

Project Idea TCP HPT Energetic Optimization of Multi Use Waste Energy Heat Pumps

27.10.26

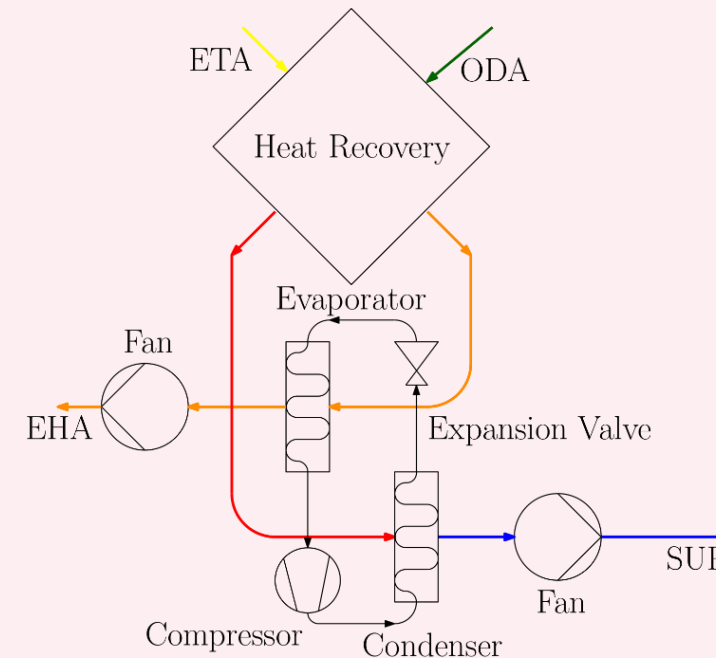
Prof. Dr.-Ing. Thomas Hartmann, Dr.-Ing. Anne Hartmann



The HPT TCP is part of a network of autonomous collaborative partnerships focused on a wide range of energy technologies known as Technology Collaboration Programmes or TCPs. The TCPs are organized under the auspices of the International Energy Agency (IEA), but the TCPs are functionally and legally autonomous. Views, findings, and publications of the HPT TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

Background for this project idea

- types of heat pumps that shall be considered
 - exhaust/extract air heat pumps,
 - exhaust water heat pumps
- building types:
 - residential as well as light commercial buildings
 - well-insulated → newly built as well as renovated
- special features:
 - use of waste energy from the building for heating as well as cooling purposes
 - possibility to use one system for heating, cooling, and DHW
 - no usage of industrial waste energy



Example for extract air heat pump

Objectives

- optimization of control strategies for heating and cooling by the use of model predictive control strategies
- consider different boundary conditions
 - climate conditions
 - usage, e.g. exhaust air temperature, room temperature, exhaust water temperature, mass/volume flow, heat loads, and humidity loads
- methods:
 - laboratory and field measurements
 - simulations

Considering other TCPs

- TCP HPT Project 66 (ongoing) → **optimizing the design and operation** of outdoor air heat pumps
- TCP HPT Project 61 (finished) → implementation of heat pumps in neighborhoods/districts, usage of **waste heat** considered
- TCP HPT Project 62 (finished) → heat pumps in **multi-family houses** with focus on renovation
- EBC TCP Annex 88 “Evaluation and Demonstration of Actual Energy Efficiency of Heat Pump Systems in Buildings” (ongoing) → efficiency of heat pumps under **part load conditions**
- “Air Conditioner” of the 4E TCP (ongoing) → **testing procedures** of heat pumps → exhaust air not especially mentioned

Means

- Task 1: State of the Art: Design and evaluation of waste energy heat pumps
- Task 2: Definition of standardized measurement conditions for waste energy heat pumps
- Task 3: Improvement of Control strategies during heating season
- Task 4: Usage of waste energy heat pumps for cooling
- Task 5: Summary and processing of the findings

Target audience and benefits

- *Manufactures of heat pumps:*
 - collaboration among research institutes as well as manufactures to share knowledge considering different climate as well as legislative boundary conditions
 - consideration of different types of waste energy heat pumps → e.g. exhaust air, extract air, waste water combined with air- as well as water-based systems and domestic hot water
 - investigation of the impact of environmental conditions on energy efficiency
 - closely aligning the real-world scenarios → evaluation of the performance of current as well as improved heat pumps
 - Manufacturers sell products in a wide range of countries (climate and regulatory conditions) and therefore the collaboration is really important for them

Target audience and benefits

- *Designers / legislators / standardization bodies:*
 - adaptation of existing standards on the specific requirements of these types of heat pumps
 - regarding testing and energy balancing and
 - adding design guidelines for cooling purposes considering energy efficiency as well as thermal comfort
 - consideration of EcoDesign rules
 - consideration of national as well as international regulations
- German national project OKRAft is supported by five companies (Nibe, Quantum, Wildeboer, Zehnder, Zimmermann) and two national trade associations (BWP, FGK) → international dissemination of results is important for them

Deliverables

- Task 2:
 - standardized measurement conditions
- Task 3 and 4:
 - transfer of gained knowledge between research institutes and industry → no product design
- general:
 - executive summaries (1-3 pages)
 - publications in open access journals and at conferences

Organisation

- duration: 3 years
- intended project start: end of 2026/ beginning of 2027
- funding between 4.000 and 6.500 € per participating country and per year depending on the number of participating countries
- Potential partners:
 - Denmark – Technical University of Denmark (DTU), Department of Environmental and Resource Engineering
 - The Netherlands – Saxion | University of Applied Sciences – School of Business, Building & Technology (BBT), Lectoraat Sustainable Building Technology
 - *Potential associated partners:*
 - Estonia – Tallinn University of Technology, Nearly Zero Energy Buildings Research Group