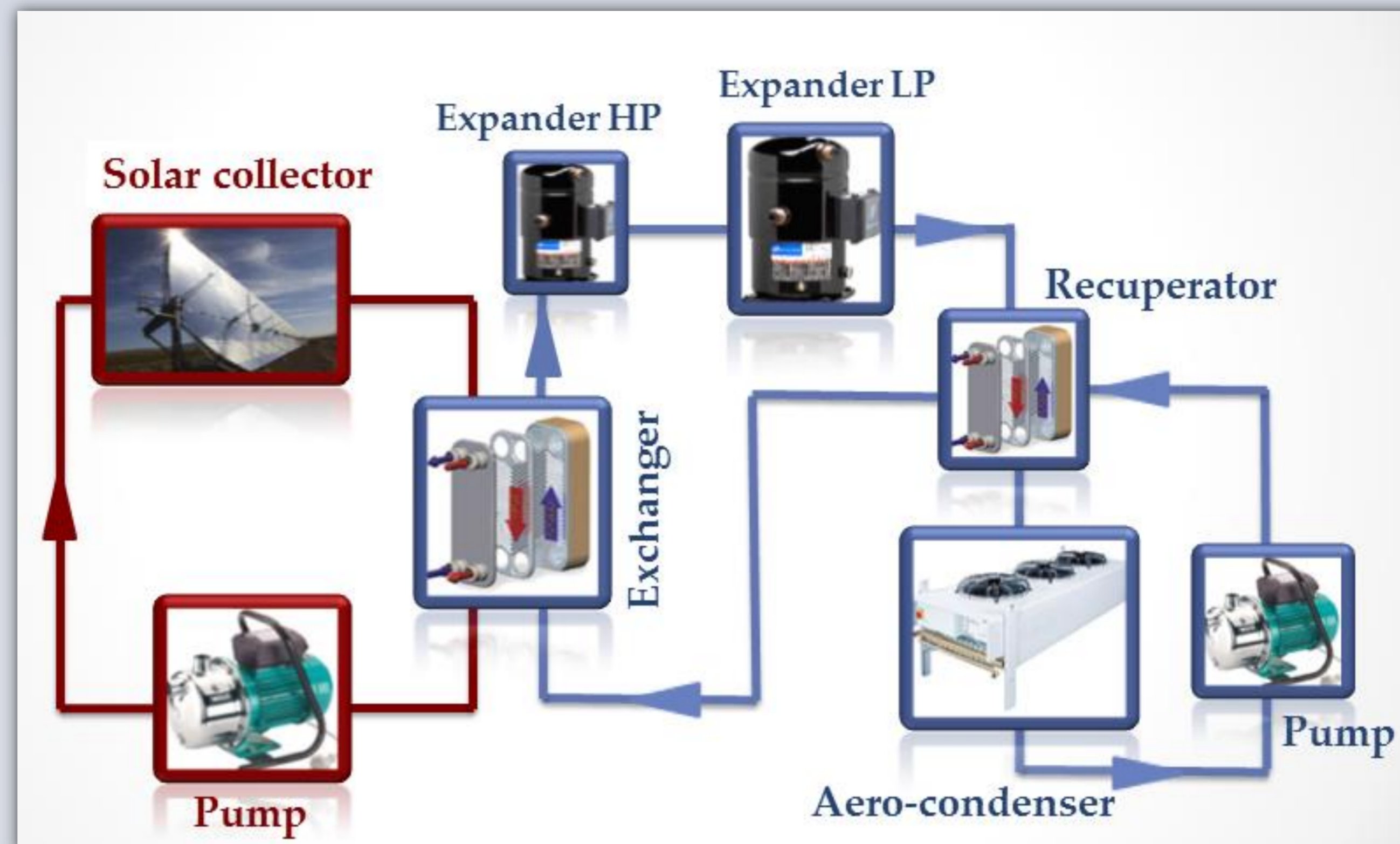
## Purpose of the study

- Experimental investigation of an Organic Rankine Cycle used to recover energy from parabolic trough solar collectors
- Development of a test bench
- Improvement and optimisation of the cycle

## Test bench description

- Heat source: Electrical boiler (replacing the solar collectors in the lab)
- Air cooled condenser
- Working fluid : Refrigerant R245fa
- Expansion device : Two grid-connected scroll expanders in series connected
- Evaporator and recuperator : Brazed plate heat exchangers
- Variable speed pump
- Refrigerant flow rate: Coriolis flow meter

## Simplified scheme of the bench



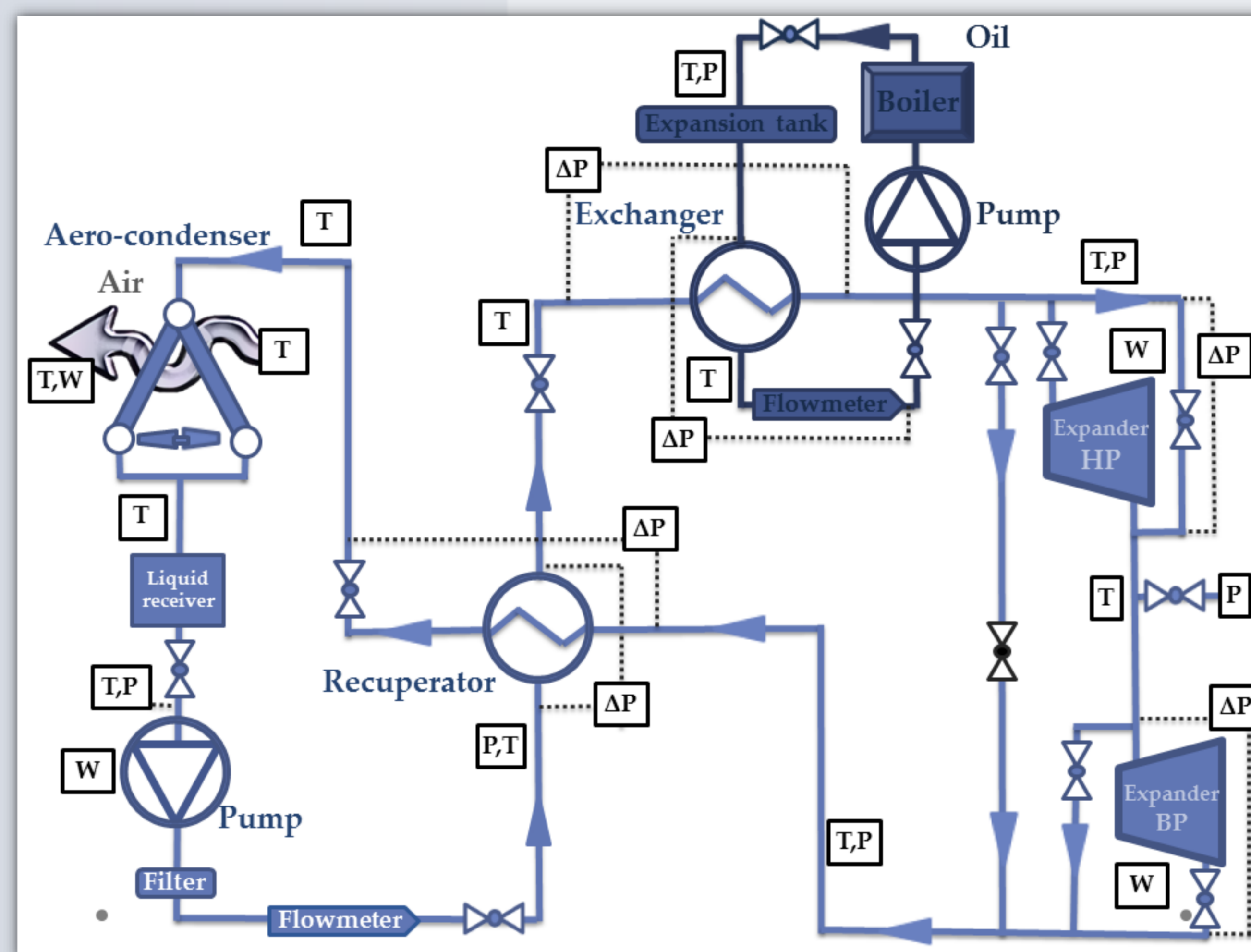
## Predicted results :

- Maximal net electrical power: 3 kW
- Maximal cycle efficiency: 11,3 %
- 13,5 MWh/year
- 3 kW during 2300 h

## Perspectives

- Study of the influence of operating parameters (heat source temperature, air flow, refrigerant flow and oil flow) on performances
- Validations of cycle and components models
- Automatization of the bench – validation of control strategies
- Installation of the bench in France with parabolic through collectors

## Detailed scheme of the bench

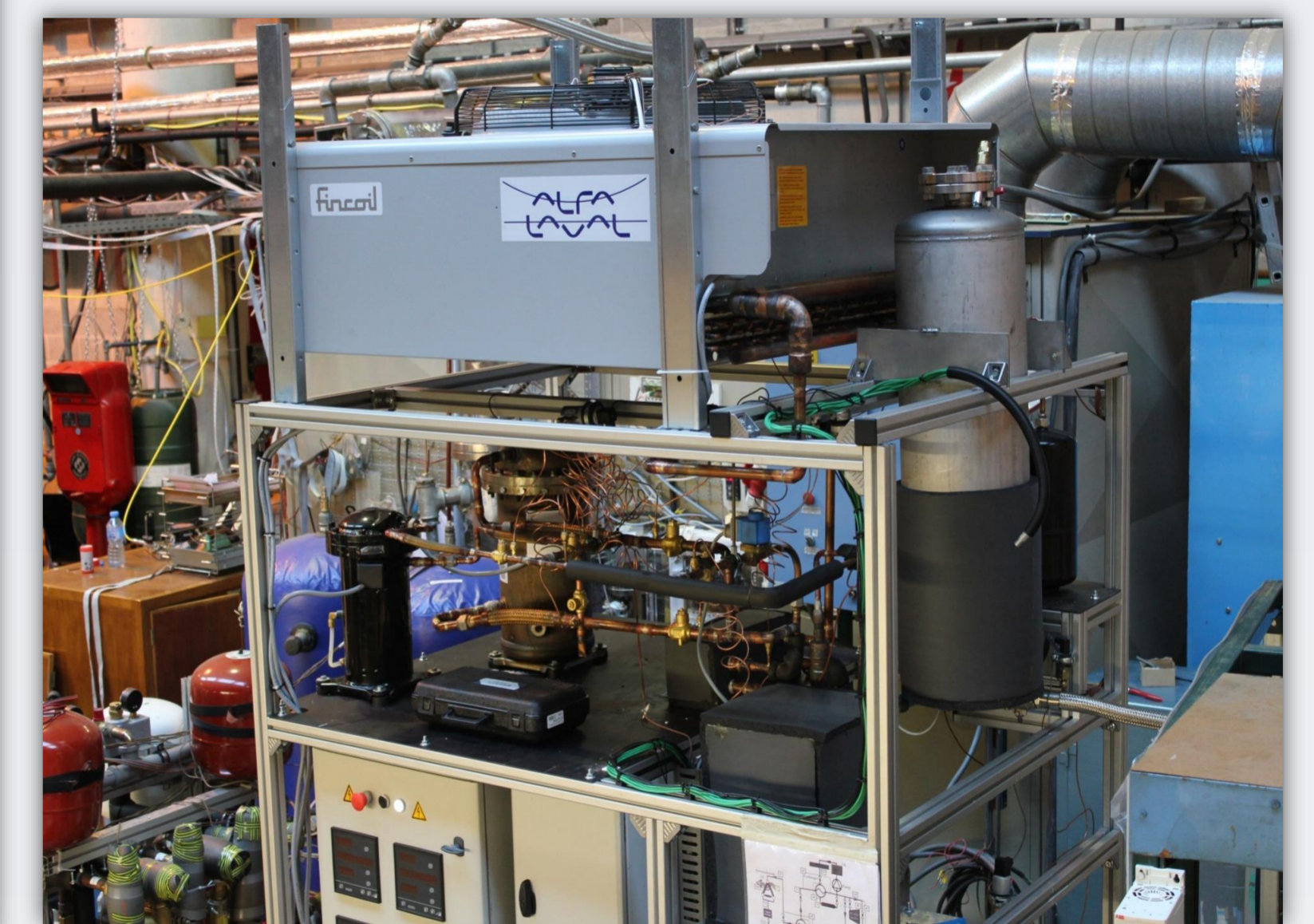


Scroll compressor adapted to run in expander mode :

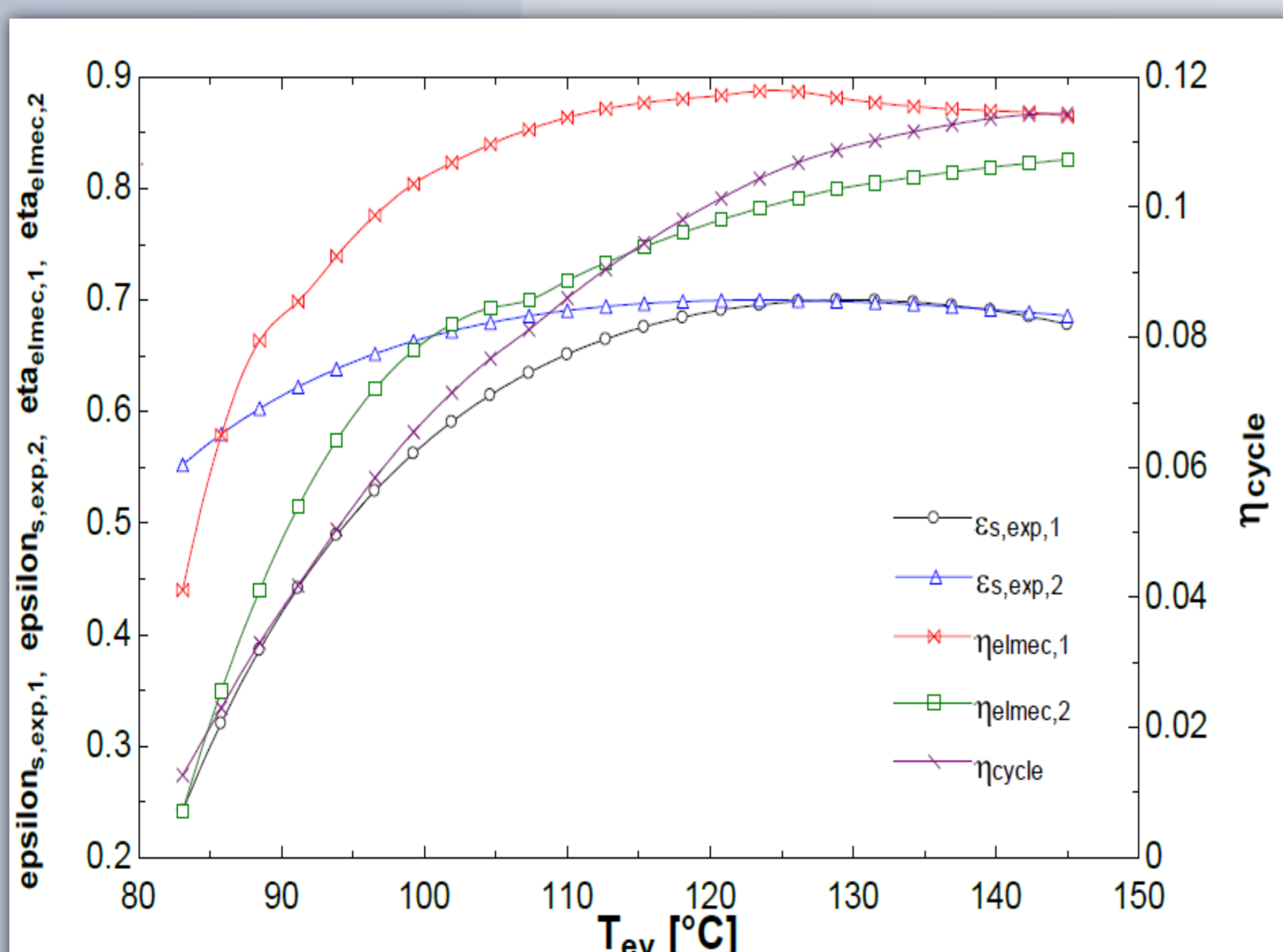


## Solar ORC prototype

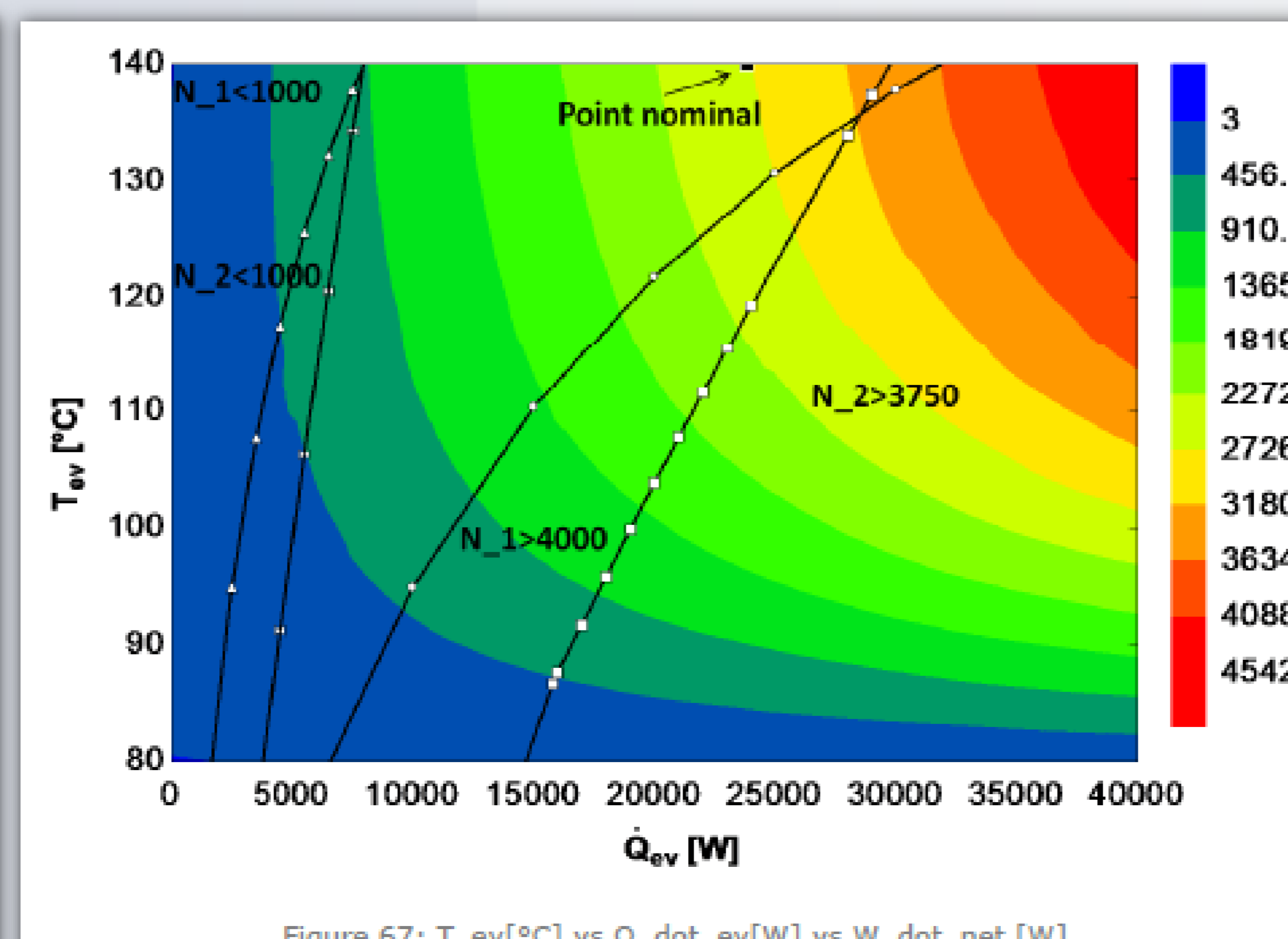
(ongoing experimental campaign)



## Predicted efficiencies



## Predicted net power



## Cycle diagram

