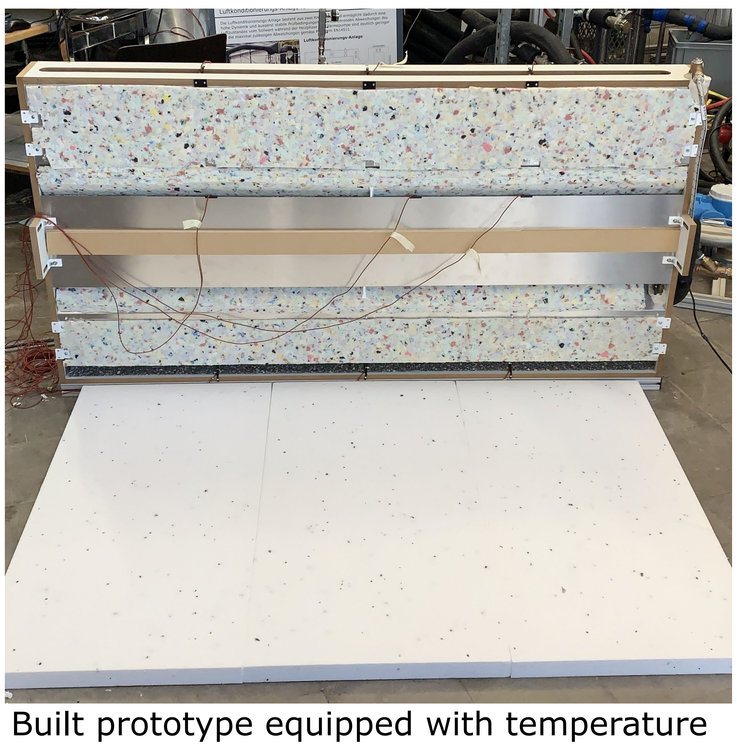
HSLU Hochschule Luzern

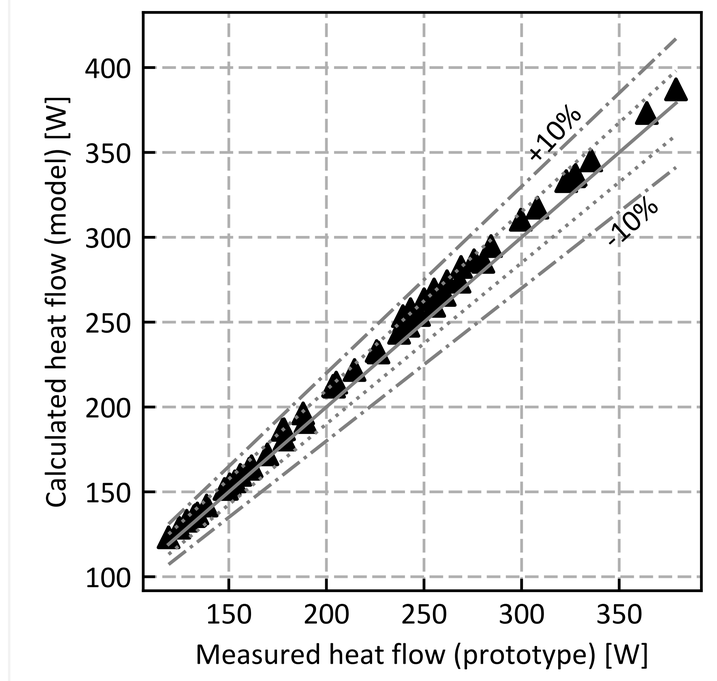
Technik & Architektur

Master-Thesis Energy and Environment

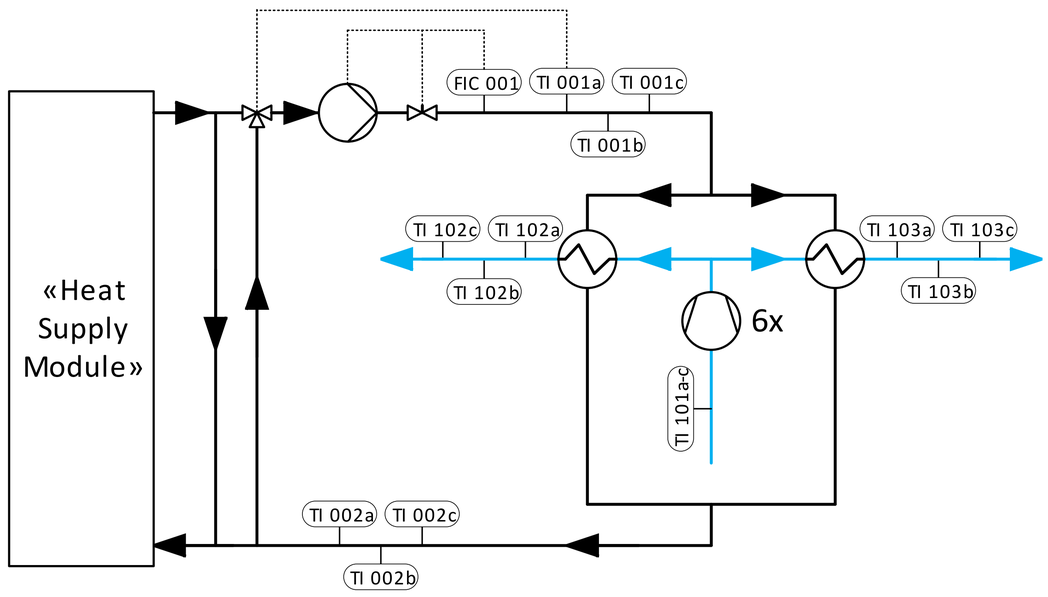
Development of a novel fan coil unit for building heating and cooling



Built prototype equipped with temperature sensors



Comparison between the calculated heat flow by the design tool and the measured heat flow at defined inlet conditions



Schematic representation of the measurement setup

Problem & Objective

In 2019, the Swiss government decided to adopt the goal of 'Net-Zero-Emissions' by 2050. In Switzerland the building sector is still responsible for about 24% of the greenhouse gas (GHG) emissions of the country. In order to decarbonize the building sector, not only the fossil fuels have to be replaced by renewable energy sources, but also the energy demand for space heating must be reduced significantly.

To reach this goal, the usage of low temperature heat emission systems has to be increased.

In new buildings, the standard is to install underfloor heat emission systems that require rather low supply water temperatures of <35°C. However, in renovations it's often unfeasible to retrofit underfloor heating systems. Another approach of a low temperature heat emission system are fan coil units for heating purposes.

The objective of this thesis was to advance the development of fan coil units as low-temperature heating systems.

Solution Concept

A prototype device was developed and constructed. This prototype was then used to measure the thermal capacity of the prototype device and whether the set requirements are met. Further, a design tool was developed, to design the used fin and tube heat exchangers for the prototype.

In addition a tool was developed, to calculate the carbon dioxide concentration of the air in occupied rooms (flats, schools etc.). This tool can be used to design the ventilation system in order to optimize the supply air flow rates to further reduce the energy demand of the ventilation system.

Results

The developed design tool showed a well agreeance with the measurement results, with a deviation from the experimental results from 2 – 7%. It can therefore be used to design the fin and tube heat for further projects.

The prototype was well suited to perform the experimental investigations in the lab and produces reliable results. Also the set requirements were met. The tool to calculate the carbon dioxide concentration in occupied rooms still needs to be validated.

Stefan Hochuli

Supervisor:
Prof. Dr. Beat Wellig

Expert:
Dr. Andrea Grüniger

Industry partner:
Kegel Klimasysteme AG
schaerHolzbau AG