Topics change with times. In 2007, all activity of the heat pump industry was focussed on achieving the technologies acknowledgement in the Directive on the promotion of the use of Renewables (2009/28/EC). It was perceived a great success when this goal was reached and the Directive changed the definition of renewable energy to include air and water (ground had been part of it already).

It became clear very soon afterwards, however, that this was only the opening chapter in the book towards a future orientated, sustainable energy supply. Many chapters would have to be written until the story was told. The RES Directive implementation is currently in full swing and the efforts Member States make will most likely lead to a 20 % share of renewable energy in 2020. With target being appropriately addressed, the focus is shifting to energy efficiency. The proposed target of a 20 % increase in energy efficiency by 2020 is not mandatory (yet). It is nonetheless important to reach it, as further increase in energy demand may even put the renewable target at risk.

In consequence the European Commission, the European Parliament and the Member States are now working on finalising the Energy Efficiency Directive. The first draft shows a strong focus on large scale technology, combined heat and power as well as thermal energy grids. The perspective taken seems to be too technology prescriptive for an energy landscape characterised by a switch from central to decentral production, by a shift towards more renewables and by a strong effort towards a continous reduction in buildings energy demand. The draft text implies a strong belief in the efficiency improvement potential of large scale installations, both on the heat source and the heat sink sides. They should then be connected via district heating grids to balance peaks in heat supply and demand and to make best use of waste heat.

While energy should not be wasted, the outlined approach seems to be too single sided, as it overlooks (again) the potential of distributed heat production. If the heating sector as a sleeping giant is really taken seriously, central production and heat distribution via grids can only be part of a full pack of measures. It must inevitably address small-scale heat production in buildings. Efficient production will have to be augmented by flanking measures on the demand side. When looking at this task from a heat pump perspective, their widespread use is obvious: the technology can transform waste and ambient energy, that is normally useless to a usefull level. Heat pumps can be employed as individual installations and connected to low temperature energy grids. They will make the energy infrastructure more efficient – in a cost and an energy perspective.

If planned properly, the integration of efficient production, efficient use and smart demand side strategies will lead to a more sustainable heat supply with a much larger RES share. Overcoming boundaries towards change means overcoming current high investment cost. The end consumer needs to understand that, in the long run, the choice towards an efficient, renewable energy solution pays off. Encompassing information can be provided by government agencies, supported by financing options. Contrary to current belief, governments and society will benefit from this effort, as it will contribute to higher energy efficiency, more RES use and lower GHG emissions. In addition, a larger share of heat pumps, in connection with smart grids, will balance heat supply and demand and will allow a larger share of intermittent renewable electricity.

This is the message to policy makers on all levels: an energy efficiency Directive as proposed today that does not address the big picture hardly deserves the name. It should be technology neutral and focus on all available options, giving preference to the least cost solution and avoiding a distortion of cost by unequal taxation and/or subsidy schemes. This requirement is indespensible taking into account the critical economic situation of many Member States, cities and regional administrations.
A proposal for a Directive on energy efficiency

The EU is not on track to meet the proposed 20% increase in energy efficiency of primary energy use by 2020. Not even half of the target, only 9% savings was reached in 2010. On 22 June 2011, the European Commission presented a new Directive on energy efficiency to put more pressure on stakeholder activity towards increasing energy efficiency. This legislation will replace both the Cogeneration Directive (2004/8/EC “CHP Directive”) and the Energy Services Directive (2006/32/EC “ESD”) and extend to all sectors with energy saving potential.

The current proposal includes a set of binding measures promoting energy efficiency, but falls short of any legally binding national target.

First, Member States are required to:

+ Set their national energy efficiency target for 2020.
+ Establish national energy efficiency obligation schemes. Energy suppliers – distributors or retailers – should accordingly achieve annual energy savings of 1.5% of their energy sales among final customers.
+ Adopt national heating and cooling plans by 1 January 2014 (see Annex VII). They should develop “high-efficiency cogeneration” (CHP) and “efficient district heating and cooling” – i.e. using at least 50% renewable, waste or co-generated heat (with a primary energy factor of at least 0.8).
+ Adopt authorization criteria for new electricity production (with thermal input > 20 MW) that ensure:
  - high-efficiency CHP units with waste heat recovery equip all new electricity installations and existing installations that are substantially refurbished to recover waste heat (or when their permit / license is updated),
  - the generation site is close to heat demand (see Annex VIII).
+ National regulations on urban and rural spatial planning should be adapted to these authorization criteria.
+ A few exemptions are provided, but are restricted and subject to review by the European Commission.
+ Establish connection of these installations to district heating and cooling networks, as well as priority or guaranteed access of high-efficiency cogeneration to the electricity grid.
+ Small scale and micro cogeneration units may especially be concerned.
+ Create certification schemes for the providers of energy services, energy audits and other energy efficiency improvement measures – including for installers of building elements such as for heating, cooling and hot water.
+ Promote the energy services market (ESCOs) and its access for SMEs.
+ Remove barriers to energy efficiency, notably the split of incentives between the owner and tenant of a building or among owners.

Public bodies should renovate all buildings at an annual rate of 3% from 2014 to upgrade their energy performance. This will double the current refurbishment rate. Public bodies should also purchase energy efficient products, services and buildings (as defined in Annex III).

Large companies should carry out energy audits every 3 years by mid-2014. SMEs and households should, in turn, be encouraged to undergo such energy audits. Final customers should also get individual meters to measure their actual energy consumption and time of use. They should then receive their energy bill based on actual consumption.

By mid-2014, the European Commission will assess whether the EU can achieve its energy efficiency target by 2020. It may propose a legislative proposal laying down mandatory national targets “if appropriate”. This draft Directive on energy efficiency will be debated in the Energy Council of 24 November 2011. In turn, the European Parliament will consider it in its first reading in April 2012.

In December, the Commission should also present its Energy Roadmap 2050 with possible development paths for the EU energy system to 2050.

From the perspective of an industry that mainly deals with distributed small scale products, this Directive is falling short of expectations. It is not explicitly addressing an efficiency increase on all levels as it gives too much focus on large scale installations, on the use of their waste heat as well as on cogeneration and on the development of district heating. While this is certainly important, a feasibility check should be mandatory. Investment in large scale infrastructure is not forward looking in times characterised by a strong will to reduce energy demand in general and in buildings in particular.

EHPA does not question with the fact that one option to supply densely populated areas with heating energy is via district heating. However this is not the only option and as such, it should not be the legislator, who limits the technology choice. As in other pieces of legislation, goals should be set, but the means to achieve them should be left to the Member States and eventually to the investor. They should have the option to choose from available energy efficient solutions. If framework conditions are properly set, decision makers will make their choice to their own benefit, but also contributing to a more energy efficient and cost optimal energy system.

Info at: http://ec.europa.eu/energy/efficiency/eed/eed_en.htm
Energy revolution 2050 – Strategies from an Austrian perspective

Currently the European energy policy experiences the largest radical change since the industrial revolution with its hunger for fossil energy sources. A common European Union sustainable energy policy will strike a completely new path and will speed up the use of potentials of renewable energy sources for cities, households and enterprises.

The renewable energy guideline of the European commission and the 20-20-20 goals are to be seen as the first important step for setting up a new energy system. Looking at ambient heat used by heat pumps, much more is feasible and will be necessary in order to make Europe independent of fossil energy sources and of importing energy. Some Austrian initiatives can be seen as examples for the European Union.

The Austrian Minister for the Environment Niki Berlakovich went towards finding a broad discussion platform in the energy policy with the topic “energy autarky” – thus the goal of being independent from energy imports. In the context of the environmental Ministry assigned study, Professor Streicher from the University of Innsbruck could show that energy autarky is feasible in Austria up to the year 2050. A further study of the Institute for Higher Studies shows, which measures must be set to cover the majority of the power supply of Austria with renewable sources of energy around 2050. First of all, both studies set ambient heat used by heat pumps into the centre of the attentions and attribute for it the highest energetic potential. The fact that ambient heat represents the best alternative as regards CO2 reductions and energy savings is proved by another current study of the Johannes Kepler University in Linz. In the following graph, the mentioned study results are represented briefly.

In his autarky study, Professor Schleicher illustrates two scenarios for the development of final energy demand until 2050: the so-called “constant scenario”, which assumes constant demand of energy services, as well as the “growth scenario” that assumes a rise of energy services of approximately 40% in comparison to 2008. In both cases, however, the national final energy demand reduces due to efficiency increases of the used technologies as well as shift in higher efficiently technologies.

Based on these study results, buildings will exclusively be heated with renewable energy sources in the year 2050, that is to say almost exclusively with heat pumps or solarthermics. However, for the predominant part, biomass is used for electricity generation (electric mobility) and for industrial applications. In order to realize this scenario, the study authors imply a rise of use of ambient heat of about the factor 8 in relation to the base year 2008. This rise would even be possible without additional electricity consumption, since the substitution of direct electric heatings would compensate more than the electrical power requirements of installed heat pumps.

Additionally to the fact that heat pumps will cover a big share of heating and cooling in the building sector, heat pumps can also serve low-temperature process heat within the industrial sector. By this, energy recovery by heat pumps can contribute to another important share of energy in 2050.

For these goals to be achieved, it is necessary to take committed, clear and politically precise decisions. Because of limited national funding, it is of utmost importance to force and promote those technologies, which reach the energy goals with a minimum employment of capital.

Potential of renewable energy sources in Austria
Source: Study Energy Autarky, Ministry of Environment, Prof. Schleicher, 2011
The Austrian Heat Pump Association (BWP) assigned a study to the Energy Institute of the Johannes Kepler University in Linz. This study determines the measure leading to the best result in respect of energetic, ecological and economic targets. Its focus was on building insulation and installation of heat pumps. For this purpose, a single-family house, which was equipped with a gas condensing boiler, was used as a reference building. In the first case, the gas condensing boiler was replaced by a heat pump. In the second case, the building was thermally insulated as an energy-saving measure. The result shows that the energy reduction of both measures is approximately the same. Also for CO2 emission reduction, both measures do not show serious differences. The point is that the investment cost for the insulation is double the amount of the one for the heat pump.

In the space heating sector, several alternative measures are in principle possible in order to achieve national goals for reducing energy consumption as well as for reducing CO2 emissions. Building insulation and installation of heat pumps are to be equally valued.

However, it is wrong to support solely investments for insulation and neglect or even exclude investments in heating technology such as heat pumps. An installation of a heat pump into a non-insulated building helps to reduce both heating costs and CO2 emissions compared to the old heating system (negative CO2 reduction costs) – a simultaneous building insulation would in addition lead to the fact that the economic effect gets lost and only CO2 could get saved.

Until 2050, heat pumps will contribute to the fact that the energy intensity within the sector of space heating and cooling, as well as within the sector of process heat will be dramatically reduced. The installation of heat pumps will considerably rise until 2050. This is the core statement of the Austrian autarky studies. When it comes to reaching the energy and climatic goals, those measures have to be supported, which can help to achieve them with minimal costs. Also from this point of view heat pumps are the preferred technology.

Karl Ochsner, Chairman
European Heat Pump Association


<table>
<thead>
<tr>
<th></th>
<th>Non-insulated building</th>
<th>Insulated building</th>
<th>Reduction of energy demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas condensing boiler</td>
<td>45 853</td>
<td>10 695</td>
<td>35 163</td>
</tr>
<tr>
<td>Ground source heat pump</td>
<td>13 200</td>
<td>3 079</td>
<td>10 121</td>
</tr>
<tr>
<td>Air source heat pump</td>
<td>15 557</td>
<td>3 629</td>
<td>11 928</td>
</tr>
<tr>
<td>Reduction of energy demand GSHP [kWh] p.a.</td>
<td>32 653</td>
<td>7 616</td>
<td>--</td>
</tr>
<tr>
<td>Reduction of energy demand ASHP [kWh] p.a.</td>
<td>30 396</td>
<td>7 066</td>
<td></td>
</tr>
</tbody>
</table>

Non-insulated building: 240 m²/14kW

Costs €/to CO2 reduction

<table>
<thead>
<tr>
<th></th>
<th>Non-insulated building</th>
<th>Insulated building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of ASHP instead of gas condensing boiler</td>
<td>- 64,11 € (benefit)</td>
<td>40,98 € (cost)</td>
</tr>
<tr>
<td>Installation of GSHP instead of gas condensing boiler</td>
<td>- 132,88 € (benefit)</td>
<td>19,86 € (cost)</td>
</tr>
</tbody>
</table>

SEPEMO – Common Monitoring Methodology

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. Defining the system boundaries directly impacts on the measurement equipment needed to measure the parameters required for the calculation of the different SPF. The development of a common monitoring methodology is mandatory for evaluating all monitored systems during the project in the same way and to make the monitoring results comparable.

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 in deliverable D4.1 “guideline for heat pump field measurements”. The project partners will set up field measurements on heat pump systems using this methodology in order to ensure the comparability of the systems and their performance measured. The data gathered will provide 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.

General

In order to implement a common system evaluation, it is not mandatory to use the same measurement equipment, but it is obligatory to record the same parameters 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.

The deliverable “D4.1 guideline for heat pump field measurements” contains information on what to measure and also information about the measurement quality that is needed – accuracy, sampling intervals, measurement equipment quality (sensors), etc.

Common monitoring procedure

In order to facilitate the comparison of field measurement data, a common procedure for data collection is defined. Generally there are measurable and non-measurable data. For characterizing the building and the system, the detailed test site specification gives additional information. Additionally a “log book” for the user and installer reports about different occurrences during the measurement season. This additional information makes the evaluation and interpretation of the measurement data easier. The measurable data define the operating behaviour and the efficiency of the system. Therefore the common monitoring procedure is structured into the following three steps:

- detailed test site specification and user / installer log about the non-measurable data,
- Measuring of data by a data logger directly on site,
- Evaluation of the system.

Detailed test site specifications

For characterizing the building, the detailed test site specifications give information on the building insulation, number of inhabitants, construction year of the building, type of the heat pump / chiller or air conditioner, heating / cooling capacity, type of the heat source / sink and operational mode system.

Measurement data

The measurable data consists of the data, which can be recorded by the measurement equipment during the measurement season. For a common monitoring evaluation the following “minimum results” should be mandatory in order to ensure the comparability of the different systems. It is important to get additional information to the SPF (e.g. average supply...
temperature, indoor temperature ...) to understand under which operating conditions the heat pump system was operated.

### Minimum results

<table>
<thead>
<tr>
<th>Metric</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric energy input – total</td>
<td>kWh</td>
</tr>
<tr>
<td>Electric energy input backup heater</td>
<td>kWh</td>
</tr>
<tr>
<td>Electric energy input pumps/fans heat source side</td>
<td>kWh</td>
</tr>
<tr>
<td>Energy output heating / cooling</td>
<td>kWh</td>
</tr>
<tr>
<td>Energy output DHW</td>
<td>kWh</td>
</tr>
<tr>
<td>SPF2</td>
<td>-</td>
</tr>
<tr>
<td>SPF3</td>
<td>-</td>
</tr>
<tr>
<td>Average supply temperature heat sink*</td>
<td>°C</td>
</tr>
<tr>
<td>Average return temperature heat sink*</td>
<td>°C</td>
</tr>
<tr>
<td>Average supply temperature DHW*</td>
<td>°C</td>
</tr>
<tr>
<td>Average return temperature DHW*</td>
<td>°C</td>
</tr>
<tr>
<td>Average supply temperature heat source*</td>
<td>°C</td>
</tr>
<tr>
<td>Average return temperature heat source*</td>
<td>°C</td>
</tr>
<tr>
<td>Average outdoor temperature*</td>
<td>°C</td>
</tr>
<tr>
<td>Average indoor temperature*</td>
<td>°C</td>
</tr>
</tbody>
</table>

* during operation of the unit

According to the different system boundaries, different requirements on the mandatory equipment are given. The mandatory measurement equipment can be separated into two parts: firstly the energy meters for calculating the SPF according to the system boundaries, and secondly the temperature / humidity / pressure-sensors to gather information on the boundary conditions under which the system was operated during the measurement season.

### Frequency of measurement

The logging interval depends on different approaches and measurement methods. For calculating mainly SPF, the logging interval can be less frequent e.g. 10 minutes like recommended by the "logging interval SEPEMO". A/W and A/A systems need a smaller logging interval due to their short defrost cycles. If the main purpose of the monitoring is focused on different system operations, it is necessary to reduce the logging interval to e.g. 1 minute, to be able to record small changes in the system during operation.

<table>
<thead>
<tr>
<th>Measuring interval</th>
<th>Logging interval SEPEMO</th>
<th>Logging interval operation interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/W and A/A</td>
<td>5 s 1 min. 1 min.</td>
<td></td>
</tr>
<tr>
<td>DX/W</td>
<td>5 s 10 min. 1 min.</td>
<td></td>
</tr>
<tr>
<td>B/W</td>
<td>5 s 10 min. 1 min.</td>
<td></td>
</tr>
<tr>
<td>W/W</td>
<td>5 s 10 min. 1 min.</td>
<td></td>
</tr>
</tbody>
</table>

### Quality Assurance

The most simplistic approach is to specify that all measurements are ‘as accurate as possible’. However, this may lead to an over-specified measuring system, and significant unnecessary extra cost. In practice, sensor accuracies need to be specified using a combination of prior knowledge of the accuracies of commonly available sensors and the analysis, which will be applied to the data.

The resolution of each measurement is also important. This determines the smallest change in a measured quantity which can be registered. The table below summarises the accuracies and resolutions required to provide useful information at a one or ten minute data recording interval. Regarding A/A methods, different methods are being tested and the accuracy of the heat output measurement is not yet known, although it is likely to be above the +/− 2 % target for water based heat pumps.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Accuracy</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption compressor</td>
<td>± 2 %</td>
<td>1 imp/Wh</td>
</tr>
<tr>
<td>Electricity consumption auxiliary drives</td>
<td>± 2 %</td>
<td>10 imp/Wh</td>
</tr>
<tr>
<td>Heat output</td>
<td>± 2 %</td>
<td>1 imp/Wh</td>
</tr>
<tr>
<td>fluid temperatures</td>
<td>±0.15 °C</td>
<td>0.01 °C</td>
</tr>
<tr>
<td>Internal air temperatures</td>
<td>±0.4 °C</td>
<td>0.1 °C</td>
</tr>
<tr>
<td>External air temperatures</td>
<td>±0.4 °C</td>
<td>0.1 °C</td>
</tr>
</tbody>
</table>

### 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.

Andreas Zottl, AIT – Austrian Institute of Technology
Roger Nordman, SP – Technical Research Institute of Sweden
Philippe Rivière, Mines ParisTech
A Concept for evaluating heat pump CO₂ reduction potential

In the IEE project SEPEMO-Build, a calculation methodology for calculating the CO₂ emission and primary energy reduction potentials of different heating systems has been developed. This allows the comparison of heat pump systems with conventional heating technologies like coal, oil or gas heating systems on essential energy relevant data.

Based on the defined system boundaries for field measurements (deliverable D4.1), the concept for a common monitoring methodology (deliverable D4.2) and the concept for the evaluation of CO₂ reduction potential (deliverable D4.3), a proposal for comparing heat pump systems with conventional heating systems like coal, oil or gas heating has been developed within the IEE project SEPEMO-Build.

The proposed methodology for comparison is based on the following three parameters:

1. CO₂e emissions using a LCA approach
2. Primary energy demand
3. TEWI (Total Equivalent Warming Impact).

Life cycle analysis

The life cycle analysis is used in order to show the annual CO₂e emissions, the yearly energy demand, as well as the impact on global warming during the whole time of operation of both the heat pump systems and the conventional heating systems.

Use phase

The primary energy demand, as well as the CO₂ emissions, will be calculated for the “use phase”, which covers the time of operation of the heating unit. It will enable the comparison of heat pump systems with other heating systems by allowing for the calculation of the CO₂ emission and primary energy reduction potentials.

Life time – TEWI

The concept of the “Total Equivalent Warming Impact” – or TEWI – was developed as a comparative index of the global warming impacts of an end use application by accounting for both the direct contributions from refrigerants and blowing agents to the atmosphere, and the indirect contributions from energy consumption.

SEPEMO approach

The analysis concerning the CO₂e emissions and the primary energy demand in the course of the IEE project SEPEMO-Build is focused on the use phase only. Additionally, the TEWI is calculated in order to show the CO₂e emissions during the whole time of operating the heating system.

In order to gather more information on the long-term impact on CO₂e emissions during the life time of the heating units, the TEWI will allow the comparison of heat pump systems with other heating systems by allowing for the calculation of the CO₂ emission and primary energy reduction potentials.
A new network on heat pumps named INPAC (Institut National des Pompes à Chaleur) has just been launched in France, bringing together seven major research actors. INPAC members are: CEA, CETIAT, COSTIC, CSTB, EDF, GDF SUEZ, MINES ParisTech.

INPAC will allow information exchanges, consultation about research programmes and contacts with relevant partners at national and international levels.

INPAC will also play a key role in disseminating scientific and technical knowledge to the French professional audience interested by heat pumps.

A national annual conference about heat pumps has been implemented, with the objective to improve the dissemination of results from research projects and technology watch operated by INPAC members and partners.

The 1st French Conference on Heat Pumps took place on 20th September 2011 in Paris, with more than 160 participants. High level presentations were given about energy performance improvement of heat pumps, their use together with other systems and energies, the optimization of their integration into buildings and industrial process.

be calculated according to EN 378-1 [EN378, 2009]. This shall result in an easy-to-handle LCA of the different systems. It is used for the estimation of the total contribution of the heat pump heating systems to the greenhouse effect. This calculation procedure can be extended to conventional heating systems like gas, oil and coal heating systems as the TEWI is equal to the indirect global warming impact, since there are no direct emissions of refrigerant for the conventional systems.

Validation process for heating systems

The following validation process defines the methodology for calculating the primary energy demand and the CO2 emissions based on the measured usable energy.

As the visualization of the validation process above shows, different factors, coefficients and the efficiencies of the different systems are needed for calculating the final energy, the primary energy and CO2e emissions. Whereas the final energy demand of the conventional systems is calculated using the results of the field measurement of the heat pump systems, the primary energy factors and the CO2e emission coefficients are used as described in EN15603. As far as the annual efficiencies of the conventional systems are concerned, results of the MEEuP4 (Methodology study for Ecodesign of Energy-using Products) are taken into account.

Market relevance

Based on industry numbers, the overall contribution from the heat pump stock can be calculated. Using accumulated data for the heat pump stock installed from 2005–2009, an annual 6.9 Mt of GHG emissions is saved by heat pumps installed in the field. It is expected that this amount will strongly increase in the future for two reasons: the GHG emission from the use of electricity will decrease and the number of installed heat pumps will increase.

Deliverables

More detailed information on the system boundaries, measurement equipment and the calculation methodology can be found on the web page of the project www.sepemo.eu/deliverables.

Andreas Zottl, AIT – Austrian Institute of Technology
Markus Lindahl, SP – Technical Research Institute of Sweden

4. MEEuP; Final Report - Methodology study for Ecodesign of Energy-using Products; European Commission DG ENTR, Unit ENTR/G/3, 2005
Heat pumps in near zero energy houses – a winning concept for buildings

In Europe the heat pump technology got the "green light" by the recognition as being a renewable energy technology in the European Directive on renewable energy sources (RES-Directive). The inclusion of heat pumps in the RES-Directive served as an eye opener for several Member States (MS) in the European Union. Heat pumps that in several MS were a complete unknown technology suddenly turned into a possible knowledge in order to fulfill the national obligations in terms of increased use of renewable energy. However the inclusion of heat pumps in the RES-Directive is no more than just a green light to take part in the race of competition on the heating market. A race that in most cases is far from tight. As an example, the UK heat pump market that is showing a tremendous development sold almost 20 000 units in 2010. In comparison, the annual sales of gas boilers amounts to 1.6 million per year. There are however examples of national markets being on the other side of the scale. In 2010 more than 90 % of all heat generators sold on the Swedish market was some kind of heat pump.

Yet it is evident that the heat pump technology is becoming increasingly recognized. The IPCC, as well as the IEA, have highlighted the importance of improved energy efficiency in all energy sectors. Heating and cooling are seen as prioritized areas, where a lot can be done, and heat pumps have been identified as one of the most important technologies in order to limit overall global warming. These credible international institutions have a strong influence on national policy makers. There seems however to be a gap between the international perception and national policies. The European association for electric utilities, EURELECTRIC, has found that only a minority of the European Member States predicts a wider use of heat pumps until 2020. Given the challenging targets for increased use of renewable energy, several countries need to revise their energy plans and re-evaluate the importance of heat pumps. The need for a completely new strategy is not only enforced by the RES-Directive. The EU Commission has set several political tools to promote the heat pump industry and to stimulate the market. These tools are dependent on national, regional or local conditions, including a primary energy factor expressed in kWh/m² per year. MS are at this very moment developing these definitions. The heating / cooling technologies and building concepts that manage to demonstrate practical and economical solutions fulfilling these definitions will have a great advantage on the market. In order to be successful, it is essential that the heat pump industry initiate cooperation with the building industry. The Swedish Heat Pump Association SVEP has initiated such a project together with Chalmers Industry Technology. The project is focused on the sector for existing multi-family buildings in Sweden.

Consequences of proposed definition of nearly zero energy buildings in Sweden

The project aims at identifying practical and economic measures to refurbish the stock of existing buildings to nearly zero energy building (NZEB) standard. In this initial study, new buildings have been excluded as the heat pump industry already have a generally good picture on how this market segment may be reached with heat pumps. The existing building stock is much more of a challenge and also the most important sector if substantial energy savings are to be reached in the building sector. Due to the fact that the energy performance of the existing building stock is depicted in a broad band, it is believed that we will see at least two different definitions of NZEB: one for new construction and one for existing buildings. Earlier this year, the Swedish Energy Agency published a report including a proposal for NZEB definition for new and existing buildings. The requirements proposed for existing buildings set a level of 50% of the present building codes. The proposed limits for the existing buildings are set at the same level as

Policy changes influencing the European heating market

The European Parliament and the Council adopted the revised Energy performance of buildings Directive (EPBD) on May 19, 2010. The new Directive will enforce very strict building regulations for new buildings as well as all buildings undertaking major renovations from 2021 (2018 for public buildings). Even though there are still several years left until we will see the full impact of this Directive, we already see a “fast track” approach being adopted in several places around Europe. The city of Stockholm has already taken a decision that all new construction on city grounds need to meet very strict building codes, much higher than the existing building regulation prescribes. The fact that a growing number of policy and decision makers wishes to distinguish themselves as forerunners in energy conservation can be seen as a sign that energy has become, if not sexy, at least trendy. Several MS follow suit and are already at a stage where national building codes and building concepts have been adopted. The revised French building code – RT 2012 – and the Swiss Minergie concept are examples of this.

EPBD requires that all new buildings and buildings undertaking major renovations are to meet a “nearly energy zero” definition. The definition of nearly zero energy is to be defined on the basis of national, regional or local conditions, including a primary energy factor expressed in kWh/m² per year. MS are at this very moment developing these definitions. The heating / cooling technologies and building concepts that manage to demonstrate practical and economical solutions fulfilling these definitions will have a great advantage on the market. In order to be successful, it is essential that the heat pump industry initiate cooperation with the building industry. The Swedish Heat Pump Association SVEP has initiated such a project together with Chalmers Industry Technology. The project is focused on the sector for existing multi-family buildings in Sweden.

Figure 1: LCC for different energy efficiency measures in Sweden.

<table>
<thead>
<tr>
<th>Energy Efficiency Measure</th>
<th>1961-1975</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without measures</td>
<td>1 000 000</td>
</tr>
<tr>
<td>District heating</td>
<td>2 000 000</td>
</tr>
<tr>
<td>Air-water pump</td>
<td>3 000 000</td>
</tr>
<tr>
<td>Geothermal heat pump</td>
<td>4 000 000</td>
</tr>
<tr>
<td>Exhaust air heat pump</td>
<td>5 000 000</td>
</tr>
</tbody>
</table>

Figure 1: LCC for different energy efficiency measures in Sweden.

Low rise apartment building Climate zone III

1961-1975
The Fraunhofer Institute on solar energy systems (Fraunhofer-ISE) is currently running one of the largest field measurement programs in Europe. In cooperation with seven well known heat pump manufactures, a total number of 110 heat pump systems equipped with measurement tools. Data was collected and analysed from 2006 to 2010.

The project in brief
The majority of heat pumps observed were installed in new buildings and provided from 5 to 10 kWthermal capacity using air, water and ground as energy sources. The main goal of the project was to achieve a better understanding of factors influencing efficiency including system design and varying application conditions. Lessons learned were expected to contribute to optimized products and systems in the future.

Results
Stiebel Eltron group participated with a total of 16 heat pump installations in the „WP-Effizienz“-project. Air, water and ground were used as energy source. Three installations were analysed more closely. One of them included solar collectors for sanitary hot water production, the other two showed a more complex design combining the heat pump with a forced ventilation and heat recovery. This analysis revealed

- an increase in final energy efficiency of up to 20 % when combining a heat pump with a solar thermal collector;
- an increase in final energy efficiency of from 2 to 5% when combining a GSHP with forced ventilation and heat recovery
- an increase in final energy efficiency of up 3 % by using the exhaust air for sanitary hot water production.

Independant of the system complexity, all heat pump systems use a large share of renewable energy, show a positive primary energy efficiency and save greenhouse gas emissions. Compared to traditional fossil fuel based systems, all heat pump systems save considerable amounts of primary energy. Applying the primary energy factor (PEF) of 2,6 kWth/kWhel (as currently common for Germany) reveals the following primary energy savings (always compared to a gas condensing boiler):

- 41 % when using a brine-water heat pump;
- 42,48 % when using a brine-water heat pump with exhaust air and solar brine pre-heating;
- 53,9 % when using a brine-water heat pump combined with a solar thermal panel for sanitary hot water production and support of heating;
- 18 % when using an air-water heat pump, and
- 23,3 % when using an air-water heat pump in combination with an exhaust air heat pump for sanitary hot water production.

An increasing share of renewable sources in the electricity from PV, Wind and Biomass will improve these advantages for existing and future heat pump systems. Based on the positive results of the „WP-Effizienz“-project additional installations will be observed in the follow-up „WP-Monitor“-project.

Given the current status of the European heat pump markets and the changes of energy policies, we believe that there is a sound basis for an optimistic market outlook. The European Member States are forced by laws and regulations to introduce a major shift in terms of their energy usage. Heat pumps offer a technology that is in line with the aims of reducing greenhouse gas emissions as well as improving energy efficiency. Heat pumps are representing a technology that no country can afford to overlook. The current economic situation has temporarily put the market on hold, but the pressure to improve the energy efficiency will force the MS to stimulate activities in this sector.

Lessons learned from the Fraunhofer-ISE field test „WP-Effizienz“

Impact of different systems design approaches using Stiebel Eltron products on performance

The full article is on the EHPA website.
Geothermal Energy – a safe bet:
The German Heat Pump Association (BWP) launches new quality initiative

As a consequence of a drilling accident, while preparing the energy source for a heat pump in the south German federal state of Baden-Württemberg, around 50 houses were damaged.

In order to avoid a similar future incident, the German Heat Pump Association BWP decided to take immediate action. Activity of several actors has now led to the launch of the BWP quality initiative for geothermal drilling. This initiative aims at minimizing the small risk that is in some cases related to geothermal drilling.

The initiative includes steps for ensuring high quality standards in drilling companies like deploying the revised DVGW-worksheet W120 part 2 (yellow print), which notably demands external audits. Apart from that, drillers which are BWP members also have to establish a liability cover of minimum 10 million Euro.

Additionally, also builders can now conclude a special insurance initiated by the BWP that covers damage events independent of liability. This new insurance solution sets up immediately in a case of damage – contrary to the nowadays already common liability insurances. “In case of a damage event the non-involved third parties need help in a fast and non-bureaucratic way. That’s what our new geothermal drilling insurance is for.” declares BWP General Manager Karl-Heinz Stawiarski. A precondition for this special insurance is a high quality drilling company, so as to ensure quality standards and minimize the remaining risk.

German quality initiative for geothermal drillings
1. The German heat pump association (BWP) requests all members/drillers to show evidence of an insurance covering third party damage up to 5 million Euro (if the member operates more than 5 drilling rigs, a minimum coverage of 10 Million Euro is asked for).
2. BWP members shall execute the precautions taken in VDI standard 4640.
3. Drillers that are member of BWP shall fulfill the requirements of DVGW-standard W120 – part 2 (yellow print).
4. BWP will audit drillers for compliance with requirements of DVGW-standard W120 – part 2 in the future.
5. BWP – in cooperation with partners – has created a new type of insurance covering damage caused to third parties – independent of liability. This insurance will be mandatory to those drillers that drill across ground water levels.
6. BWP will extend education and training for drillers.

Verena Gorris | BWP
More information can be found at www.waermepumpe.de

Portugal 12th country to join EHPA EUCERT installer training and certification program

Portugal is the 12th country joining the EHPA training and certification program for heat pump installers “EUCERT”.

In Portugal, EUCERT is run by three companies: “APIRAC”, “APIEF” and “CENTERM” that represent the manufacturers’ and technicians’ association, a training centre, and a certification institution respectively. These organizations proudly hosted the fall meeting of EHPA’s Education Committee in September 2011, and had the opportunity to learn, from other countries’ experience, the best practices for the training and certification of Portuguese heat pumps technicians.

At this event, Portugal was officially accepted as new member.

Obliged to deal with severe economic rules, Portugal must be equally severe with the energy package, with a decisive focus on sustainable sources and on the search for the best available solutions for its use.

Moreover, the BWP is intensifying its training activities for near-surface geothermal heat pumps. “We are interested in a quick solution, because the current depth restrictions for geothermal drilling in Baden-Württemberg cause numerous drilling projects to stop. That’s why we quickly implemented the suggestions of Baden-Württemberg’s environmental minister Franz Untersteller.” Karl-Heinz Stawiarski points out.

The BWP quality initiative ensures that future geothermal drilling does no longer hold an incalculable risk for builders and third parties: The quality standards for drillers, the insurance and the training activities provide extra security.

The sustainable energy sources in Portugal are a significant reality due to important options that have been developed and put into practice.

On the other hand, the use of heat pumps with their high energy performance is an important part of the solution, keeping in mind the good environment for life quality and work productivity that they provide.

A good training and certification process is a fundamental part of the heat pump solution, and, with the help of EHPA, Portugal is on the safe path and in good company to get there.

For more information check: www.ehpa.org/eucert
Fulfilling Poland's RES targets with heat pumps: National insights and European outlook

Poland is deemed as one of the promising markets for the future use of heat pumps. Starting at a small basis, heat pump sales are growing. The Polish government is currently focusing on heat pumps as a possible technology to take off the use of renewable energy in heating.

The European Heat Pump Association – in cooperation with the Polish Presidency – is organizing an event on 18.10.2011 in Brussels to discuss opportunities of heat pumps in Poland and Europe. To allow for an easier start, lessons learned from the IEE SEP EMO project are presented as well as market data from EHPA's freshly published Outlook 2011. The event ends with a panel discussion addressing the question of how to boost heat pump recognition in Poland and make full use of their contribution to Poland’s RES targets.

Further information and registration on www.ehpa.org/291

Preliminary Program

13:30  Registration and welcome coffee
14:00  Welcome by Mr Bogdan Kazimierz Marcinkiewicz  
Member of the European Parliament
14:10  Heat pumps contribution towards meeting the Polish energy challenge  
Janusz Pilitowski, Deputy Director of Poland’s Ministry of Economy’s Energy Department
14:30  Polish experience in the heat pump market, perspectives of development  
Andrzej Oczos, PORT PC
14:50  Increasing recognition, growing markets, increasing contribution: the European heat pump market  
Thomas Nowak, EHPA
15:10  The importance of quality installations on performance: SEPEMO-Build  
Roger Nordman, SP
15:30  Coffee break
16:00  Lessons learned from field trials to improve installer knowledge  
Onno Kleefkens, Agentschap NL
16:20  Lessons learned from field trials on system design  
Marek Miara, Fraunhofer ISE
16:40  Panel discussion: “How can we boost heat pump recognition and contribution to Polish and EU targets?”  
Moderation: Sonja van Renssen, environmental journalist, Brussels
17:30 – 19:30  Reception

This report is published as part of the project “Seasonal Performance factor and Monitoring for heat pump systems in the building sector” – SEPEMO-Build.

Project supported by the European Commission, Intelligent Energy – Europe (IEE).
Contract No: IEE/08/776/ S12.529222  
www.sepemo.eu