

Heat Pump Concepts for Nearly Zero Energy Buildings (nZEB)



Heat pumps provide both energy-efficient and cost-effective energy solutions for nZEB. Furthermore, they can increase the electricity self-consumption from on-site solar PV production and reduce the local impact of solar PV production on the grid.

Key Findings

- 1 Case studies and technology comparison for HVAC systems in nZEB** across different countries and regions in Europe, Canada, and Japan regarding system performance and cost **confirm that heat pumps range among the most energy-efficient and cost-effective system solutions.**
- 2 Field monitoring** of heat pumps in nZEB **confirm the good performance and remaining optimisation potentials in the real operation.** Different systems developed and demonstrated in the project are now **on the market.**
- 3 Demand response strategies** have been evaluated in field monitoring of heat pumps in residential buildings with e-mobility and offices with thermally-activated building systems. **Evaluations show a reduction of grid-interaction by the load shift options with the heat pump.**
- 4 New technologies for both heating and cooling** needs were developed and demonstrated. One system developed in Japan, that is **now on the market** decouples the humidity and sensible cooling loads and **field tests confirmed a 70 % energy reduction with improved comfort** values compared to a conventional system.



Figure 1. First MINERGIE-A® certified building in canton Zurich with mixed residential and office use. The building has been monitored and optimized within the framework of Annex 40. [Source: Hässig]

Heat Pumps Range Among the Best Systems in nZEB

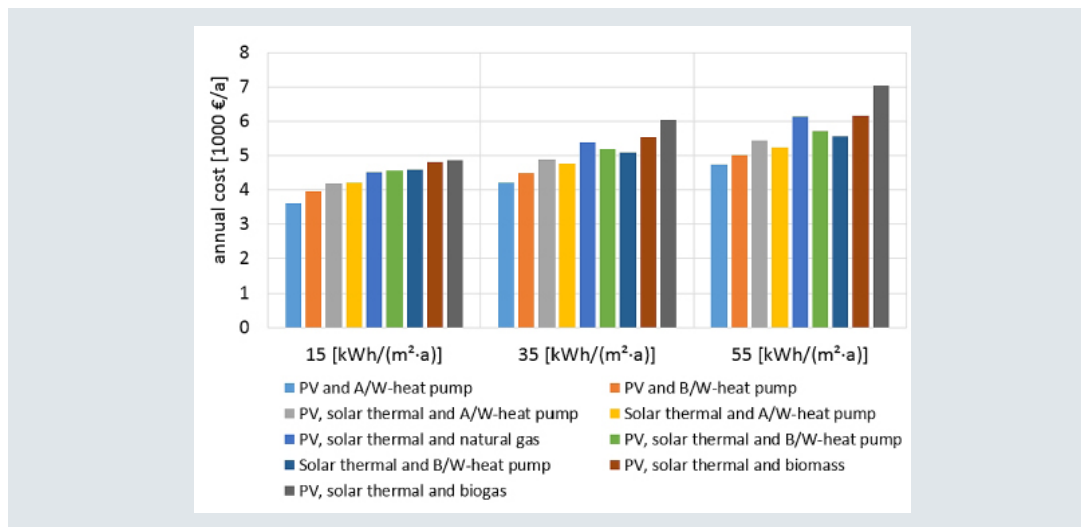


Figure 2. Comparison of different building systems and heating needs confirm the good performance and low annual cost of heat pumps. Different studies by simulation have also been performed by other participants with a similar result regarding the cost of heat generation systems.

Background

Nearly Zero Energy Buildings (nZEB) are the political target for new buildings in the time frame of 2020–2030. Even though the time schedule in the EU is quite tight, only a limited number of nZEB have already been built and no common definition of an nZEB is in place, yet.

In built nZEB heat pumps already play an important role in HVAC systems. Therefore, Annex 40 was to assess and further develop heat pump concepts for nearly Zero Energy Buildings. Heat pumps offer different integration options with other components of the building technology and on-site energy production.

Moreover, heat pumps enable a local load management by storing electricity surplus of on-site solar PV as space heating and cooling energy in connection with storages or the building thermal mass.

Objectives

Heat pumps contribute to enhance flexible operation and reduce grid interaction, which will become an important aspect with a broad introduction of nZEB. Thus, the objectives of the Annex 40 were to ...

- ... characterise the state-of-the-art of the application of heat pumps in existing nearly Zero Energy Buildings and assess and improve systems with heat pumps.
- ... develop and lab-test new integrated heat pumps in nZEB capacity range and combinations with other technologies like solar generators and storages.
- ... evaluate the heat pump performance in nZEB by field monitoring in order to document best-practice systems and improve integration into the energy system.

Further information

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Publications:	Final reports (4 parts) of Annex 40 and Executive Summary of Annex 40, available at www.heatpumpingtechnologies.org
Internet:	www.annex40.net