

Categorization of heat pump systems in multi-family buildings

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The use of heat pump systems in apartment buildings is already being practiced, as many examples from several countries show. Nevertheless, there is still no evidence pointing to a wider adoption of this solution for heat supply due to both administrative and technical reasons. Within the framework of Annex 50, "Heat Pumps in Multi-Family Buildings for space heating and DHW", a concept was developed to categorize the possible solution variants of heat pump systems in multi-family buildings on a higher level. As a result, five "solution groups" were presented. In parallel, practical examples were identified and described in a standardized way. All examples are available on the annex website at www.heatpumpingtechnologies.org/annex50/case-studies/.

Introduction

The building sector plays a significant role in energy consumption in every country. Next to electricity generation and transportation, it is a top producer of greenhouse gas emissions. The massive reduction of CO₂ eq emissions from buildings and the long-term achievement of a climate-neutral building sector should therefore be considered inseparable.

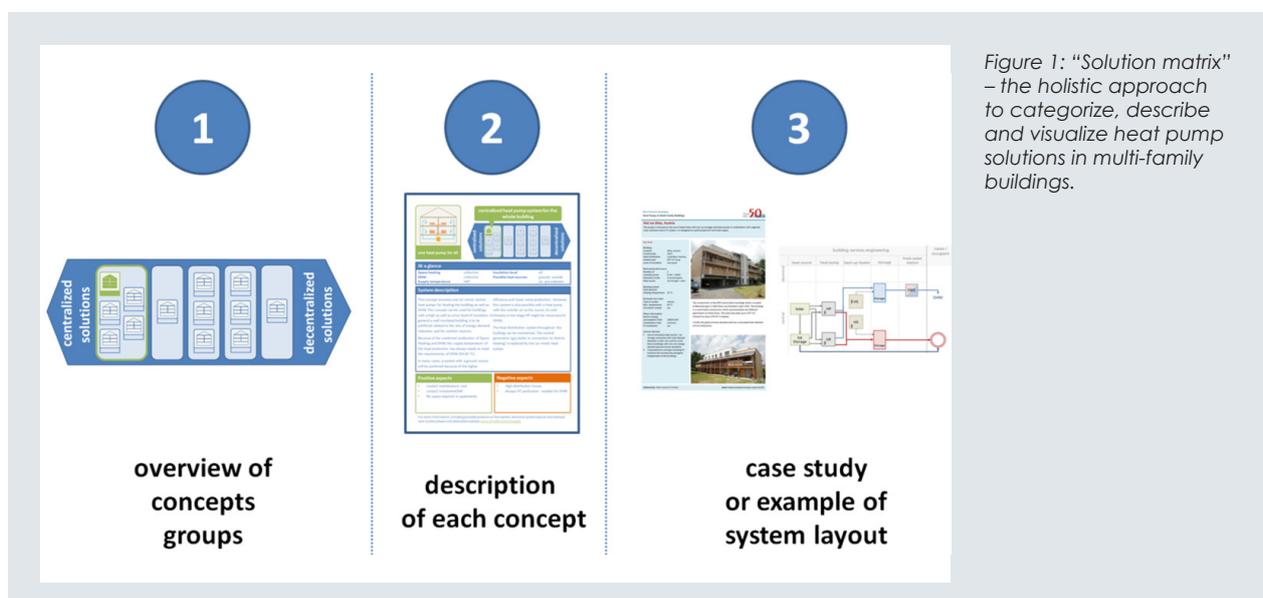
New residential buildings are often built with an envelope and heating system designed for low energy consumption and with potential for using renewable energy technologies like heat pumps. For multi-family houses, the challenge of using heat pump technologies and renewable energies is more complex. Ownership of multi-family buildings varies between the member countries of the Technology Collaboration Programme on Heat Pumping Technologies. In some countries multi-family buildings are often owned by local municipalities or housing associations, while in other countries building ownership is divided among apartment owners. Various heating

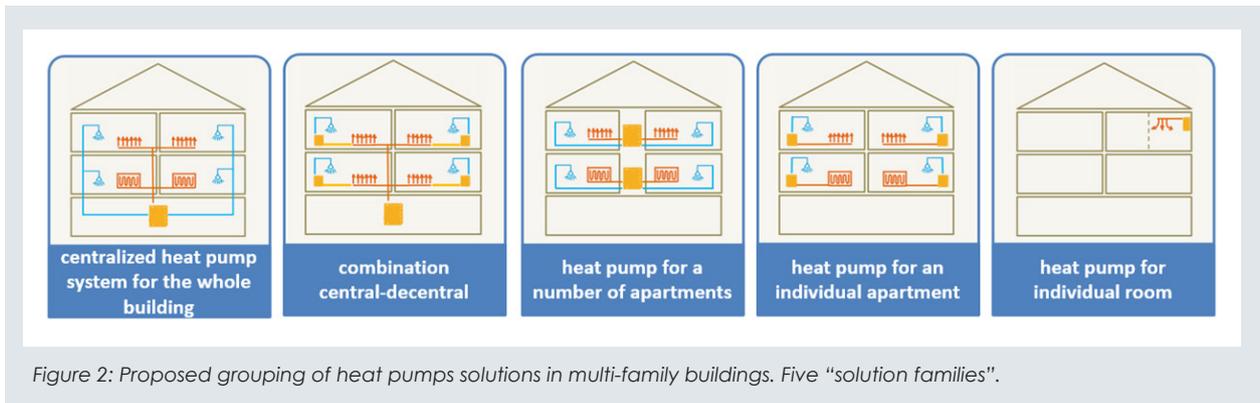
considerations are important in multi-family buildings. Firstly, the share of hot water demand on overall heat demand varies due to different building standards and different climates. Secondly, the temperature level of the heating system is influenced not only by the energy condition of the building and its location, but by the installed heat transfer system. Addressing the multiplicity of heat demand characteristics will thus pose a challenge on the way to a more widespread dissemination of heat pumps in multi-family buildings.

The "solution matrix"

The project partners within the framework of Annex 50 have proposed a holistic approach to categorize, describe and visualize possible heat pumps application solutions in multi-family buildings. The entire method (internally called a "solution matrix") is presented schematically in Figure 1.

The first step – overview of concept groups – presents possible solutions grouped into so-called "solution families". There are numerous possibilities for differentiating





and grouping heat pump solutions for multi-family houses. The methods differ in terms of the main focus ("the perspective") and the level of detail for one or several factors. The consideration of a multitude of differentiation criteria leads to a multidimensional matrix, which is very extensive which may compromise its clarity. Within the framework of Annex 50, a simple overarching grouping and presentation were developed (they are thus somewhat incomplete). This resulted in five "solution families", which represent the general types of WP solutions in MFH (see Figure 2). Each family consists of several "family members", which represent different variants of the main solution. The proposed method does not specify the heat source in most of the families. The type of heat transfer system is likewise not specified in most cases, being either underfloor heating or "conventional" solutions such as radiators.

Brief characteristics of the families:

- » "Centralized heat pump system for the whole building": All apartments in the building are centrally supplied by one or more heat pumps. The heating of the rooms, as well as preparation of the domestic hot water, are centralized.
- » "Combination central-decentral": All apartments are heated by a central heat pump. Domestic hot water preparation is provided by decentralised booster heat pumps, which are installed individually in each apartment.
- » "Heat pump for a number of apartments": The apartments form a group (e.g. by floor), which is heated by one heat pump. This solution is an intermediate solution between a decentralised and a centralised solution.
- » "Heat pump for an individual apartment": Each apartment is equipped with a decentralised heat pump. The heat pumps usually provide both hot water and space heating.
- » "Heat pump for individual room": The individual rooms of the apartment are heated individually by a small air-to-air heat pump. Hot water preparation is not included in this solution.

The second step of the solution matrix describes in detail each of 13 family members. The description includes key schematic scheme of the solution, key facts, detailed explanation as well as positives and negative aspects of the solution.

The third step consists of the corresponding (to the theoretical family members from the step two) case studies, showing the realized system. All case studies are collected and presented on the dedicated website www.heatpumpingtechnologies.org/annex50/case-studies/.

Next steps

The single steps of the described method are still under development and improvement. The first step can be considered as finished. The current activities of Annex 50 focus on step two, a description of each solution. Step three, "case studies data base", is already available on the annex website and will be expanded with new cases. Annex members aim to further develop the presented methodology and also create an online tool called a solution finder. This tool should include the number of different selection criteria (for example, building type, energy demand, heat source, etc.), giving the user a preselected solution from the members of the family solutions.

Summary

Heat pumps in multi-family buildings are still the exception rather than a standard solution. Both regulatory and technical challenges stand in the way of a broader implementation of the technology. Yet examples from many countries prove the applicability of heat pump systems in multi-family houses. Within the framework of Annex 50, "Heat Pumps in Multi-Family Buildings for Space Heating and DHW", a concept was developed to categorize the possible solutions in a simplified way. As a result, five solution families were identified. In parallel, existing case studies were collected, described in a standardized way and visualized online in form of case studies database.

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