ehpa
european
heat pump association

European Heat Pump

Action Plan

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1 Background

Governments and environmental institutions alike have stressed the importance of an increased share of renewable energy sources in the European energy mix. This is the result of two major streams of argument:

1. Energy supply is still predominantly based on fossil fuels. However these non-renewable resources are limited. Increasing demand raises their price level which in turn puts stress on national economies. Import dependency makes those countries relying heavily on oil and gas imports more vulnerable to political pressure.[1]
2. The use of non-renewable energy sources has the disadvantage of greenhouse-gas (GHG) emissions. As a consequence of the Kyoto protocol the emission reduction of different pollutants measured in CO_2-equivalents is an important matter on the political agenda. Meeting the goals set in this protocol and the EU energy strategy requires joint action.

Both effects are undesirable and make the search for replacements more important than ever. Only recently did the EU member states commit to a 20% reduction of primary energy demand as well as of CO_{2equiv}-emission and a targeted 20% share of renewable energy sources as compared to the predicted primary energy demand. All targets are to be reached by 2020. These ambitious goals can only be achieved when energy efficiency is improved and the remaining energy demand is covered to a large extent by renewable energy sources. Focus areas for progress are electricity production, heating & cooling and transport.

Within heating and cooling ambient heat is a particularly suitable option to contribute to the named goals. While electricity production from renewable sources is part of the different national and international policy agendas, only biomass and solar thermal energy are widely acknowledged as renewable sources for heating. Ambient heat has a significant potential, that needs further support to exploit it. .

Ambient heat – used by heat pump technology – can provide heating and cooling to cover the needs of a variety of users, from private to public and commercial building owners throughout Europe. Current heat pumps have reached a high level of efficiency and should therefore be the premier choice for renewable heating and cooling in Europe.

While the EU market for heat pumps has been growing strongly for the past years there is still a lot of unused potential suitable for heat pump applications. Limitations are caused by higher investment cost, the lack of knowledge and awareness among end users, and the underdeveloped extend of institutional and financial support.

A heat pump action plan could contribute to overcome these barriers. As a result the demand for heat pumps would continue to increase making them one of the most important technologies to cover today's energy needs. Successful R&D projects will lead to even better environmental and economic efficiency. Quality assurance schemes for the unit as well as information, education and certification programs for the relevant actors will result in even higher reliability.

Increasing market share, improved economic and environmental efficiency and progress towards a more environmentally friendly electricity mix will increase the impact of heat pumps as a technology using renewable energy.

1 Europe imports 50% of its final energy demand. This number is expected to increase to 70% in 2030.

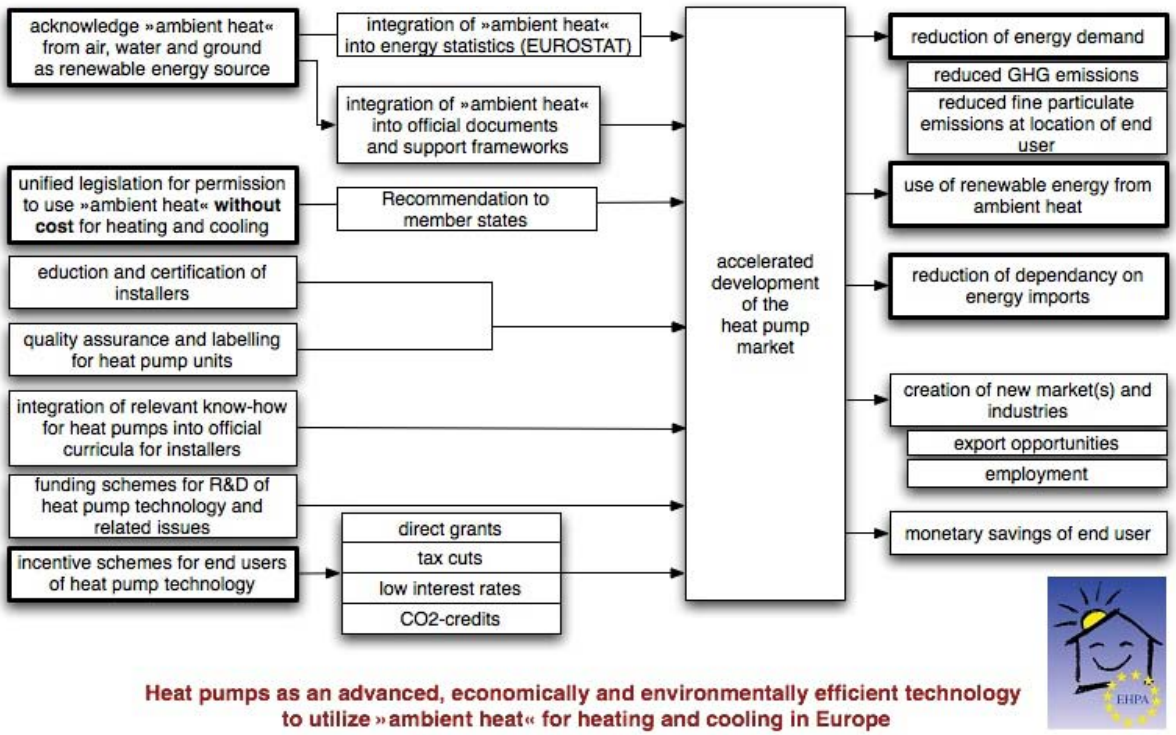

Figure 1: Cause-effect relations: measures necessary to reach the goals of the European heat pump action plan.

2 Heat pump technology and application overview

Heat pump technology

Heat pumps transform omnipresent »ambient heat« (**a form of renewable energy)** from air, ground and water **to useful** heat. Additionally they can utilize waste energy from industrial processes (potential for cascading energy use;) and households (exhaust air). **They are using a renewable energy source while contributing to the total efficiency of energy use**.

»Ambient heat« is ubiquitous energy stored in the air, surface & ground water, and shallow ground. It is the result of natural processes (solar irradiation, nuclear disintegration) and can be transformed to useful heat by using heat pump technology.

»Waste heat« is a product of other energy uses (exhaust air, waste and cooling water etc.). Low temperature waste heat can also be transformed to useful heat by heat pump technology.

A heat pump consists of a heat source, the heat pump unit and a distribution system to heat/cool the respective building (see Figure 2). It uses the same technology as a fridge: a transfer fluid transports heat from a low-energy source to a higher energy sink. Electricity is used for the compressor and the pumps. It is possible to switch the direction of this cycle to **use the same machine for heating and cooling.** In heating mode, the heat source is outside the building envelope (ambient heat from air, water, ground), in cooling mode, the cycle is reversed: the building itself is the heat source while the outside is used as heat sink.

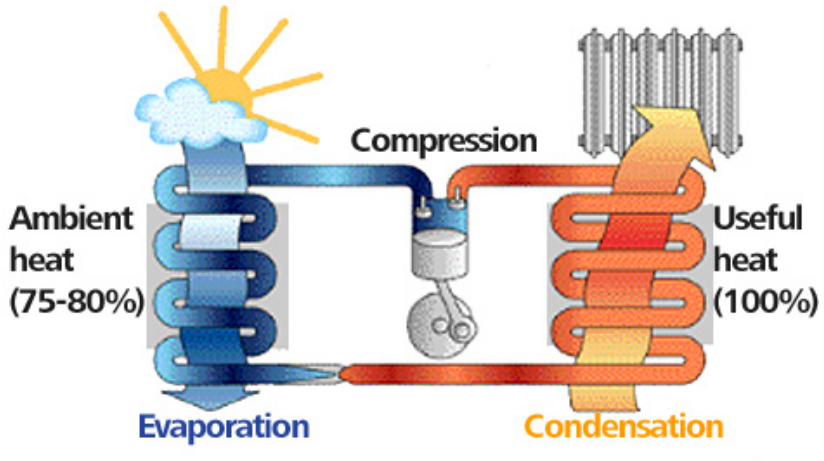

Figure 2: Functional Scheme of a heat pump

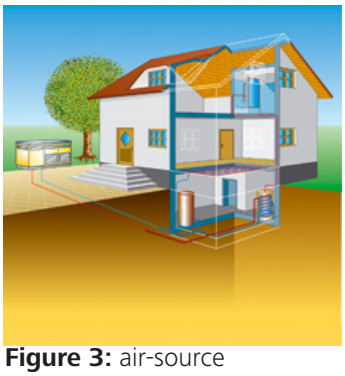

Figure 3: air-source heat pumps

Air-to-air heat pumps.
Air source heat pumps use outside or exhaust air as energy source for heating, cooling and hot water. They can be installed entirely in-house or as a split solution with the condenser being a separate outside unit (see figure 3). Heat is commonly distributed by hydronic distribution systems (air-water) or by fans (air-air). While they have been employed in moderate climates, recent technical advancements even allow for their efficient use in rougher regions. Air-source heat pumps have a cost advantage over ground-source variants.

Figure 4: water-source heat pumps

Water-to-water heat pumps.
Water-source heat pumps can be used where ground water is easily accessible. They require two drillings. One is used as a water source, the second is used to reinject the water into the ground (see figure 4). The average water temperature is 8°C to 12°C. The heat pump extracts part of this energy and makes it available for heating, cooling and hot water. Water-water heat pumps profit from a particularly high SPF due to the good temperature characteristics of water. A water heat pump can reach a SPF above 4,5.

-Brine-to-water heat pumps.
Brine-water heat pumps use geothermal energy for heating and hot water production. They can be operated efficiently by employing the constantly high temperature level of the ground (approx. 10°C). They use a vertical (drilling, see figure 5) or horizontal collectors as heat source. Brine-water heat pumps can achieve a SPF of 4.

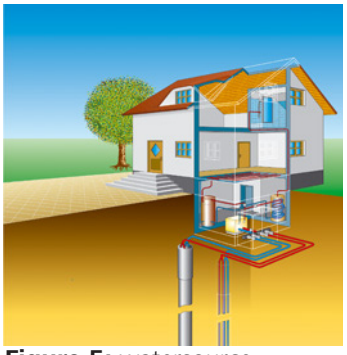

Figure 5: watersource heat pumps

Horizontal collector: Direct expansion or brine to water heat pumps.
A horizontal heat source uses the energy stored in the shallow ground (see figure 6). It can either be designed as a direct expansion system or as a brine water system. Direct expansion systems can achieve very high efficiency ratings (SPF above 4,2) by directly using the refrigerant cycle of the heat pump. This saves an extra heat exchanger and the brine circulation pump. Direct expansion systems are very cost efficient.

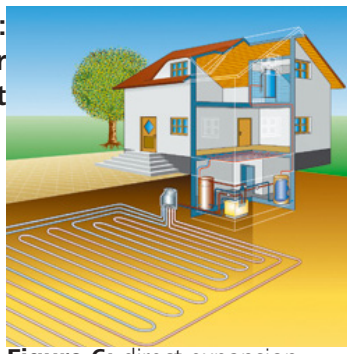

Figure 6: direct expansion heat pumps

Heat pumps typically require 20% to 25% of electricity to produce 100% energy for heating, cooling and the production of hot water. As the share of electricity from renewable energy sources increases, they become even more environmentally friendly. **Heat pumps multiply the positive effect of electricity from renewable energy sources.** The combination of state-of-the-art heat pump systems powered from 100% green electricity provides a highly efficient and

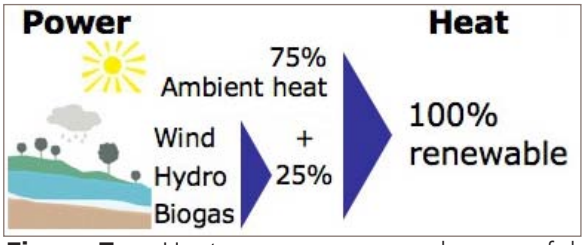

Figure 7: Heat pumps can produce useful heat that is to 100% renewable .

totally »green« source of energy (see Figure 7).

This effect results in a very specific and unique property: **each heat pump installed profits from improvements in the technical efficiency and the environmental impacts of electricity production**.

The efficiency of heat pump appliances is known as **coefficient of performance (COP)**. It expresses the ratio of necessary electrical input vs. total energy output. A COP of 4 indicates that one unit of electricity is necessary to produce 4 units of energy. The performance of the total system (heat source, pumps, heat pump) per year

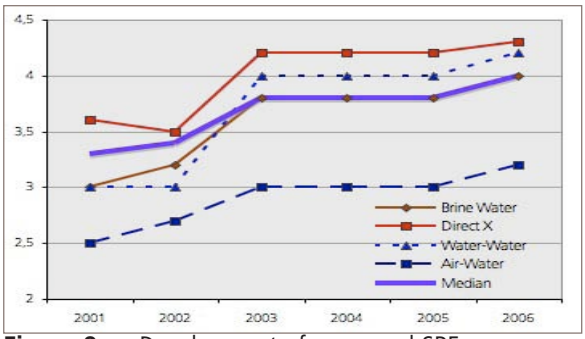

Figure 8: Development of measured SPF over time (Source: Fanninger).

is expressed as **seasonal performance factor (SPF)**. An SPF of 4,5 indicates that one unit of electricity is necessary to produce 4,5 units of energy. Parallel to the COP (see figure 8) the SPF of heat pumps has greatly benefited from technological improvements. Over the last 20 years the COP for ground-coupled heat pumps as increased from an average 2,5 to 4,5 while air-water heat pumps have reached a COP of more than 3,5.

State-of-the-art ground source heat pump systems reach a minimum SPF of 4, air to water heat pumps a minimum SPF of 3,5. Better values are possible depending on design, installation, climate and type of heat source employed.

	new	renovation
Air-to water HPs	3,5	3
Brine-to-water HPs	4,0	3,5
Water-to-water HPs	4,5	4
Direct expansion HPs	4,2	3,7

Table 1: Average seasonal performance factor of heat pump systems (Source: EHPA)

It must be noted however that table 1 presents average values. A simple judgment on the preferable type of heat pump based on the presented values would be misleading: Due to climate differences an air-water heat pump employed in southern Europe may reach a higher SPF than a ground-coupled heat pump installed in northern Europe.

As the SPF of heat pump systems depends on the total energy demand of the building and the energy input required to cover this demand, it improves with correct planning and skillful installation of the whole system. The heating system has to fit the building and the building has to be planned with heat pumps as heating systems in mind. This makes a reliable unit as important as educated installation partners.

Heat pumps reach best SPF values when the building designed allows for very low feed-in temperature (30°C to 35°C) and a small temperature drop. A good insulation standard, a floor or wall heating system and an automated ventilation system are components used to achieve this goal.

Application overview

Heat pumps can successfully be employed in residential buildings (single and multi-family housing), commercial buildings and industrial applications. While the market for heat pumps in new residential buildings has picked up momentum and is even self sustaining in some countries, their application in the retrofit segment as well as in commercial and industrial buildings is just starting (see table 2).

	New building	Renovation
Residential: single/double family house	Mass market currently developing	Largely undeveloped (besides Sweden & Switzerland)
Residential: multi-family residency	Small market developing	Initial development steps
Non-residential/ commercial	Minority share in currently sold heat pumps. Several demonstration projects, potential for heating and cooling projects unexploited.	Initial steps, increasingly important with owners that value low operating cost.

Table 2: Market segments for heat pumps (Source: EHPA)

With regard to their geographical location heat pumps are mainly employed for heating and hot water production in northern Europe while their main application in the southern European states is cooling (where hot water is produced by solar thermal panels). Demand for cooling is only recently gaining importance in middle and northern Europe due to rising demands for year-round comfort.

Type: one-family house
Heated area: 130m²
Location: Austria
Heat pump: ground source; vertical drilling
Measured SPF: 4

Key issue for the employment of heat pumps in the retrofit segment is their higher total heat demand per square meter. While heat pumps can be employed as a simple exchange of the traditional heating system, a renovation of the heating system and improvement of the building envelope increases their efficiency.

Current heat pumps are entirely feasible for employment in the renovation sector. This issue is also addressed by the Energy Performance Directive for Buildings (EPBD) as it requires lower energy demands for houses that undergo renovation.

	ambient heat (heat pumps)	Biomass/ Biofuels	Solar thermal	Photo-voltaics	geothermal electricity	wind/water
Type of energy	Heat/Cooling	Heat /electric power	Heat	electric energy	electric power	electric powery
Use/ application	Heating/ Cooling/ Hot water	electricity Heating Hot water	hot water support for heating	electricity	electricity	electricity
Energy source	solar energy stored in air, soil, water	stored solar	solar radiation	solar radiation	geothermal heat	wind/water
Availability	365d / 24h	365 days/ 24h regional advantages	daytime	daytime	365 days 24hours	wind speed water flow
Coverage rate	100%	100%	0% - 60%	depends on availability	100%	depends on availability
Emission at site	none	CO2, fine particulate matter	none	none	none	none

Table 3: Renewable energy sources: a comparision (source: alpha innotec GmbH, Germany, modifications by EHPA)

In the segment for commercial and industrial buildings heat pumps solutions are unique to each project and require specific skills on the side of the planner.

When compared to other renewable energy sources **»ambient heat«** utilized by heat pumps **requires considerably less effort** to make it usable (table 3). Heat pumps do not need extra infrastructure as electricity is available at every house and ambient heat does not have to be delivered but is »produced« on-site. It should be noted, that heat pumps can provide 100% of the required energy for heating and cooling, 24 hours a day, all over Europe. When used with green electricity, even today a CO_2-free energy solution is available. As an additional bonus the installed base of heat pumps profits from future progress towards a more environmentally friendly electricity mix.

Type: administration building
Heated area: 28.000m²
Location: Austria
Heat pump: ground-source (energy piles)

Industry characteristics

Heat pumps are a small but growing segment in the market for heating, cooling and ventilation (HVAC). In several fields of application they are a substitute product to established gas and oil burners as well as to air conditioning units.

The heating and cooling market on a European if not on a world level is dominated by large companies. While these companies are active in the heat pump segment it is characterized by the multitude of small and medium sized companies (SMEs) that cater to the different regional and building needs.

Manufacturers can broadly be distinguished in two groups:

1. Heat pump only manufacturers,
2. Manufacturers of heating and cooling equipment, most often with a strong base in the HVAC-market (gas and oil driven burners or in the field of air conditioning), also producing heat pumps.

The European market is currently consolidating. About 20 years ago there were more than 100 smaller, locally active manufactures. This number decreased considerably and today there is a split into a few companies with industrial size production and several smaller ones that often cater to regional or otherwise specific demands. The pick-up in demand has also created a strong incentive to invest in capacity. Several manufacturers have increased an modernized their production processes. Larger companies have also bought several smaller ones. Most often both parties have been profiting from these transactions. Usually the smaller companies got access to the big players sales service network while the larger company gained technical specialist knowledge.

In summary: Heat pumps are a technology

- to make «ambient heat» as a renewable energy usable for heating and cooling,
- that is increasingly efficient from an economic perspective,
- that is environmentally beneficial (up to 100% renewable),
- that is locally available everywhere in Europe, 24 hours a day (reducing transport needs for oil and a fine distribution grid for gas),
- whose know-how and installation competence is widespread in Europe, and
- that is developed, proven and reliable

3. Contribution potential of heat pumps to EU goals

Heating & cooling consume at least 40% of all primary energy within the EU. The widespread replacement of oil and gas boilers as well as of direct electric heating systems with heat pumps could contribute significantly to the renewable energy strategy of the European Union in terms of primary **energy savings (energy efficiency), renewable energy production and greenhouse-gas-emissions reduction (GHG emission).** How ever such support will requires that **»ambient heat« is recognized as a renewable energy source** and its contribution is accounted for in the national energy statistics.

Equipping a new one family house with a heat pump instead of an oil burner saves (on average) more than 4 tons of GHG- emissions and around 50% of primary energy per year. Around 75% of the total required energy is produced from ambient heat (see table 6). In order to illustrate the potential contribution of heat pumps on a European level (EU-25 states) EHPA has crafted a vision along the question **»which impact would the employment of heat pumps in all new and renovated one-family houses until 2020 have for the European economy?«**. The potential contribution to the EU energy strategy is impressive: Starting in 2008 more than 70 million heat pumps would be installed by 2020. They would reduce final energy consumption by 902 TWh, would produce 774 TWh of renewable energy and would save 230 Mto of GHG (see Table 5).[1]

Heat pumps are energy efficient and reduce primary energy demand

A current heat pump requires one unit of electricity to produce four to five units of heating and cooling. In terms of primary energy usage the replacement of a traditional burner by a current heat pump saves approx. 50% of the primary energy required. When heat pumps are employed to use waste heat, they further increase the efficiency of the energy originally used for a different purpose.

This result depends mainly on the process of electricity production and its efficiency. The total primary energy demand will benefit twofold form a widespread use of heat pumps:

- technological improvements in the seasonal performance factor will further reduce electricity demand of heat pumps.

1 It should be noted that potential utilization in multi-family housing and commercial building is not taken into consideration within this report. As well improvements in power production efficiency, efficiency of heat pumps and improved insulation standards are not included. As a result, the potential impact of heat pump use is probably greater than calculated.

EU energy targets for 2020	EU target	Change required to reach target	Potential contribution by heat pumps	as a share of the EU target
Primary energy consumption	reduction by 20%	4.385 TWh (20%)	902 TWh	20,6%
Renewable energy production	contribution of 20% by RES	3.508 TWh	774 TWh	22%
Greenhouse-gas-emissions	reduction by 20%	1.073 Mto (20%)	230 Mto	21,5%

Table 4: Contribution potential of heat pumps to EU energy goals (Source: EHPA «our vision 2020»)

- the installed heat pump base will multiply all improvements in the way the electricity mix is produced. The combination of heat pumps and electricity from renewable energy sources leads to a 100% renewable energy source for heating and cooling.

Reduction of GHG emissions

The reduced energy demand of heat pumps leads to much lower amounts of GHG gases per se. Depending on the national power production mix heat pumps can provide heating, cooling and hot water nearly emission free.

No fine particulate matter emission at the location of energy demand

As electricity is used to power heat pumps, most emissions appear at larger power plants that are usually equipped with efficient filter technology. Again heat pumps benefit from future improvements in the efficiency of power production and of filter technologies.

Production of renewable energy from ambient heat

Heat pumps use a single unit of electricity to produce three to five units of usable heat. 75% to 80% of the final energy produced is from a renewable source: »ambient energy«. As usable energy is stored in air, water, ground and waste heat, this type of energy production can be used all over Europe. A unified method for the calculation of heat produced from renewable energy sources has been presented in the recently completed ThERRA project.

Monetary savings to the end user and additional comfort

While currently the initial investment for a heat pump installation is higher than for other technologies, its running cost are usually much lower (less than 50%). Cost comparisons over the long run show an advantage for heat pumps after 10 to 12 years even when calculated with current energy prices. In addition the necessary floor or wall heating systems as well as automated ventilation systems and cooling options provide extra comfort to the home at virtually no extra cost.

Creation of new markets and industries: export opportunities and employment

The current EU market for heat pumps is just starting to gain momentum. Today's products, production and installation standards benefit from a history of rather difficult development phases. A further development and concentration of this knowledge in Europe not only create local markets but will also create export opportunities and employment for European companies.

ThERRA: »Thermal energy from renewables« is a project targeted at the development and the dissemination of a universal methodology for monitoring the total amount of renewable heat produced in the EU.
Info: www.therra.info.

Reduced import dependency.

Current import dependency for fossil fuels exceeds 50% and is predicted to grow. On average (and based on the current electricity mix) each heat pump employed saves 50% of primary energy when compared to an oil boiler.

Country	Oil burner (for comparison: kg/year)	GHG emission of electricity (kg/kWh)	Air-water (kg/year)	Ground-coupled (kg/year)	Water-water (kg/year)
Austria	5.800	0,23	899	786	699
Germany	5.800	0,62	2.349	2.055	1.827
EU-25 average	5.800	0,406	1.822	1.594	1.417

Table 5: Comparison of yearly emission values for an average heat pump in low- and high-carbon intensive national energy mixes.

4 The current heat pump market in the EU-25

The market for heat pumps started development in the 1980's. After an initial phase characterized from very strong growth market development suffered from quality issues of the individual heat pump and the complete system. Over the last 20 years manufacturers and installers have made great efforts to overcome these limitations. **Lessons learned from this process result in high quality, reliable products, technical competence of manufacturers and installers, a focus on quality expressed by the existence of a heat pump quality seal and education standards.**

The European market for heat pumps is atomistic in nature. Several manufacturers , mainly from Austria, Germany, France, Sweden and Switzerland are developing and producing heat pumps for the provision of heating, cooling, hot water and residential and industrial fields of application. The majority of heat pumps employed for heating purposes is produced inside Europe. The advanced know how in this technology leads to increased demand of heat pumps from abroad, thus creating an export market. Currently a consolidation process takes place reducing the number of producers and making size and economic power more important.

With regard to the number of heat pumps sold, the EU-25 market is characterized by double-digit growth since at least 2004. However precise numbers are difficult to find as **heat pumps, «ambient heat» and the produced renewable energy are not yet part of the official statistics**. EHPA collects the data provided by its member companies according to a standardized questionnaire and provides estimates on the rest of the European markets (see table 4). Eight markets have reached a state that enables the national associations to provide their domestic sales figures within this scheme. These nations cover more than 80 % of the European market for heat pumps (space heating including hot water production). Available statistics are from central and northern European countries and count heat pumps mainly used for heating. Only expert estimates for the southern European states where heat pumps are mainly used for cooling.

Country	2003	2004	2005	2006
Sales numbers for countries with statistics	178.001	207.164	242.435	368.019
Total sales	204.599	253.070	310.343	452.320

Table 6: Sales figures space heating EU-25 (Source: EHPA)

Within the six market segments outlined in table 2 heat pumps have reached the largest market share in the segment of **new single/double family houses** where market saturation can nearly be seen in Sweden (95%) and Switzerland (87%) and a strong development is under way in Austria (36%), France (15%) Finland (35%) and Germany (25%) (see figure 4, numbers based on 2006 statistical data).

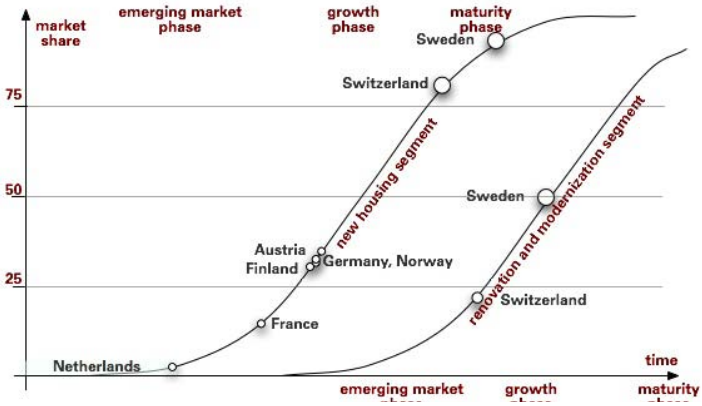

Figure 4: Market development status 2006 for new and renovated one/two family houses. (Source: EHPA)

	2003	2004	2005	2006	change 03/04	change 04/05	change 05/06
Austria	3.780	5.129	6.098	8.853	35,7%	18,9%	45,2%
Czech Rep.	1.200	2.400	4.000	4.000	100,0%	66,7%	0,0%
Denmark	0	0	4.000	4.000			0,0%
Estonia	510	750	1.095	2.333	47,1%	46,0%	113,1%
Finland	8.540	12.648	22.307	36.950	48,1%	76,4%	65,6%
France	13.700	17.300	25.200	61.510	26,3%	45,7%	144,1%
Germany	15.838	19.636	25.486	51.827	24,0%	29,8%	103,4%
Ireland	1.300	1.800	2.300	2.300	38,5%	27,8%	0,0%
Italy	0	12.131	13.000	13.000		7,2%	0,0%
Netherlands	1.557	1.800	1.891	2.767	15,6%	5,1%	46,3%
Norway	55.081	35.390	40.000	40.000	-35,7%	13,0%	0,0%
Poland	0	0	1.465	1.465			0,0%
Sweden	68.100	100.215	101.350	122.473	47,2%	1,1%	20,8%
Switzerland	8.695	9.796	12.008	15.806	12,7%	22,6%	31,6%
UK	0	0	750	750			0,0%
Total	178.301	218.995	260.950	368.034	22,8%	19,2%	41,0%

Table 7: Sales numbers for different EU countries. (Source: EHPA)

5 Targets and recommendations

The impact of this potential on the national, European and international energy systems depends largely on the success of heat pumps in the market place. This success in turn depends on knowledge on heat pumps and awareness of their opportunities with relevant actors as well as on public institutional and financial support schemes. Verifiable targets are necessary to further promote the employment of heat pumps.

EHPA suggest the equal support of all renewable energy sources and energy efficiency options independent of the technology used. In order to reach a high degree of economic and ecologic efficiency, support - institutionally and financially - should be based on their contribution potential in terms of energy savings, renewable energy production or GHG emission avoidance per Euro of investment.

Such an approach would reduce market intervention, leaving the decision on which means to develop in the future to the respective actors. This approach would favour those technologies with the biggest contribution potential and should lead by a rapid response of the market actors.

With regard to heat pumps, the European Heat Pump Association supports an ambitious energy strategy including specific sectoral targets. EHPA would welcome such target on a European or national level as part of the currently debated burden sharing agreements. Independent of such details EHPA believes that heat pumps could meaningfully contribute towards the ambitious energy and climate targets set on the EU level. To realize their potential collaborative

action is necessary at all levels from all relevant actors.

For continuous market development and success it is necessary to make heat pumps better known and to communicate the technologies benefits more widely with the public. Specifically the following actions will support this goal:

Acknowledge »ambient heat« from air, water and ground as renewable energy source

EHPA suggests strong support for the utilization of renewable energy sources on the different European, national, regional and local levels. In order to support heat pumps in particular it is of necessary to accept ambient heat as another form of renewable energy. General acceptance of this status should automatically lead to an integration of heat pumps into existing institutional and financial support schemes.

Most notably energy produced from renewable sources, particularly from ambient heat should be part of the national and European statistics. EUROSTAT and the national statistical offices should be advised to adopt a common methodology for data collection and should augment their data tables accordingly.

On a European level ambient heat should be acknowledged as part of the solution to today's energy problems and should be emphasized as such in the upcoming European renewables directive. Additional recognition could be provided by acknowledging the contribution from heat pump technology into for future European legislation, recognizing the technology within the directives on energy using products (EuP) and energy efficiency in buildings (EPBD), and by supporting future research within the 7th framework programm (FP7), the intelligent Energy Europe sheme and others.

A more detailed approach is recommended on the national level where heat pumps should be recognized within the expected laws on heating from renewable sources.

Information dissemination on »ambient heat« and heat pumps

The mentioned approaches blend with a more general need to disseminate information on ambient heat and heat pumps with all related actors.

- make utilization of renewable energies mandatory in public buildings
- Create financial support programs that treat all renewable energies equal based on their GHG-reduction potential
- Define minimum technical requirements to be met before financial support will be granted (for heat pumps: minimum SPF and a certificate of the installers/drilling companies).

Especially financial support measures will create coverage in the media and will help to create market pull.

Education and certification of installers and drilling companies.

Experience from the last 20 years of market development support the need for a certification scheme for heat pump installers accepted throughout Europe. Such a scheme and certificate has been created as result of the EU-Cert project. This project was successfully coordinated by EHPA. The resulting materials and guidelines are available in several languages and are currently used by several national associations. Its success should now be brought to the next level by integrating basic and advanced know-how on renewable energies in general and heat pumps in particular into the curricula and education schemes of those institutions responsible for vocational and professional training (schools, technical universities, universities)

Official support should be provided for establishing a EU-wide and accredited education program for installers and other relevant actors such as planners and architects.

Quality assurance and quality labelling for heat pump units.

EHPA supports the **EU eco-label** for heat pumps. With regard to the activities in the **EuP-Directive** EHPA calls for the commission and other relevant actors to support a function orientated, energy independent labelling. EHPA strongly beliefs that such a label creates the necessary transparency for the customer and leads to buying decisions that contribute to the EU energy savings and climate goals.

EHPA has contributed to the development of the **EHPA/DACH quality label for heat pumps** that is currently used in Austria, Germany, Sweden and Switzerland. More countries are on the verge of joining. As actors interested in heat pumps have to trust their planner, manufacturer and installer, certain insecurity on the reliability of the product is normal. The quality seal is based on stringent quality criteria giving trustworthiness to the tested products. It makes it easier to distinguish high-quality, efficient and environmentally friendly heat pumps from cheap and unreliable competition. A connected arbitration process supports the customer in case of disputes that cannot be settled easily. EHPA recommends to support the extension process of this seal throughout Europe and to make it a mandatory requirement for financial support to be granted to the individual investor.

Unified legislation for permission to use »ambient heat« for heating and cooling.

National, regional and local governments should work together to remove market barriers such as over-complicated administration requirements to achieve a permission to utilize heat pumps, and financial royalties or taxes on ambient heat.

EHPA suggest to make the installation of heat pumps much easier for those builders / constructors / investors that plan the installation of heat pumps with a minimum SPF by qualified and certified installers. Similarly the installation of ground-coupled heat pumps should made much easier when performed by certified drilling companies.

Funding schemes for research & development of heat pump technology and sustainable energy supply.

Research on heat pumps is performed inside companies. In order to further support these activities specific action is necessary within the European and national research agendas. EHPA recommends to open the research agenda on renewable energies to heat pumps. Specific tenders within FP7 should include basic research on the efficiency of the heat pump unit, the utilization of environmentally friendly refrigerants and the improvement of drilling technology.

Cross-cutting issues include the adjustment of heat pumps for ever reduced energy demand of passive or even plus-energy houses, thermal storage systems and the combined employment of heat pumps with other renewable energy sources.

EHPA supports specific research and dissemination support for activities towards a renewable energy mix for electricity production as the environmental performance of heat pumps is directly linked to the sustainability of electricity production

Incentive schemes for end users of heat pumps.

Heat pumps have gained over the years in terms of economic efficiency. However initially they are still considerably more expensive than fossil fuel based burners. Thus EHPA recommends incentive schemes that help to reduce this deteriorating effect. These schemes must be strongly tied to strict requirements such as

- an above average SPF
- high quality products (quality seal!), and
- certified installers.

Support could be granted in the form of

- financial grants to the end-user
- tax cuts (VAT or income tax reduction),
- the provision of low-interest financing options, and
- even the integration of heat pumps into a CO_2-trading scheme.

Experience from past incentive programs shows that they need to be designed appropriately, per-

manently managed and supported by information dissemination action. Programs that do not fullfill these requirements may do more harm than good to the market by inducing unreliable demand and by attracting lower quality manufacturers and less qualified installers.

The most important elements for success are

a) appropriate amount of support (ie.. a reduction of 10-15% of the initial investment),

b) continuity in time as well as

c) a transparent and simple application process.

EHPA supports the development of financial and institutional support schemes by national governments. However these measures should be explicitly encouraged within the upcoming EU directive on the share of renewables (RES-directive).

Heat pumps are based on a mature and widely available technology to utilize renewable energy sources (ambient heat from water, the ground, air and a multitude of waste energy sources) for heating and cooling. Heat pumps economic and technical efficiency as well as their environmental performance make it especially suitable to provide a major share of the energy needed for heating and cooling. Heat pumps can contribute to an independent, secure, cost efficient and environmentally friendly energy supply.

EHPA thus suggests to give special attention and support to this technology as outlined in the proposed heat pump action plan.

The successful execution of this action plan would help to face challenges such as energy autonomy (security of supply), climate change and local employment and would thus contribute the energy outlined in the green paper »A European strategy for sustainable competitive and secure energy«.

The proposed measures would create a stable legal and financial framework, this would improve investment conditions and create security the players in this market thus enabling the creation of a stable European industry. Such an industry would maintain technological know-how within Europe. As the entire world faces an energy challenge similar to that of Europe technology leadership with heat pumps will create an export opportunity and consequently create additional employment. Possible economies of scale would lead to reduced investment cost making heat pumps even more attractive.

6 Glossary of Terms

Active Cooling
A reversible heat pump offers heating and cooling. To achieve cooling, the heating cycle is reversed.

Adjustable Speed Drive
An electronic device that controls the rotational speed of motor-driven equipment such as fans, pumps, and compressors. Speed control is achieved by adjusting the frequency of the voltage applied to the motor.

Air-Source Heat Pump
A type of heat pump that uses outdoor air to heat the indoors during the heating season, and works in reverse during the cooling season. The heat gathered from an air source heat pump can be distributed via air (fan coil) or hydronic distri-

bution systems.

Ambient heat
«Ambient heat» is the ever-present energy stored in the air, surface water and shallow ground. Ambient heat is the result of natural processes. It can be transformed to useful heat by heat pump technology.

Brine-water Heat Pump
A geothermal heat pump that transfers heat from the ground to the heat distribution system. It is named after the brine that is used as transfer fluid in the ground-collector. A brine-water heat pump can use a vertical (drilling) or horizontal heat source (collector)

Vertical loop heat source
In a vertical ground loop a whole is drilled to a depth of around 100m. The heat exchanger (ie a double-U shaped PU tube is then installed into the whole and the remaining space is filled up.
. In summer time this type of heat pump can provide passive (free) and active cooling.

Cofficient of performance (COP)
The ratio of useful heat output (in kW) of a heat pump to the (electric) power input (in kW), at defined rating conditions (e.g. B0/W35, according to Standard EN 14511).
Horizontal loop heat source
In a horizontal ground loop a plastic pipe is laid out horizontally in a depth of 1,20m to 1,80m as the heat source. It collects ambient heat from the shallow ground.

Horizontal loop heat source
In a horizontal ground loop system a whole is drilled to a depth of around 100m. The heat exchanger (ie a double-U shaped PU) tube is then installed into the whole and the remaining space is filled up.

Renewable energy sources
«Renewable energy sources» means renewable non-fossil energy sources (wind, solar, geothermal, ambient heat, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases).

Water Source Heat Pump
A heat pump that uses ground or surface water as a heat source. The geothermal variant requires a source and a feed in well. Water source heat pumps are open loop systems.

Passive Cooling
Circulation of the working fluid to transfer heat from the floor/wall heating to the ground source heat exchanger bypassing the heat pump. This option is also called free cooling as only the electricity for the circulation pump is needed.

Seasonal performance factor (SPF)
The ratio of useful heat output (in kWh) of a heat pump system to the (electric) energy input (in kWh), averaged over an entire heating season (12 month).

Vertical Ground Loop
In a vertical ground loop a plastic pipe is laid out horizontally in a depth of 1,20m to 1,80m as the heat source. It collects ambient heat from the shallow ground.

Working fluid
An environmentally friendly fluid used to absorb and transfer heat energy.

European Heat Pump Association EEIG (EHPA)

EHPA was established in the year 2000 as a European Economic Interest Group to promote awareness and proper deployment of heat pump technology in the European market place for residential, commercial and industrial applications. EHPA aims to provide technical and economic input to European, national and local authorities in legislative, regulatory and energy efficiency matters. All activities are aimed at overcoming market barriers and dissemination of information in order to speed up market development of heat pumps for heating, cooling and hot water production.

More information can be found at http://www.ehpa.org

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