



DOCTORAL RESEARCH TOPIC:

Optimal integration of air-to-water heat pumps towards decarbonization of buildings

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

In order to reduce climate change and increase energy efficiency, the integration of advanced technologies in the building sector, heat pumps are being discovered as one of the solutions that is increasingly being used. Until 2050 the building sector should become CO₂ free. Air source heat pumps are becoming an increasingly popular source of heat energy for heating / cooling buildings and domestic hot water. However, their operation is affected by outdoor and indoor conditions; this is especially true in countries with colder climates, when the problem of evaporator freezing is visible. When addressing energy efficiency and decarbonization of buildings, the optimal integration of this type of heat pump (air-to-water) in buildings needs to be assessed: both new and existing.

The aim of the work is to create a multicriteria model for the integration of air-to-water heat pumps in buildings in order to decarbonize the building sector. To achieve the goal, the following tasks are solved:

1. Examine air-to-water heat pump integration schemes in combination with photovoltaic cells or other renewable energy technologies;
2. To create a model of thermodynamic analysis from primary energy to consumption;
3. To perform an experimental study of heat pump operation in real conditions;
4. To develop a model of optimal integration of a heat pump taking into account multi-criteria evaluation in the decarbonization of buildings.

The results would include a separately developed thermodynamic model from primary energy sources to the consumption circuit, an air-to-water heat pump integration model in cold climates towards zero CO₂ emissions in buildings, experiments with parametric correlations to further explore the advantages and disadvantages of heat pumps and their potential reduction, e.g., freezing during the cold period of the year. The results of the work are published in international journals, Clarivate Analytics Web of Science database, participation in international conferences.

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