



High-temperature heat pump systems (HTHP) for hot water and steam generation in food processing

Performance evaluation

HTHPs exhibit excellent thermal performance and are a competitive technology for steam boilers replacement and surplus heat recovery in the food industry.

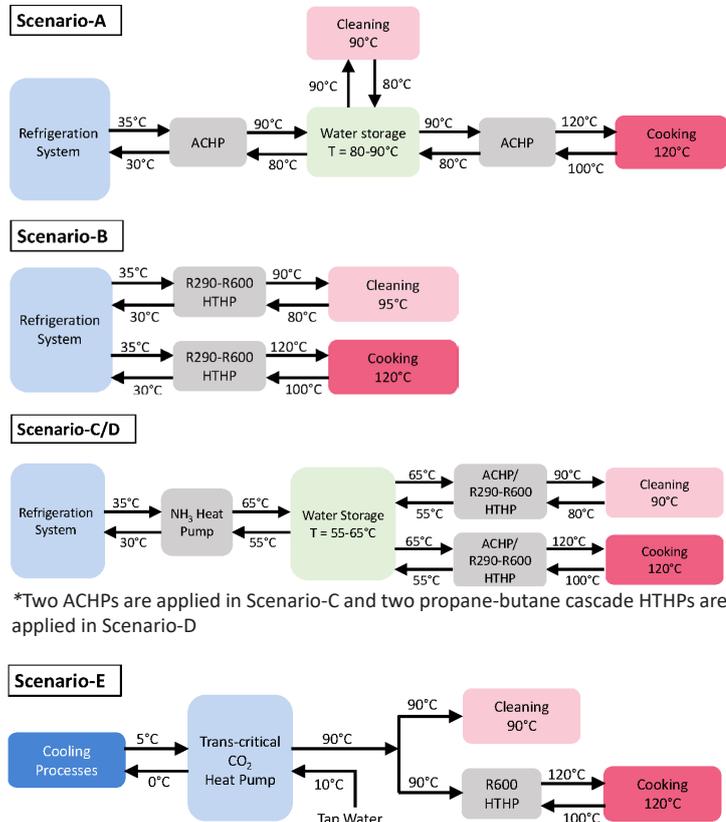
Main results: the ACHP exhibited the best thermal performance and is the most promising solution for hot water and steam production among the three studied HTHP systems.

Three promising HTHP systems using natural refrigerants:

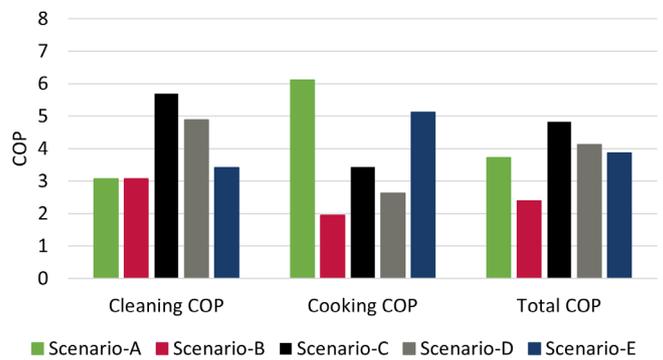
- An ammonia-water absorption-compression heatpump (ACHP) system
- A cascade propane-butane system (R290-R600 HTHP)
- A transcritical CO₂ heat pump system

The thermal performance of the three HTHP systems was evaluated according to the heat demands of common thermal processes in industrial food production as well as different energy system integration strategies.

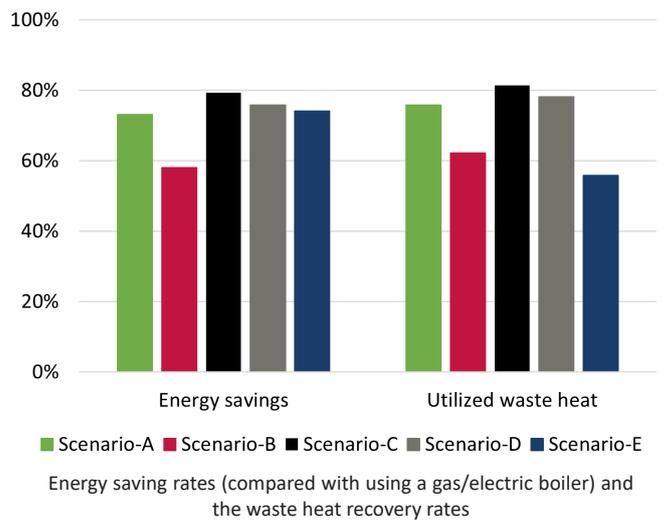
Five application scenarios were evaluated:



*Two ACHPs are applied in Scenario-C and two propane-butane cascade HTHPs are applied in Scenario-D



- In all the scenarios and temperature lift levels, the ACHP exhibited the best thermal performance with moderate pressure levels and low pressure ratios.
- The highest COP achieved by the ACHP was 6.1 for the cooking process, with the heat sink outlet temperature of 120°C and temperature lift of 40 K.
- Scenario-C showed the best total performance with a COP of 4.8 and the highest energy savings rate of 79%.



Find more about this study from the original publication: <http://dx.doi.org/10.18462/iir.q12022.0263>

