**Integration of high-temperature heat pumps (HTHP) in industrial processes**

The topic of high-temperature heat pumps is very relevant in the industry, especially for applications of waste heat utilization and heat recovery (in Europe as well as in South Africa). By transitioning away from fossil fuels and increasing energy and resource efficiency, the CO2 footprint can be drastically reduced. Electrically driven compression heat pumps play a key role as efficient heat transformers for heating and cooling tasks. The offering of high-temperature heat pumps with high performance and high flow temperatures has been constantly growing in recent years. There are already some models on the market today that can reach operating temperatures of up to 200°C.

In this thesis or internship, the integration of HTHPs in industrial processes will be analyzed, particularly focusing on the food and beverage industry, where steam systems with temperatures of up to 160°C are used for heat supply. After conducting a literature review on research and market conditions, the heat-pump system will be modeled using the Polysun software. A systematic case study will be conducted and validated under various conditions. The results will be compared to previous work on solar thermal process heat [1], and the data will be evaluated in terms of economic and ecological parameters.

This project will be co-supervised by Osnabrueck University of Applied Sciences (HOS, Prof. Koke) and Stellenbosch University (SU, Prof. McGregor). The work can be carried out in Germany and/or Stellenbosch.

[1] F. Rozon, J. Koke, C. McGregor, M. Owen, Techno-economic analyses of solar thermal process heat integration at South African beverage producers, Solar Compass, Volume 8, 2023

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**Prof. Dr.-Ing. Johannes Koke**

*Mechanical engineering, especially process engineering*

**Institute for Dual Study Programs**

**Osnabrueck University of Applied Sciences, Campus Lingen**

Kaiserstraße 10c

49809 Lingen

Germany

 Tel.: +49 (0) 591-80098 730

Fax: +49 (0) 591-80098 797

<mailto:j.koke@hs-osnabrueck.de>

<https://www.hs-osnabrueck.de/en/prof-dr-ing-johannes-koke/>