

KIT | ITES | P.O. box 3640 | 76021 Karlsruhe, Germany

Master's thesis description

Design and evaluation of alternative technologies for transforming process heat from CHP plants in paper manufacturing

Paper production is one of the most energy-intensive industries. Due to rising energy prices and increasing pressure to decarbonize, it must optimize its heat supply process in order to increase its energy efficiency and thus its competitiveness.

This master's thesis examines the design and evaluation of alternative technologies for supplying process steam at different pressure levels, which are currently provided by a gas-fired combined heat and power (CHP) plant with a thermal output of 20 MW.

Since the CHP plant is oversized for steam production, unused steam surpluses are generated, while electricity generation is becoming increasingly uneconomical due to the changed gas-electricity price ratio. The aim of the thesis is to develop transformation strategies for replacing gas-fired steam generation with renewable energies, heat recovery, and electrical alternatives.

The master's thesis comprises the following task:

- Analysis and summary of the process requirements for the various steam demands in production and space heating at a large industrial paper manufacturer.
- Development and comparison of alternative concepts for steam supply, taking into account waste heat utilization, renewable energies, and electrical energy sources.
- Thermodynamic modeling and efficiency evaluation of the concepts with EBSILON® Professional.
- Thermoeconomic evaluation of the plant variants based on investment and operating costs as well as sensitivity analyses for seasonal and energy price scenarios.

Requirements:

- Field of study: Mechanical Engineering / Energy Technology (Master's degree)
- Knowledge of power plant technology, heat transfer, and cross-sectional technologies is an advantage
- Interest in process simulation and energy system analysis is required

Contact:

Dr. Xiaoyang Gaus-Liu, E-Mail: xiaoyang.gaus-liu@kit.edu; Tel: Tel.: 0721-608 24889.