

EUROPEAN HEAT PUMP NEWS

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EHPA NEWS

Labelling of heat pumps has been an important aim of the Association since it was first proposed in the strategic study for the Directorate for Energy in 1997. In this issue we describe progress with agreeing a directive for awarding the European eco-label for heat pumps. In addition we review the state of progress on developing a range of new heat pump designs based on the use of natural refrigerants. In 2005, more than 300,000 ground source and air to water heat pumps were installed in Europe delivering annual electricity savings of 4 TWh and contributing 0.5% of the EU 2012 Kyoto target for carbon dioxide reduction. The availability of competent installers is a key requirement if the current annual compound growth rate of 20% is to be sustained.

The background

In 2002 the Member States agreed a directive to energy label room air conditioners, some of which can also operate in reverse mode and provide heating as well as cooling. This made heat pumps more vulnerable because some heat pumps are also reversible and so can provide space cooling as well as heating yet there was no intention of energy labelling this product group in the near future. So a request was made to Directorate for the Environment to eco-label heat pumps which was subsequently reinforced by a resolution in February 2006 of the European Parliament to ecolabel renewable heating and cooling systems.

Whereas the EU energy label classifies products into a number of classes of which A is the most efficient and G the least efficient, the eco-label defines a set of criteria for each product group which if met allows the product to carry the eco-label mark.

EU Ecolabel

- a voluntary label across the European Union, Norway, Liechtenstein and Iceland
- for goods and services, which have a lower environmental impact than similar products
- based on life cycle of the products, covers all impacts of the product to the environment, from the extraction of raw materials to product use and disposal



The drafting of the criteria for heat pumps has been a transparent one in that there have been a series of 4 ad hoc working group meetings involving interested parties and the Member States which have been convened by DG Environment's contractor SIS Miljo.

At the meeting of the EU eco-labelling board (EUEB) on 13 December, two drafts were placed before the Member States, one from the contractor and the other from the Commission. The latter draft was the preferred choice and amendments to the draft text are now required following the discussion at this meeting.

Labelling the unit as well as the system

As heat pumps will be the first *heating* system to be eco-labelled, a number of generic issues had to be resolved to ensure that the benefits of the unit are carried over to the installation of the system in a building including both the collector and distribution systems. The Commission's proposal adapts a concept from the EU energy label which comprises two parts the multi coloured label itself and an information fiche.

The draft eco-label directive proposes –

- the ecolabel which covers the heat pump unit as manufactured by the producer
- the information fiche which is completed by the installer and given to the customer at point of sale; this describes the heating or heating/cooling system based on information supplied by the manufacturer (or his importer) and the installation of the heat pump unit in a particular dwelling whose thermal characteristics are known
- The eco-label award can only be achieved if both sets of criteria are met.

The draft text therefore clarifies the obligations of the manufacturer and the installer so recognising that both are responsible for ensuring that the ecolabel criteria are met.

Environmental criteria

The major environmental impact of the heat pump is the energy (generally electricity but may sometimes be gas) that is used to concentrate the heat stored in the ground, air or water.

The second criterion is the choice of *refrigerant*, which should have both a low ozone depletion potential and low global warming potential. The EU fluorinated gas directive places bans on the use of certain types of such gases and their use is likely to be further restricted in 2008. This is the major influence in developing heat pumps using natural refrigerants and why the EHPA is helping to coordinate the SHERHPA project (see article below).

The third criterion restricts the use of specific hazardous substances.

Setting threshold values for these criteria

The simplest way of defining the efficiency of a heat pump unit is the ratio of heat produced to energy consumed, that is its *coefficient of performance* (COP). When the heat pump is used in *cooling* mode, that is extracting heat from a room or dwelling and transferring this heat to the outside air, ground or water, the ratio of heat extracted/energy consumed is called the *energy efficiency ratio* (EER).

There are two European sources of data for the efficiency of heating and cooling

- the DACH criteria, which have been developed by the heat pump industry in Germany, Switzerland and Austria and cover heat pumps operating in heating mode; these criteria cover all types of heat pump except air to air
- the energy classification as set out in the EU directive for room air conditioners covering air to air and air to water models for both cooling and heating modes

The draft text is based on the use of the DACH values and the A class threshold values for room air conditioners. However discussion at the EUEB meeting suggests that these should be enhanced to take into account technical advances since 2002.

Refrigerants

Whilst a threshold value has been proposed for the global warming potential of the refrigerant, a proposal has been put forward at the EUEB meeting to reward manufacturers using natural refrigerants by setting lower thresholds values at the present time. This suggestion is very relevant to the research being undertaken by the SHERPHA project in which it has become clear that compressor manufacturers are unwilling to develop rotary or scroll compressors for natural refrigerants at the present time due to the perceived lack of market. Such types are generally more efficient than reciprocating compressors.

Other requirements

These cover measurement of noise, provision of parts, documentation, training of installers and supply and completion of the information fiche.

Information fiche for installers

The manufacturer is required to supply relevant information in the form of guidelines, tools and software to enable the installer to design the heating or heating/cooling *system*. The installer has to decide for each building which will be the most appropriate heat collector system that is air, ground or water and this is dependent upon both the size and geographical location of the building.

The choice of distribution system is very dependent upon the nature of the building and whether there is already an existing distribution system in place. The efficiency of the heat pump is dependent upon the uplift temperature that is the difference between the temperature of the source and the distribution temperature. So low temperature distribution systems like warm air or underfloor heating will have a higher efficiency factor.

The draft text follows the requirements of the *energy performance in building* directive in requiring the installer to calculate the heat loss of the building and to consider the cost effectiveness of adding any further insulation in accordance with current building regulations. If the heat pump can also be used in cooling mode, then a calculation of the solar gain is required. Having completed these calculations, the installer is required to recommend cost effective measures to reduce the heat loss and solar gain *before* sizing the heat pump system.

System calculations require the installer to calculate the seasonal performance factor, the carbon dioxide emissions associated with the energy use and the amount of renewable energy that will be utilised by the heat pump system. This will enable a *competent* installer to design the heating or heating/cooling system so that the benefits of the eco-labelled unit are carried over to the system. This in turn will benefit the customer, society and the environment and will help to limit the impact of global warming.

Information fiche for customers

The installer is in turn required to complete an information fiche and give to the customer *before* completing the sale and installing the system. This information should be regarded as complementing the quotation which the installer will supply for the new installation.

At the same time this fiche can also form part of the information pack and energy performance certificate that is required by the Energy Performance in Building Directive when buildings are constructed, rented or sold.

Likely timetable

A number of issues were raised by the Member States and interested parties at the EUEB meeting which will need further consideration. These include reduction in fees for micro-enterprises and whether gas heat pumps should be included within the scope of the directive.

Whilst DG Environment has yet to decide the next step, it is likely that a revised draft will be circulated by the end of January including inter service consultation with a view to taking a formal vote in April 2007.

Competent installers

The proposed directive relies on the availability of competent installers who are able to both design and install such systems. This is viewed by the Association as an essential step in gaining confidence in the technology and to achieve sustainable growth.

The idea of an EU competent installer was discussed at a workshop organised by Arsenal Research in Vienna in early October. At this workshop the recommendations of the EU-CERT project were discussed and it was agreed to set up EHPA education and accreditation boards. The first chairperson will be Bengt Sandström of Mitthögskolan Härnösand, Sweden.

New regulations for propane heat pumps

Synopsis of a report written by José Miguel Corberán Salvador and Beatriz Gómez – UPV, Valencia; a copy can be downloaded from the Sherpha portion of the EHPA website.

Since natural refrigerants were substituted by the non-flammable refrigerants during the 1930's, mainly for safety reasons, CFC's became the state of the art in refrigeration systems. Nowadays, however, the knowledge of the environmental impact of the use of CFC's, HCFC's and HFC's refrigerants has led to the renewed interest in natural fluids like ammonia, CO₂ or HCs, which are particularly well suited to develop future environmentally friendly air-conditioning /refrigeration systems.

Despite the favourable performance from a thermodynamic and chemical point of view, HCs are highly flammable, so additional safety considerations become necessary. In this field, the great amount of information that exists on the risks and benefits of flammable refrigerants is highly fragmented. The modification of the current standards to include safety requirements for use of these refrigerants has been under continuous evolution and discussion during the past decade.

Typically ISO and CEN standards (for example EN 378 or ISO 5149) are 'horizontal' standards which mean that they are generic and apply to all RAC equipment and installations. IEC and CENELEC standards are specific to appliances where they deal with specific safety issues associated with a type of appliance and are also 'horizontal' standards.

EN 378:2000, at European level, covering safety and environmental requirements, and ISO 5149:1993 safety standard for mechanical refrigeration systems, at International level, are the 'horizontal' standards available in this field. EN 378:2000 includes the use of flammable refrigerants. However, it is not harmonised with the European Pressure Equipment Directive (PED), so a working group is currently working on the forthcoming revision prEN 378:2005, whose draft is now out for vote and will be harmonised to PED and MSD (Machinery Safety Directive) and will provide a method to avoid ATEX (Explosive Atmosphere Directive).

ISO 5149:1993 is not yet available for flammable refrigerants, but there is currently a new draft including them.

The most usual case for household air conditioners is an indoor application in an unventilated room, at least the evaporator part of the system. For the case of a sealed, packaged air conditioner, a comparison among the different standards is made between the horizontal standards ISO 5149 and EN 378 and the appliance standard IEC 60335-2-40 including the minimum floor requirements for a given room area. For example, for a propane charge of 500 g, approximately 400 m² of room area is necessary to satisfy IEC, ISO and prEN standards while only 40 m² approximately is mandatory in the other standard.

The reason for such big differences in the required room area is that formulae for maximum charge calculation in the case of human comfort appliances are based on maybe quite unrealistic assumptions. Although each of a number of circumstances may occur, the probability of all these occurring simultaneously is very low. Most catastrophic leaks tend to progress from small leaks, so much of the refrigerant will have already been released, given the pressure difference between refrigerant and atmospheric sonic flow of mixed-phase normally occurs and because this causes good mixing, the release direction is irrelevant.

Also, virtually all room is subject to some air movement.

With regard to hermetic compressors, the PED directive now in force in Europe classifies the flammable refrigerants fluids in Group 1, implying considerably increased requirements from a certain size in comparison with non-flammable refrigerants. This ensures that in practice no hermetic compressor is available for household and small air conditioners. They are only available for small equipment with charges below 150 g. This does not affect open and semi hermetic compressors which are available for a greater capacity range.

Progress with natural refrigerant heat pumps

The SHERHPA project held its third workshop in Vienna immediately prior to the workshop on EU competent installers. Three prototype systems were presented –

- Andreas Bangeri (Heliotherm) described a small 3 kW system to provide domestic hot water and space heating for well insulated small dwellings; by using carbon dioxide as the refrigerant, water temperatures up to 90° C could be achieved
- Miguel Zamora (Ciatesa) described a reversible heat pump system using propane as the refrigerant; the first unit has now been installed in the Renewable energy Building in Barcelona
- Richard Freeborn (Kensa) described the evolution of air to water and water to water heat pumps also using propane

A further eight systems are under development including two heat pumps using ammonia. Each system involves collaboration between a manufacturer and two research and technology providers. The consortium involves 31 partners across 10 European countries including the Ukraine.

The next workshop will be held at the University of Padua on Friday 30 March

First Sherpha training course

The first short course will be held in Lyon on 25/26 January and will cover the theory and design of heat pump systems using carbon dioxide. The course will cover theory, design and practical aspects of the use of CO₂ for heat pump applications. Applications will include case studies by industry on heat pumps for water heaters, space heating, automotive air conditioning and CO₂ ground loop collectors. Invited experts from research institutes and industry will contribute as well as the SHERPHA partners.

For further information or to enrol, please contact Bernard Thonon (bernard.thonon@greth.fr) or Ahmed Bensafi (ahmed.bensafi@cetiat.fr).

Micro renewables cannot solve climate change

In a widely quoted article published in New Scientist on 3rd October, George Monbiot concluded with the sweeping statement that 'micro generation devices (including heat pumps) are overhyped and will have the opposite effect to waking people up to green issues, namely that manufacturers claims are excessive and that people buying such systems are wasting money as the systems will not be cost effective'.

As Winston Churchill once remarked, with friends like these who needs enemies!

The reality is much different and it is clear that there is an enormous potential for micro-renewable sources attached to the home. Fortunately the UK Treasury has not accepted his arguments and has just made available a further £80 million in grants for micro-renewables.

It is accepted by everyone in the micro-renewable industry that trained installers are the key to sustainable exploitation. It does mean that installers will have to be much more versatile in future and be able to recommend and install various types of heating and cooling systems.

Kyoto in the home

This project is raising awareness of the potential for installing micro renewables into the home through providing relevant information of the different types of sources and which might be suitable for ones home. The renewable technologies include those that can heat and cool as well as generate electricity.

It is stressed that the starting point for considering any renewable installation is to ensure that the dwelling is well insulated so that the heating system is always sized for the reduced heat loss. Conversely the solar gain is reduced through the use of passive architecture such as shutters and awnings. This is essential for renewables as passive insulation or architecture is almost always cheaper as it has zero running cost.

Two resources are being developed

- for teachers and students a set of practical activities which will help them to understand the basic principles and application of micro-renewable sources
- for families, web based modules for each technology with advice on where to gain additional information

The school resources are being translated and will be trialled this spring and summer in 10 European countries namely United Kingdom, France, Italy, Spain, Czechia, Hungary, Poland, Romania, Slovakia and Estonia. So members of the EHPA will be able to help with providing advice or links.

The next workshop will be held on 21 February will be organised by Unita Ambiente, Cita di Bologna

Reading University installs a heat pump system

The new student services building at the University will be heated by a geothermal heat pump system. Some 24 boreholes 100 metres deep have been bored at 5 metre centres adjacent to the building. The heat pump will have sufficient capacity to heat the entire building of 2000 square metres and will provide passive cooling during the summer. Maximum use is also being made of natural ventilation to reduce any need for cooling to a minimum.

What makes this choice interesting is that the installation has a cheaper initial cost than a gas fired boiler. This confirms the long held belief by the editor of this newsletter that heat pump systems are cost effective in the United Kingdom compared with gas if the correct decisions are made by the client, architect and installer working closely together.

The interesting question is whether retrofitting to the other existing buildings on the Campus will also be cost effective and whether other Universities and schools could benefit from such renewable installations.

Calendar

- January 25/26** Short course on theory and design of heat pump systems, Lyon, France.
Contact bernard.thonon@greth.fr or ahmed.bensafi@cetiat.fr
- February 21** Kyoto in the home workshop on Application of micro-renewables to the home, Unita Ambiente, Bologna, Italy.
Contact francesco.tutino@comune.bologna.it
- 30 March** Sherpa workshop on use of natural refrigerants for heating and cooling buildings, University of Padua, Italy.
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