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European Heat Pump NEWS

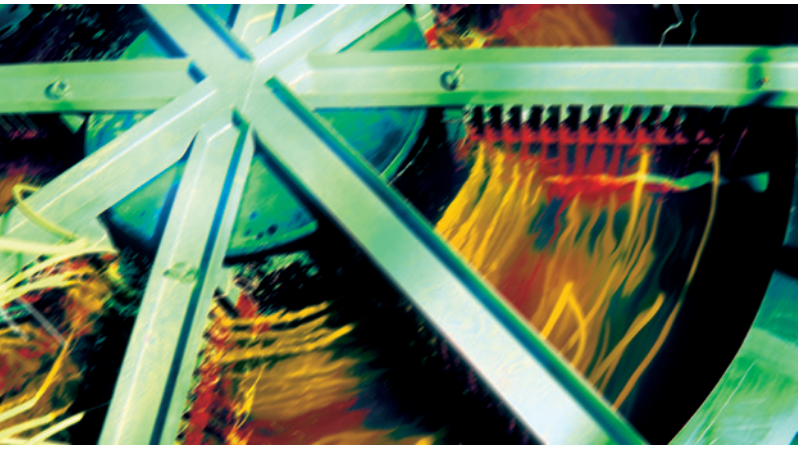
ehpa european heat pump association

editorial

The need for robust data: heat pump field measurements

Karl Ochsner (President)

Heat pump technology faces a paradox: albeit being an "old", established and reliable technology, they are still perceived as "new". The concept of heat pumps was found in the late 19th century, the oldest heat pump still in operation can be found in the majors house in Zurich (built in 1937) and the basis of heat pump technology, the refrigeration cycle, has proven reliable in reverse mode in millions of existing refrigerators and air-conditioning systems.



Consequently, heat pumps are an effective, efficient and reliable technology using renewable energy. They are also successful in the market place: more than 520.000 units were sold in the European market place in 2009, the heat pump stock is exceeding 2 mio. units. This success is accompanied by an increasing demand for reliable data on the energetic efficiency of the individual heat pump and the heat pump stock. Such data are used as the basis of subsidy programs, recognition of the technology as using renewable sources and counting this contribution towards statistics.

Measurement of the performance of unitary heat pumps is frequently done by the manufacturers. Verification by third parties is requested for the established EHPA quality label. On the other hand, we only dispose of a few results of field tests, and standards which guarantee the conformity of monitoring are still missing.

The EHPA is currently participating in a project that aims at developing such standards. SEPEMO-Build (SEasonal PErformance factor and MOnitoring for heat pump systems in the building sector) is lead by the Swedish research institute SP and focuses on filling the gap of missing robust data on the conditions "in real heat pump installations" across Europe. The project has already come up with a thorough description of system boundaries which is an essential information for the comparability of data. As well, a description of measurement setups has been agreed upon. Both will become part of a method for performance measurements. As many of the key stakeholders in the heat pump industry are participating in this project, the results are expected to be suitable to form the basis for a European standard to be used in future field measurement projects.

Such standard approach is essential to create a better basis for the understanding of heat pump installation efficiency across Europe. It can provide the information required by the different bodies of EU and national legislation addressing heat pump technology and will also be a useful answer to end-consumer questions on heat pump performance and efficiency.

Especially the last extremely cold winter has demonstrated how much the efficiency and dependability of a heat pump depends on the installation and heating system design. Extended field measurements would contribute to increase the quality of the installations and thus insure a high performance level of the heat pumps.

Thus the project results will contribute to the overall goal of realising the potential of heat pumps towards energy savings and emissions reduction in future sustainable energy systems.

content

SEPEMO – System boundaries and measurement equipment

In the IEE project SEPEMO-Build a proposal for system boundaries and corresponding Seasonal Performance Factors (SPF) calculation models for heating and cooling of heat pump systems have been developed for use in field measurements. The system boundaries stretch from the heat pump refrigeration cycle to the whole heating system boundary in heat pump systems and will lead to a common system evaluation which allows for a comparison of different measured systems. Defining the system boundaries directly impacts on the measurement equipment needed to measure the parameters required for the calculation of the different SPF.

In the course of the IEE project SEPEMO-Build a methodology to provide comparable field monitoring data from different types of heat pump systems has been developed. The project partners will set up field measurements on heat pump systems using this methodology, so that the systems measured and their performance are comparable. The data gathered will be the basis for further measurements in order to obtain comparable measurements in different countries. A common evaluation method for field measurements will make it possible to get and analyse data for quality characteristics of heat pump systems and technologies.

System boundary description

For calculating the SPF for heating and cooling in heat pump systems, the system boundaries have to be set. Defining those boundaries directly impacts the measurement equipment needed to measure the required parameters for the calculation of the different SPF. This SPF-calculation method also facilitates the quantification of the impact of the auxiliary devices like brine pumps and fans on the performance of the heat pump system. It also enables the comparison of heat pump systems and other heating systems like oil or gas by allowing for the calculation of the CO_2- and primary energy reduction potential. Furthermore the quantity of renewable energy supplied by the heat pump system can be calculated and used for EUROSTAT statistics.

The definition of the system boundaries influences – in dependency on the impact of the auxiliary devices – also the results of the SPF. Therefore the SPF should be calculated according to different system boundaries. Since the units can operate in heating and/or cooling mode the system boundaries and the SPF-calculation methodology is separated into heating and cooling mode. According to the system boundaries, the SPF can be calculated for cooling, space heating and domestic hot water production.

For systems with an additional heating system other than an electrical back up heater (e.g. oil, gas or biomass) the quantity of heat and the energy content of the fuel demand have to be determined for the calculation of the SPF according to the system boundaries. For any additional (solar) thermal system, the electric auxiliary energy to run this system has to be measured. With the heat energy delivered to the heating system by the additional heating, the energy supply ratio of the heat pump system is calculated.

The definitions of the system boundaries considered in the project SEPEMO are a general description for all different heating and cooling systems. Therefore the possibility to realise the measurement can be slightly different for the different systems, although it is possible to have correct comparisons within the different systems e.g. air/water with another air/water system.

Comparison of the system boundaries in standards and the system boundaries of the SPF-calculation methodology

There are different existing standards and regulations for calculating the SPF. These calculation methodologies are mainly based on input from the testing standard EN 14511. The system boundaries of testing standards are however focused on the heating or cooling unit itself. In comparing test results, the system integration is not taken into account. Therefore these standards do not include the entire energy consumption of the auxiliary drives on the heat sink and heat source side.

Due to the different framework conditions, there are differences between field testing and testing on a test rig, which can't be avoided due to reasons of practicability. Those differences shall be pointed out. The main difference in the evaluation methodologies originates from the evaluation subject. While testing on a test rig is focused on the unit, the field measurements are determined by the system. Hence, the system boundaries for testing and field measurements will be slightly different and therefore have to be considered when comparing calculated and field measured SPF. Within the project the following differences concerning the nomenclature of SPF, COP, EER, SCOP and SEER have been defined:

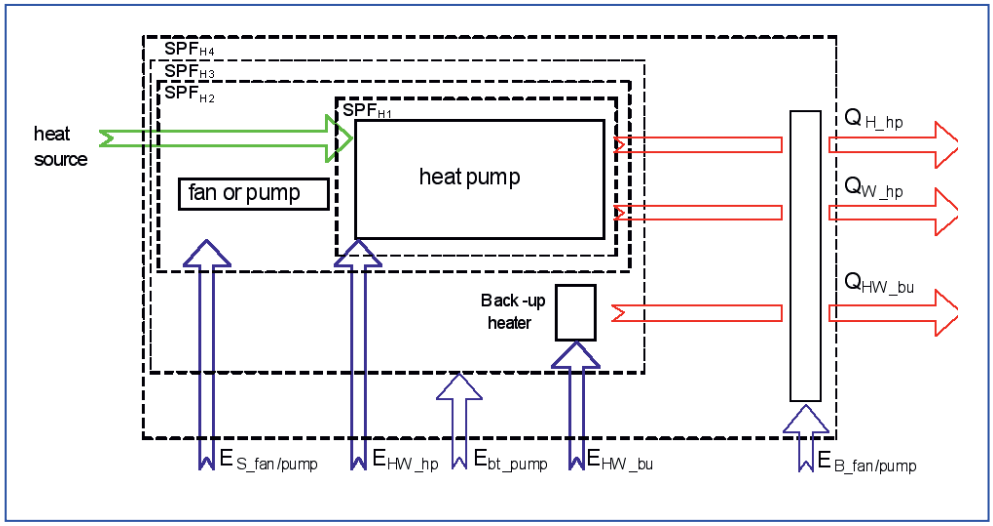


Fig. 1: Energy flow and defined boundaries for a heat pump system in heating mode

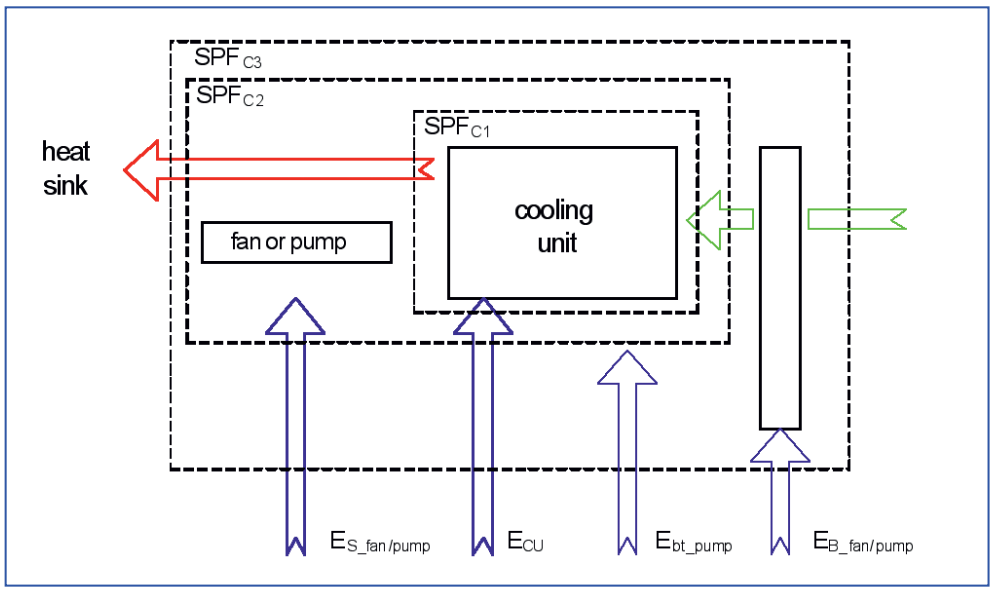


Fig. 2 Energy flow and defined boundaries for a heat pump system in cooling mode.

• SPF – evaluation of field measurement data according to the defined system boundaries
• COP/EER – measurements on test rigs according to certain standards or regulations e.g.: EN 15411, EHPA-Quality label

Measurement equipment

In order to implement a common system evaluation, it is not mandatory to use the same measurement equipment, but it is obligatory that during the measurements the same parameters have been recorded, and with comparable accuracy. The need for different measurement equipment derives from the different system boundaries, which also influence the measurement of the electric energy input.

Therefore it is important to define what to measure in order to apply SPF calculations and to provide information about the measurement quality that is needed (accuracy, sampling intervals, measurement equipment quality (sensors), etc). Additionally for accurate measurement data, proper equipment integration into the system is needed.

Deliverables

More detailed information concerning the system boundaries and measurement equipment can be found on the web page of the project www.sepemo.eu/deliverables/project-reports/.
• D4.1 – "guideline for heat pump field measurements": the first concept will be available on the web page for download in August 2010
• D4.2 – "Concept for evaluation of SPF": the first concept is available on the web page for download

Andreas Zottl, AIT – Austrian Institute of Technology
Roger Nordman, SP – Technical Research Institute of Sweden

Back-up heating under real conditions

Outcomes of field test project "heat pump efficiency" or back-up heater under suspicion

The statistics of the sales figures show an impressive rise and pointing out the increasing popularity of heat pumps. Heat pumps became competitive on the market compared to conventional technologies, as by now heat pumps can reach adequate Seasonal Performance Factors (SPFs).

However, the operation of the back-up heater, influences the SPF negatively. In the case of ground source heat pumps (GSHP) the back-up heater can represent an emergency heating source. In contrast, the back-up heater of air source heat pumps (ASHP) is part of the heating strategy and regularly scheduled for outside air temperatures below a certain point. In this article the operation of back-up heaters will be examined with data measured within a framework of a field-test, carried out by the Fraunhofer Institute for Solar Energy Systems ISE.

The Fraunhofer ISE evaluates the efficiency and the system behaviors of heat pump systems under authentic conditions since 2007. Meanwhile the third large scaled field-test "HP Monitor" with a duration until 2013 started. The outcomes of this article are based on the field-test "HP Efficiency" of which the project duration is currently reaching the end. The content of this project is the evaluation of heat pumps with a small output capacity of 5–10 kW thermal, with outdoor air (ASHP), earth (GSHP) and groundwater (WSHP) heat sources. The project includes over 100 heat pump units installed primarily in new family houses. Here the measured space heating energy need in 2009 ranges from 32 to 169 kWh/(m∞a) with an average value of 71 kWh/(m2a). Furthermore, the majority (90%) of the HP-systems are equipped with floor heating which enables low inlet temperatures of averaged 36°C. Further project information is available in EHPA-Newsletter No 2 (December 2009) and the homepages (in German), stated at the bottom of the article.

For the examination of the back-up heating activity, two different system boundaries are required. Therefore, the SPF 1 is concerned with the electrical energy consumption of the compressor, the brine pump (ventilator for ASHPs) and the controller. SPF 2 deals additionally with the energy consumption of the electrical backup heater. The produced thermal energy is considered accordingly each kind of SPF.

Fig. 3 (GSHP) and Fig. 4 (ASHP) show both SPFs during two years of operation. The average share of the electric heater for the entire period amounts to 2 % (ASHP: 3 %), whereas the monthly shares deliver different numbers. Especially during the winter season, the share of the electrical heater seems to be decreased. Therefore, the monthly usage of electrical energy has to be considered in total. The remarkable shares during the summertime are results of accidently working electrical heaters and can hardly contribute to the share of the whole period. In some cases the high activity of the heater has to be traced back to the activity of drying-out the building. In case of ASHPs the operation of electrical heaters following more clearly the weather conditions in each month such as in cold January and December 2009. By considering the entire period, the activity of the electrical heater leads to a SPF 1 which

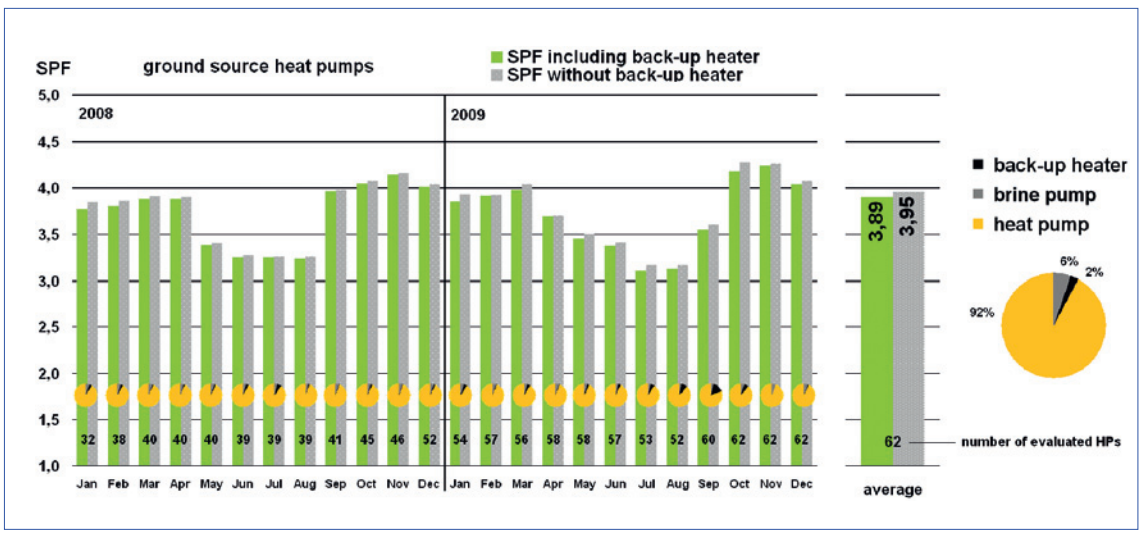


Fig. 3: Monthly SPFs with and without back-up heater and average values for 2008 and 2009, share of electrical energy usage for GSHP

exceeds SPF 2 of about 0.06 (ASHP: 0.06), whereas the most extreme monthly difference between both SPFs accounts for about 0.09 (ASHP: 0.13).

The diagrams of Fig. 5 give an overview of electrical heater activities regarding individual objects. Every bar shows the amount of the electrical energy usage for back-up heater related to the electrical energy consumption in total, which imply the additional usage of the compressor, and the pump in the primary circle respectively the ventilator.

The period of consideration depends on the individual running time of the objects. Considering the left side of the graph, all ground source heat pumps with the mentioned activities are illustrated. About 30% of the GSHP are registered with significant activities of the electrical heater, whereas the top value of 22% was merely reached by the malfunction in one month. This phenomenon is to observe for various heat pumps. Furthermore, as to observe on the right side of the diagram, an activity of back-up heater in normal operation can be observed more often considering air source heat pumps. Almost all the examined ASHPs show activities of the electrical heater, which is common, in terms of the dimensioning of ASHP including the back-up-heater for lower temperatures during the heating period. Nevertheless, the amount of the individual shares of the objects is not as high compared to the shares of the GSHP.

Conclusions:

- According both GSHPs and ASHPs, SPFs, considering the back-up heater or not, have similar results
- back-up heater work infrequent and change efficiency of the system very slightly
- back-up heater operation of ASHPs work regular, its operation of GSHPs depend on malfunction and on drying out the buildung

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http://wp-monitor.ise.fraunhofer.de

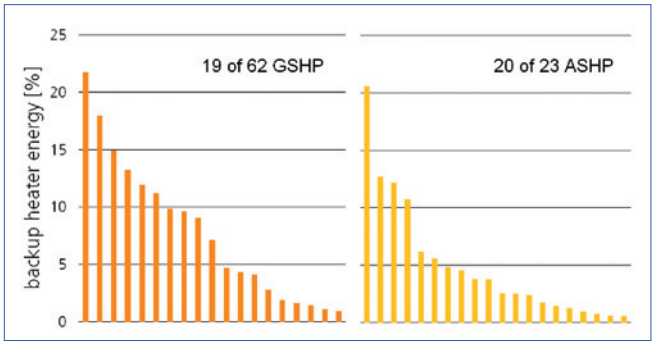

Fig. 5: Share of used electrical energy of the backup heating unit for GSHP and ASHP systems over the individual monitoring period

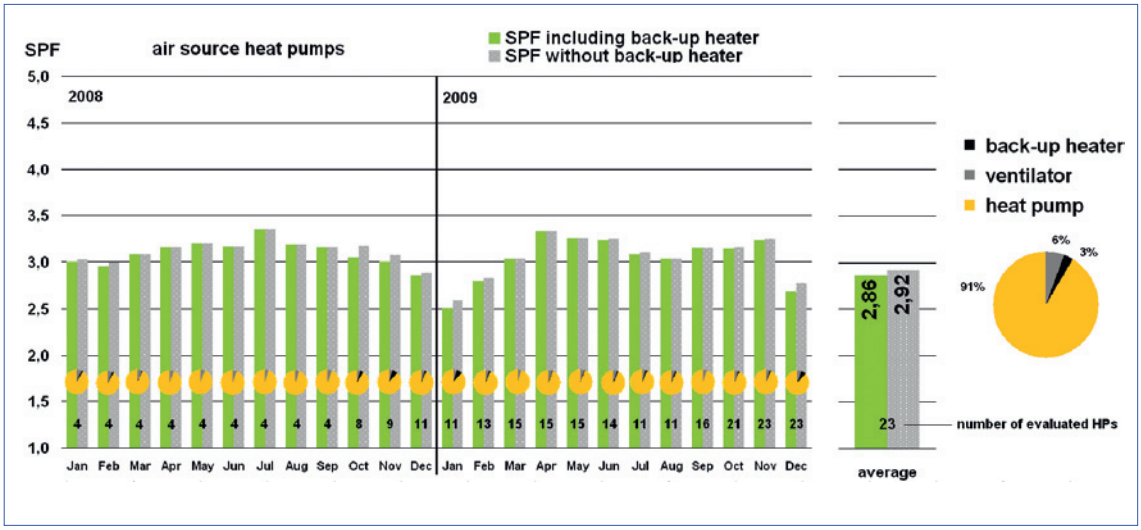

Fig. 4: Monthly SPFs with and without back-up heater and average values for 2008 and 2009, share of electrical energy usage for GSHP

Emerging building concepts for low energy houses in the Netherlands

This paper is based upon a study done under Annex 32 of the Heat Pump Program of the International Energy Agency.

Introduction

The Dutch calculation method for the energy performance of houses is based upon the Dutch standards NEN 5128:2004 and NPR 5129 and directly translated into the Energy Performance Coefficient (EPC). According to the Dutch Building Regulation newly built houses have to have an EPC equal or lower than 0.8. This will be increased to a level of 0.6 by 1st January 2011.
There is no official definition of a low energy house in the Netherlands, but houses with an energy performance under 0.7 can compared to low energy houses defined elsewhere.
Ambitious project developers, building companies and housing corporations have already realized several projects for which the EPC range from 0.4 – 0.7. Houses with an EPC of 0.4 can be combined with solar pv to make them Energy Neutral. In almost all cases, heat pumps have been used in various concepts.
The study for Annex 32 focused on practical concepts with a high performance, good feasibility and for which monitoring data was available. An important theme was to investigate further improvements, development and standardisation needs to make these concepts better suited for the next generations of low energy housing projects.
Six basic heat pump concepts for low energy houses are described in some detail in the report.
As there is no obligation to monitor the energy performance, monitoring systems differ. Most of these are aimed at checking maintenance needs and system conditions with no direct relation to the energy performance goal. Still, the information results in useful insights in the performance of the systems. Under the SEPEMO-project new projects will be monitored to get a clear view on the performance of the different concepts. In all cases, the integration between building and installation proved to be crucial to achieve good results at acceptable costs. The design and the specifications of the building are as much part of the concept as the heating, cooling and ventilation system.

Discussion on the concepts

All concepts under survey are suitable to achieve an energy performance of 0.4 – 0.6. This performance can be achieved without the use of solar energy and extreme insulation by using a good design, good build quality and a well integrated heat pump concept. In fact, the insulation needs only to be marginally improved compared to the present legal minimum requirements. Thermal solar energy can integrated to further improve the performance, as can photovoltaics.

Designers often feel that it is better to use a house with much improved insulation as a reference for system development. But this does not have to be taken to the extreme, as room heating is only a part of the total energy consumption and will quickly become minor to the energy requirement for hot water production and auxiliary energy and the cooling load. The balance at the moment seems to be an Rc (thermal insulation) value of 4.5 (4 for outer walls, 5 for the roof and 4 for the ground floor), an improved infiltration value, High Efficiency glass (Uc = 1.2 or 1.5 for framed windows) and insulated doors. In the average Dutch climate, this will result in a much shortened heating season, as no heating will generally be necessary with an outside temperature over 7°C. At higher outdoor temperatures and normal internal heat production, the surplus will have to be cooled away by increasing the ventilation or by using a cooling system Low energy houses are more sensitive to disturbances of the inside temperature than the present generation of houses. This is a result of the smaller capacity of the heating system, which is matched to a much smaller demand. This puts an emphasis on the quality of the building envelope, avoiding thermal bridges and air leaks, and on the design and the building process.
The low infiltration and good insulation of building parts results in an increased dependence on ventilation and cooling systems.

Description of Concepts

The report describes six concepts capable of realizing an energy performance up to and better than the requirement for 2015 (at EPC 0.4, convertible to Energy Neutral) at acceptable costs. As space is limited, we describe only a few, with the monitoring set up.

Concept #1: Seasonal storage and solar collector integrated heat pump with individual ground sources for the application in low energy homes

This concept realizes an energy performance coefficient op 0.6 in project Care in Delfgauw with insulation levels (Rc) of 3.5 to 4 [m2.K/W], an Ucπvalue for windows of 1.2 [W/m2.K], balanced ventilation and ventilation heat recovery of 90%. The infiltration value is a 'normal' 0,625 [dm3/m3.s]. The solar collectors add to the production of hot water and regenerate the ground source.
The presented system in Delfguaw was built in 2002 and extensively monitored by the manufacturer of the heatpump (ITHO). Energy consumption: system runs on approximately 5 kWth on cold days, 40% lower than expected. This can be explained by the regeneration of the source by the solar collector. The ground source temperature has risen 5°C, including the cold winter of 2009/2010, after 5 years. The solar panel is effective from 10°C outdoor temperature. While the contribution of the collector to the hot water production under these circumstances is limited to a few hours per day, the temperature outside these hours will still be enough to store the energy in the (closed) ground source. The higher source temperature leads to better a heating-COP of the heat pump.
In Eindhoven, Berckelbosch, Ballast Nedam is developing energy neutral (net-zero) single family terraced houses with the described concept without the solar panel, taking the

development a step further and using the experience from the Delfgauw project. Monitoring of this project will start in september 2010.

Concept #2: Seasonal storage integrated heat pump concept with individual ground sources and demand regulated ventilation for the application in low energy houses

This concept is capable of an excellent energy performance of 0.38 in the Ypenburg project, with non extreme insulation values of 3,5 to 5 [m2.K/W] and an Uc for windows of 1,5 [W/m2.K]. The measured infiltration is 0.2 [dm3/m3.s]. This is much better than the standard value used in the EPC calculation method. As a result, the energy consumption will even be lower than the calculated value. The first monitoring data confirms this, but is not yet conclusive, because the project has recently been built. It is of great importance to notice that the manufacturer of the heat pump system offer this with a guarantee on the energy performance of the system under a lease or EsCo-contract. A recent development used in the concept is the demand regulated natural ventilation system. As a result the heat loss due to ventilation is greatly reduced and a good energy performance can be reached without the need for an ventilation air heat recovery system. This system is combined with a ground source heat pump for floor heating and hot water production.
The source is regenerated by subtracting thermal energy from the floor during warm periods in the summer, when cooling is needed. Thus a thermal solar collector for regenerating the ground source is not needed while adding to the comfort of the building. Monitoring of the project start in september 2010.

Concept #3: Air-water heat pump concept with exhaust air heat pump boiler for the application in low energy houses

An air source is less costly than drilled wells, but in the case outside air is used, the source temperature will vary over a much wider range. This concept uses a heat pump boiler for the production of hot water from warm exhaust ventilation air and an air to water heat pump for room heating, using outside air as a source.

In project 'De Kreken van Nibbeland' in Bernisse, this concept is used, resulting in an energy performance coefficient of 0.57. The project uses only slightly improved insulation levels of 3 to 4 [m2.K/W] for floor, outer walls and roof and Uc 1.5 [W/m2.K] glazing and no active use of solar energy.
In a moderate climate, with a mean air temperature of 12 degrees, the temperature difference between the ambient air and the set point for the room temperature is usually small, leading to a favourable COP for an air source heat pump. A temperature of -10 degrees is rare, but still offers a COP of 2,5 for heating. At lower temperatures, the hot water tank can be used as a buffer, to back up the reduced heating capacity of the air source heat pump, when needed.

The energy from the exhaust air is recovered by a heat pump boiler, with a theoretical COP of over 3. Studies have shown that the COP in practice depends on the type and volume of use. This will be an aspect of the monitoring. The heat recovery rate of the heat pump boiler is expected to be about 50%, but this is not very relevant outside the heating season, and will become less relevant in homes with a further improved thermal quality, as the heating season will become shorter.
The split unit air heat pump offers good flexibility to concentrate the system components in the home, offering short leads and avoiding thermal losses.
The energy concept has been evaluated by TNO using physical simulation, leading to a confirmed energy consumption reduction of 40% in houses that comply to the present building standard. The performance in the monitored project is expected to be much better, because of the higher insulation of the shell and better build quality, leading to lower infiltration. As the project is in the realisation phase at the moment, the monitoring will start in the course of 2010.
Sibe Jan Koster, Q + P Communicatie en Innovatie, Netherland

Existing field trials of heat pumps in Europe (with N>= 20 units)

Name of study	Duration	capacity	sample size	Energy sources included	Function	Buildings included	Regional coverage	Test standards	operator	Link
FAWA	1995–2004	up to 20kW	221	Air-water/ brine-water units in series production	Heating, heating & hot water	New and existing	Switzer-land	EN 255	Swiss federal office of energy (BFE)	[1]
Fawa "best of class"	1995–2005	Up to 60kW	20	Air-water/ brine-water units in series production	Heating, heating & hot water	New and existing (best in class selected)	Switzer-land	EN 14511, EN 255.3	Swiss federal office of energy (BFE)	[2]
Fraunhofer "Effizienz" Neubau			75	Air-/water-/ ground-source	Heating, heating & hot water	New buildings	Germany	Acc. to system boundary	Fraunhofer ISE	[3]
Fraunhofer "WP im Ge-bäudebestand			110	Air-/water-/ ground-source	Heating, heating & hot water	Existing buildings	Germany	Acc. to system boundary	Fraunhofer ISE	[4]
Heat pump field trial	2008–2010		83	Air source and ground source	Heating, heating & hot water	New and existing	UK		Energy savings trust	[5]
SEPEMO	2009–2012		Approx. 40	Air source and ground source	Heating, heating & hot water		Austria, Germany, Greece, Sweden, Netherlands	Acc. to system boundary: SPF 1-4	SP and partners	[6]

[1] www.fws.ch/dateien/WP-Tagungsband_2004.pdf | [2] www.waermepumpe.ch/fe/Jahresbericht_2005BFE_Effizienzsteigerung_Bestanlagen.pdf
[3] http://wp-effizienz.ise.fraunhofer.de/german/index | [4] www.wp-im-gebaeudebestand.de | [5] www.energysavingtrust.org.uk/Generate-your-own-energy/Heat-pump-field-trial
[6] www.sepemo.eu

Getting warmer

A field trial of heat pumps

The Energy Saving Trust's heat pump field trial is the most comprehensive field trial of the technologies ever undertaken in the UK. The field trial began in early 2009 monitored the technical performance of heat pumps installed at 83 households (54 ground source and 29 air source) for a full 12 month period. The trial also recorded customers' experiences using a heat pump.

Fig. 6: Regional distribution of the 83 heat pumps monitored in the field study.

Results, which were independently peer reviewed by Roger Nordman of the Swedish SP Technical Institute, show that a number of heat pump installations performed very well, achieving an overall system efficiency (SPF) of 3 and above. The sample of ground source heat pumps had slightly higher measured system efficiencies than the air source heat pumps. The 'mid-range' GSHP system efficiencies were between 2,3 and 2,5, with the highest figures reaching over 3,0. Despite this, the system efficiency figures for the sample of GSHP were lower than those monitored in similar European field trials.

The 'mid-range' of measured system efficiencies for air source heat pumps were near 2,2 and the highest figures in excess of 3,0.

There were a number of poor performing installations of both ASHP and GSHP with system efficiencies of 1,5 or below. These installations are being investigated further to determine what has impacted performance.

A few of the key findings suggest that:

1. The impact of domestic hot water production on system performance is unclear. Heat pumps can be designed to provide domestic hot water at appropriate temperatures, but more investigation is needed to determine the factors which have an impact on overall system efficiency.

2. Heating controls for heat pump installations have to be comprehensively reviewed. There has been a failure to explain proper control requirements to both installers and heat pump customers.

3. Further study needs to be undertaken on an installation-by-installation basis, to record what has been done wrongly (or correctly), what could be done better, and what exactly should be done in the future. A second year of the field trial will be undertaken to provide further investigation of performance.

Based on the findings so far, off-gas properties, of which there are about five million in the UK, are the primary market for both air and ground source heat pumps. If all off-gas properties were installed with a heat pump it would save 10 million tonnes of CO_2 per year and would result in around £1,5 billion savings on fuel bills in a year. Over a product's lifetime, a high performing heat pump installed today will save CO_2 even when replacing gas condensing boilers due to the planned decarbonisation of electricity.

As part of the report, the Energy Saving Trust provides a **check-list for consumers** guiding them towards thorough research on the appropriateness of a heat pump installation in their building, on understanding heat pump basics and on understanding key parameters of installation quality. EST has also boilded down the impact of installation quality on heat pump system efficiency in a check-list for installers!

The Energy Saving Trust plans to work with the heat pump industry to undertake a review of installer skills and training within the next year.

For more information, check the EST website or contact Jaryn Bradford (Jaryn.bradford@est.org.uk) www.energysavingtrust.org.uk/Generate-your-own-energy/Heat-pump-field-trial

energy saving trust

One Year Monitoring Case Study of IGEN-OCHSNER GMLW 19 – Air Source Heat Pump

Air-source field test in Ireland

Air Source heat pumps extract heat from the outdoor ambient air and raise it to a level suitable for domestic and commercial use. While simpler to install, as they do not require ground loops they must be designed and specified correctly to the characteristics of a given installation.

A 16kW Ochsner GMLW 19 air source heat pump was designed and installed by IGEN at a crèche on the east coast of Ireland in December 2008. The performance of the system providing heating and hot water was monitored over one year (16.02.2009 to 16.02.2010) by the Centre for Renewable Energy at Dundalk Institute of Technology (CREDIT). The monitoring period included one of coldest winters in Ireland on record. A summary of the results is presented here.

The building has a floor area of 400m², it is well insulated and has under floor heating. The installed heat pump was designed to provide all hot water and space heat required. The system consists of an Ochsner Millennium outdoor evaporator, (extracting energy from the ambient outdoor air), a GMLW 19 heat pump unit and an Unifresh 800 litre storage tank (both hot water and space heat for the building is drawn from the cylinder).
The heat production by the heat pump and the electricity consumption along with the system's flow and return temperatures, outdoor temperature and outdoor relative humidity were monitored and logged in five minute intervals for one year. **The annual Seasonal Performance Factor (SPF) for the system was 3,55 for combined heating and hot sanitary water production and 4,0 for heating only.**

The operating cost of the heat pump amount to ~ 67% of the cost of a system using natural gas, ~ 40% of the cost of using home heating oil, ~ 31% of the cost of using LPG

In terms of environmental benefit, the heat pump system does not emit CO_2 at the point of operation. As electricity is used, CO_2 emission occures at the point of electricity production. Using the Irish electricity mix, CO_2 emissions are best for the heat pump system (56% lower than oil, 29% lower than natural gas and 36% lower than an LPG based system).

The study has shown that over the monitoring period a well designed, high quality heat pump like the Ochsner GMLW19 is well suited to an Irish maritime climate in the provision of hot water and space heat to the building. The installation met the building regulation with regard to renewable energy requirement for new buildings well in excess of the requirements 2007 Technical Guidance Document L Conservation of Fuel and Energy – Dwellings.
A detailed report on the study is available on request.

For more information contact:
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UK Heat Pump Association welcomes recognition of heat pumps significant role in efficient heating of UK homes

A steep learning curve from field trials!

The UK Heat Pump Association welcomes the recognition in this report of the significant role that heat pumps are set to play in the efficient heating of the UK's homes.

The Trials have been a steep learning curve for all involved due to the difference from more traditional heating products, the variety of different heat pump products monitored, and the 'early adopters' included. However, the trials have established valuable pointers to performance factors requiring further analysis in the second phase just announced, **so the report can be seen as work in progress.** The Trials also confirm the need for a significant increase in training for heat pump installers in the design and installation of systems.

The momentum created by manufacturers and MCS is growing, but a lot more training initiatives are now needed to support the ever-increasing numbers of heat pumps being installed.

The HPA and its members will continue to provide EST with technical advice and support for the Trials.

For more information see:
www.heatpumps.org.uk

Industry replies to EST

Dimplex positive towards EST report

Dimplex has welcomed the initial findings of the Energy Savings Trust's 83-site heat pump field trial, which has identified that correctly designed, specified and installed heat pumps retrofitted to existing domestic properties can achieve carbon dioxide emission savings and reduce home heating bills. The report also identified a number of areas including design, commissioning and user operation where there is still much scope for improvement.

Other Expert comments

These comments are taken from the EST press release!

Department of Energy and Climate Change, Chief Scientific Adviser David Mackay:

"Heat pumps will be a crucial component of our low-carbon future, provided they perform well. It's therefore essential to conduct trials to establish best practice, and perfect this technology for use in building throughout the UK."

Roger Nordman, of the Swedish SP Technical Institute, who peer reviewed the methodology for the trials, says:

"Domestic heat pumps are a well established technology in Sweden and although there are differences in UK and Swedish applications, some of the best performing sites in this project compared favourably with what has been monitored in other European countries. The major difference is that the UK has particularly old and inefficient housing stock. The market is also more mature in the rest of Europe and installers have much more experience in installing the technology."

From NIBE's press release:
Phil Hurley, Managing Director of NIBE Energy Systems Limited says: "we welcome this report and it clearly shows that heat pump technology works within the UK, however, by highlighting the negatives as well as the positives, the industry can now concentrate on where improvements need to be made. It needs mentioning that all these sites are pre MCS (Microgeneration Certification Scheme) and NIBE has always been committed to training and making sure that installers are well aware of the importance of correct design and commissioning. We have invested significantly in nationwide training academies, so that installers can gain access to training wherever they are based within the UK. We have also worked hard to introduce Benchmark log books with all of our heat pumps and are the first manufacturer to use benchmark as part of our warranty, promoting best practice and customer confidence". Contact: phil.hurley@nibe.co.uk

Key findings of the report are that despite a varied set of performance results, well installed heat pumps can achieve valuable savings particularly when installed in new buildings and in buildings off the gas grid (replacing fuels such as LPG and oil), but whole house efficiencies can vary widely.

As a leader in the renewables sector, with over 30 years' experience in manufacturing heat pumps that are widely acclaimed in Europe, Dimplex was among the first to introduce the technology to the UK. And the company has been providing advice and training consistent with the report's conclusions throughout its time in the UK market, addressing factors such as the sensitivities of the technology regarding installation and commissioning, user operation, the heat pump's integration within the overall design of the building itself and levels of building insulation.

Chris Davis, business development director for Dimplex renewables and chairman of the BEAMA Domestic Heat Pump Association: "*We welcome this trial which provides valuable information for policy makers and the whole industry in improving performance and ultimately lowering carbon emissions. The conclusions are broadly in line with our anticipations and it confirms our view that in the correct situation heat pumps work very well but education and training are essential to future success.*
A number of trial sites show very encouraging levels of performance which clearly indicates the technology itself works. The challenge now is to identify measures that improve the lower functioning installations and using these for future market education. This is why the planned second year of the trial is so important".

The trial was established as a partnership by government organisations, heat pump contractors, manufacturers, energy suppliers and technical consultants. And it's anticipated that the trial will form the basis of further investigations into the factors which influence heat pump performance.

"*We've made a commitment to funding the proposed year two trial extension which we very much hope will go ahead. This will provide a unique opportunity to review the performance of systems against a measured benchmark and demonstrate directly to installers and designers what factors really affect performance in the field and what needs to be done at a design and installation stage to maximise efficiency. This is absolutely vital in the early days of a growing market and presents a perfect opportunity to raise the benchmark for the sector as a whole*" adds Chris Davis.

For more information contact:
Chris Davis at Dimplex: mail: chris.davis@dimplex.co.uk

Country in focus
Field measurements in Germany

Incentive Programs

The most important incentive program for heat pumps in Germany is the so called „Marktanreizprogramm“ (short: MAP). The MAP provides an annual fixed budget for renewable heating. Heat pumps, that want to be funded, have to fulfill certain efficiency standards. Recent changes in the program, caused by the austerity of the government, have produced hardly satisfiable seasonal performance factors of 3,7 for air-to-water and 4,3 for ground-coupled heat pumps. Additionally heat pumps installed in new buildings are not funded any more. Furthermore there is no bonus for especially efficient heat pumps any more. The overall budget for all renewable heatings was also cut back to around 350 Mio. Euros p.a. for the next years. Further degressions of 10 Mio. Euros per year is planned for the next 3 years.

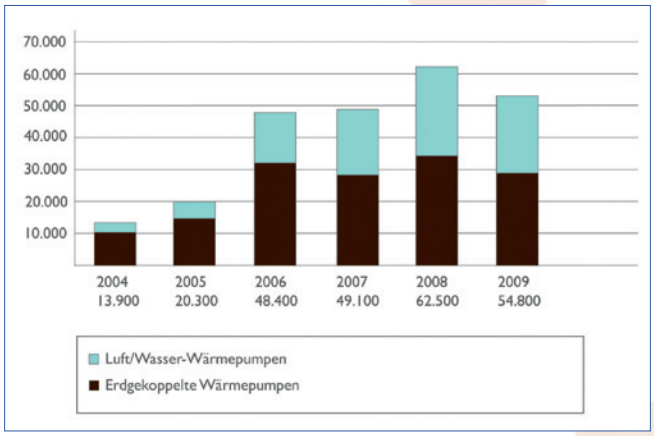

Fig. 7: Heat pump sales in Germany: Development 2004 to 2009

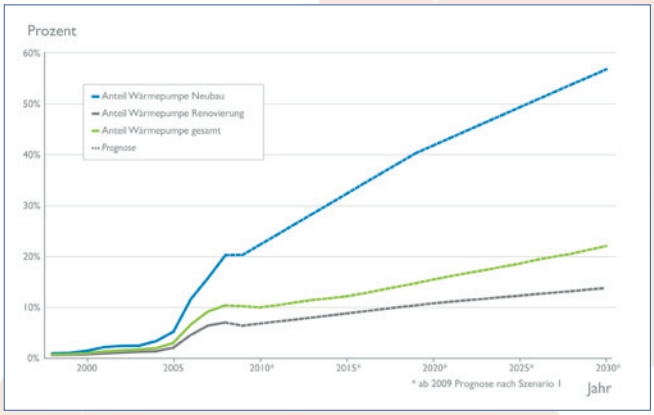

Fig. 8: Expected market share of heat pumps compared to all heat generators: Germany, Szenario 1

Furthermore the EEWärmeG (Renewable Energy Heating Law) determines that in every new building renewable heatings have to be used to a certain percentage. For heat pumps the minimum is 50% (as well as for biomass) whereas solar heat only has to account for 15% of the heat demand. Though fostering energy efficiency is approved as a contingency measure to this duty. In one federal state, Baden-Württemberg, there is also the duty to use renewable energies in the housing stock, when a significant renovation is projected. Other federal states want to follow this example.

Quality Labels and Installer Certification

Germany has been one of the first countries establishing a quality management system for heat pumps. With its partners Switzerland and Austria it has created the D-A-CH Quality Label, which turned out to be the cornerstone to the EHPA quality label. The German Heat Pump Association (GHPA – german: BWP) is the only certification center in Germany and cooperates with 5 Testing Centers.

Furthermore Germany takes part in the European training and certification program for heat pump installers (EUCERT). Over 70 installers have already successfully taken part in the lessons of one of the five training centers and received the EUCERT certificate.

Furthermore the BWP has established a certification system for drillers starting 2004/2005. Unlike the quality label for heat pumps is not granted for single drills, but for the drilling company. Till this day 11 companies have been certified.

Market development

Since the 1990s there was a steady increase in the overturn of heat pumps until 2008. A major boom has taken place in 2006, when the overturn was growing by nearly 140%, and in 2008 with 27% more sold heat pumps. In 2009 the overturn was sinking for more than 20 years. A loss of 12 % resulted in 55.000 sold heat pumps.
Nevertheless the future looks good for heat pumps in Germany. The industry outlook predicts a turnover of 120.000 per year in 2030, which results in a market share of 22 %.

8. Forum Wärmepumpe (8th Heat Pump Forum) in Berlin, Germany

About 220 participants made last year's heat pump forum a great success for the german Bundesverband Wärmepumpe (bwp). This year, the forum is taking place on 7-8 October 2010 and the bwp is sure to make it as successful as the other years by focusing especially on heat pumps and their contribution to the protection of the environment and our climate.
For more information please follow the link *www.bwp-service.de*

Chillventa 2010 in Nuremberg, Germany

For the third time now, Chillventa gives you the opportunity to discover more about heat pumps, air conditioning and ventilation as well as refrigeration. For three days, Nuremberg is hosting the international trade fair that is answering all questions concerning the key issues of the industry like energy efficiency, heat pumps, cleanrooms and insulation. Next to possible discussions with experts of all nationalities you can also have a look at this year's specials including the heat pump and the cleanroom village, the ASERCOM EPEE Symposium and the heat pump workshop 2010.
For more information please follow the link *www.chillventa.de/en/default.ashx*

10th IEA Heat Pump Conference in Tokyo, Japan

This four-day conference is organized under the umbrella of the International Energy Agency (IEA) from 16-19 May 2011 and the title of this tenth edition will be "Heat pumps – The Solution for a Low Carbon World". The conference will summarize the current technology and market status, progress and trends. The first day will be centered around different workshops whereas the following three days of the conference itself include numerous presentations giving all attendees the opportunity to deepen their knowledge about heat pumps and current technology developments.
More information on this outcome-oriented event can be found at *www.hpc2011.org/index.html*

IEA Workshop on a technology vision for the heat pump industry

9. November 2010
Austrian Institute of Technology, Vienna
Heat pumps have a long tradition in Austria. The first unit - designed & build by Peter Ritter von Rittinger in 1853 - was used in a hydro-power driven mechanical vapour recompression system. Today'sl Austrian heat pump market started developing in the late seventies of the past century and is a success-story since then. Austria played an active role in the development of the IEA activities in the field of heat pumps as well as in developing the market on the EU level. This Workshop aims to demonstrate the Austrian activities within IEA and EHPA, the impact of these efforts on the heat pump market development and an outlook of possible future developments market and technology-wise. For more information see: *www.ait.ac.at/waermepumpen*

A new home for the European Heat Pump Association in Brussels

On first of July, the European Heat Pump Association moved right into to the center of renewable energy action in Brussels. The associations new home is the Renewable Energy House (REH), a building that hosts nearly 20 associations working in the field of promoting the use of renewable energy sources.
The REH is supplied to 100 % by renewable energy for heating and cooling from biomass wood pellets, geothermal heating, solar thermal heating and absorption cooling. Its electricity demand is covered to 100 % from green sources, albeit not all of them on site.
REH is a technology showcase and a center of information exchange creating synergies and allowing easy access to information on renewable energy for association members, interested stakeholders and the public.

next meetings

Executive Committee meeting
08.09.2010 | Düsseldorf, Germany

Education Committee meeting
23./24.09.2010 | Paris, France

Quality Label Committee meeting
21./22.09.2010 | Brussels, Belgium

Norms & Standards Committee meeting
05.10.2010 | Brussels, Belgium

Executive Committee meeting
11.11.2010 | Brussels, Belgium

PROJECT MEETINGS

Qualicert meeting
30.09./01.10.2010 | Brussels, Belgium

Ground-Med Info day
26.10.2010 | Brussels, Belgium

SEPEMO project meeting
02./03.12.2010 | Vienna, Austria

IEA Heat pumps and solar integration
28./29.10 | Vienna, Austria

IEA Workshop on a Technological Vision for the Heat Pump Industry
09.11.2010 | Vienna, Austria

OTHER EVENTS

3rd Heat Pump Symposium
15.09.2010 | St-Katelijne-Waver, Belgium

8. Forum Wärmepumpe
07./08.10.2010 | Berlin, Germany

Chillventa
13.–15.10.2010 | Nürnberg, Germany

IEA Workshop on a technology vision for HP industry
9.11.2010 | AIT, Vienna, Austria

10th IEA Heat Pump Conference 2011
16.–19.05.2011 | Tokyo, Japan

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