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Evaluation of Field Study Data on Domestic Heat Pump Systems

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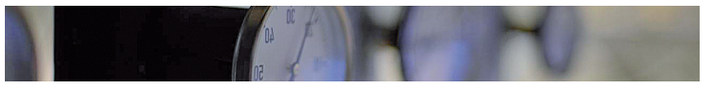
1 Executive summary

The efficiency of electrically driven compression heat pumps for existing dwellings has been evaluated with the help of data from a field test of the E.ON Energie AG, conducted through the Fraunhofer Institute for Solar Energy Systems in Freiburg. The data has been verified and grouped to allow a detailed statistical analysis. A numerical calculation procedure has been developed that models the total system consisting of heat pump, heat source and heat sink modeling the most important influencing parameters.

A detailed analysis of the heat pump field test shows that for 43 field test objects evaluable data exists. Thereof 21 are air-to-water heat pumps, 17 brine-to-water heat pumps with horizontal ground source heat exchangers and 5 are brine-to-water heat pumps with vertical ground source heat exchangers.

A mean seasonal performance factor of 2.3 for air coupled devices and 2.9 for ground coupled devices shows that the application of heat pumps of different manufacturers in existing buildings is questionable on a level of primary energy savings and is economically inefficient. The best systems achieved seasonal performance factors of 3.0 respectively 4.0. The great differences to the mean values on one hand show the high potential of the technology and on the other side the necessity of an optimization of the total system.

On the basis of field study data, a new dynamic calculation procedure has been developed using the modeling language Modelica. It allows a detailed simulation of the total heat pump system. The heat pump model works with lookup table data, all other components are modeled according to their physical properties. Numerical studies have shown that notably speed controlled heat pumps and a combination of air-to-water heat pumps and boilers (the bivalent or hybrid heat pump) have potential for primary energy savings in existing and in new buildings.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