

Economical heating and cooling systems for low energy houses



IEA HPP Annex 32

In many countries the building sector contributes significantly to the global energy consumption of the country. Low and ultra low energy houses, e.g. according to the passive house standard, can massively reduce the space heating requirement of the building, and thereby the energy consumption and CO₂-emissions. Therefore, new buildings according to low energy houses standards can help in reducing the energy consumption, and even bigger potentials are in the retrofitting of existing buildings to low energy houses. Actually, retrofitting to low energy houses is a key technology in the attempt to reach Kyoto-targets in many countries.

However, to entirely deploy the potentials of low energy houses, an efficient building technology adapted to the particular requirements of low energy houses is required, too. In the recent years, adapted building heating systems for low energy houses have indeed been developed, whose development, however, is not yet finished.

Heat pump are already integrated in many system solutions for low energy houses and have growing markets in many of the participating countries.

IEA HPP Annex 32 entitled "Economical heating and cooling systems for low energy houses", has therefore the objective to contribute to a further development of the systems in different countries, improve the system integration and standardise energy efficient solutions for the application field of low energy houses.

Objectives

The objectives of IEA HPP Annex 32 are the further development of heat pumps for the application in low energy houses.

A focus are multifunctional, highly integrated heat pump system. Research is mainly related to the component level, system level and the system design

- Component level: Optimised components/units
 - Capacity range
 - Better component performance (e.g. auxiliary energy consumption)
- System level: System integration/Standard systems/Best practice systems
 - Simplification of systems, design process
 - Integration of new functions: space cooling option, humidification, dehumidification (US, JP)
 - Prove of feasibility of system solutions by field testing
 - Evaluation of optimisation potentials by field testing => best practice systems

- Design guidelines
 - as technical handbooks, checklists, computational tools, standard calculations methods
 - Robust systems for improved real-world operation (energy consumption)
 - for the Target Groups: Users, installers, consultants, designers, manufacturers, building companies

Structure

The work on IEA HPP Annex 32 is structured in 4 Tasks

Task 1 - Market and systems survey

- Evaluation of different system configurations of integrated heat pump systems for heating and cooling applications in the market and under development including an
- Analysis of different demand structures (DHW, space heating, cooling, ventilation, de-/humidification) under consideration of possibilities of passive cooling, shading etc.
- Ambient sources for heating and cooling energy (outside air, exhaust air, ground, combination of the former mentioned)
- distribution systems attached to the generator unit (surface heating and cooling systems, air distribution, ground-coupled cooling)

Task 2 - System assessment and comparison

- Evaluation and/or development of calculation methods for the systems to be investigated
- Comparison of the different system with regard to the overall energy performance for the different building services among each other and with non-heat pump system solutions
- Evaluation of the control of the systems
- Economic evaluation of the systems solutions for heating and cooling

Task 3 - Field testing of integrated heat pump systems

- Establishing of an appropriate measuring concept and instrumentation for comparison with the assessment carried out in Task 2
- Functionality check and commissioning of test plants and derivation of key values for system performance
- summarising and comparison of results for best practice samples in the design guidelines to be developed in Task 4

Task 4 - System assessment and comparison

- Derivation of design guidelines of the results of Task 2 and Task 3 with regards to the requirements
- Transfer of the results to standardisation committees to be integrated in standard calculation if applicable
- Documentation of best practice system and typical optimisation potentials

Deliverables

Deliverables of the IEA HPP Annex 32 comprise

- Concepts of new integrated heat pump solutions for low energy houses
- Redesign, prototyping and lab-testing of heat pumps for low energy house application
- Field test results of existing and new system solutions
- Best practice systems incl. monitoring techniques for operation control
- Design guidelines and information dissemination

IEA HPP Annex 32

IEA HPP Annex 32 is a corporate research project on technical building systems with heat pumps for the application in low energy houses. The project is accomplished in the Heat Pump Program (HPP) of the International Energy Agency (IEA).

Internet: <http://www.annex32.net>

