BEUC and EEB comments on the fourth draft criteria for the European Eco-label for heat pump systems (Draft of 1 September 2006)

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General comments

Information provided by organisations such as the International Energy Agency and the UK's Energy Saving Trust show that although heat pumps have important environmental impacts themselves, they also have great potential to reduce CO2 emissions. According to the International Energy Agency (IEA – see Annex 1 of this document for more information), heat pumps have the potential to reduce global CO_2 levels by 1.2 billion tonnes – or 6% of global emissions (on 1997 figures). The UK's Energy Saving Trust (see Annex 2 for more information) identifies two main environmental impacts of heat pumps:

- Pollution from using national grid electricity generated through fossil fuel
- The global warming potential of the refrigerants used in the system

Given the importance of these two elements of heat pumps, the order of the key criteria should be reconsidered, so that these are addressed before lesser important criteria. The fourth draft document begins with criteria on noise, which we consider important but not worthy of being addressed first.

Detailed comments on individual articles and criteria

Article 1

We propose the simplification of wording for this article. The European Heat Pump Association suggested the following wording earlier in this criteria development process:
'The product group shall comprise "heat pump systems" which can concentrate low grade heat present in the air, ground or water into useful heat for either the supply of space heating or hot water for a building. Alternatively such systems can extract high grade heat present in a building and reject this as low grade heat to the air, ground or water thus resulting in space cooling.'

BEUC and EEB are happy to support this simplified wording.

Article 2

The statement that *'other laboratories than those accredited for the relevant test methods can be accepted'* should be omitted from the criteria. The eco-label aims to support ecological product development, therefore it should take care to base decisions on relevant and accurate input data. Accredited laboratories have the necessary equipment and skills and are also independent, guaranteeing high quality of the input data to the eco-label. If other laboratories are accepted, the variation in quality of data will likely result in larger deviation in data and situations can occur where test data from one laboratory is always more in favour of the manufacturer than other laboratories. We do not mean that laboratories manipulate in order to provide services for their customers, rather equipment used and knowledge about uncertainty of measurement will deviate more if non-accredited laboratories are allowed. Further, test laboratories work on a common European market, where the manufacturer does not need to perform the tests at their "home" institute or laboratory, thus there is no need to have a special rule if there is no accredited laboratory in the home country.

Aims of the criteria

The second aim of the criteria appears too general by addressing *'the efficiency of heating buildings'*, since this includes many factors beyond the heating appliance in question. We suggest that this be narrowed to *'the use of efficient heating appliances in buildings'* and continue the sentence as it is now.

Criterion 1: Noise

Before addressing the actual issue of noise, we want to repeat one point in the General Comments at the start of this position paper. Although noise is an important issue, and we are pleased to see a criterion addressing it, we do not think that it is one of the main impacts of heat pumps and therefore should not be the subject of the first criterion. We suggest that noise be addressed after the criteria relating to efficiency and refrigerant, before design and materials.

Turning to the draft text on this criterion. It is not enough that sound power levels be tested and stated. Noise features as part of the EU's 6th Environmental Action Programme (6EAP), aiming 'to reduce noise pollution to acceptable levels' (see Annex 2 for more information).

Additionally, consumer organisation tests for such appliances include an assessment of noise levels. The most recent example of this (January 2006, not supplied here, but available on request) is in a Test-Achats (Belgian consumer organisation) report on wall-mounted condensing boilers. Noise is tested, the aim of which is to detect elements of noise that are not necessarily loud, but that can still be annoying (a weak hiss might not be loud but it can still be annoying). Their evaluation is based partially on the level of noise but also the impression of the testers. The 'subjective' impression is usually considered more priority since, in the end, it is not a number (which hides a spectrum of frequency) that gives the final rating of the appliance, but the ear of the users.

As noise is still a relatively undeveloped policy area, and is an annoyance that varies from person to person, the ecolabel should at least address the noise volume (sound power) of the product. The World Health Organisation has produced guidelines (see Annex 2) that give dB limits to *sound pressure* (noise emitted by the appliance where it is installed). SP Swedish National Testing and Research Institute have undertaken sound power tests on different heat pumps, with results shown in the table below. The aim of the ecolabel should be to encourage lower levels of sound power, but BEUC and EEB cannot yet suggest any absolute limiting figures. We welcome input from industry, according to informed design knowledge and effects on noise levels.

The ecolabel on refrigerators restricts sound power to no higher than 40dB. This figure is possibly too strict for heat pumps, especially as heat pumps are not always installed in living areas. Ground-source heat pumps are often installed in a basement or similar parts of the building where you do not normally stay. Whereas air-to-air heat pumps are normally installed in the living space of the building.

Type of heat pump	**SP Swedish National Testing and Research Institute mean test results, and range of results**
Air-to-air heat pump, indoor unit	54 dB (49-58) 12 units
Air-to-air heat pump, outdoor unit	60 dB(58-63) 12 units
Ground-source heat pump	53 dB (50-57)6 units

Based on the above test results, we suggest that a simplified noise level be established for all units, whether for indoor or outdoor installation. We suggest a dB level of 52, which represents a mean-minus-one for 2 of the 3 types of units tested.

Criterion 2: Refrigerant

Given that refrigerants are one of the two main environmental impacts of heat pumps, we cannot agree to a refrigerant GWP limit of 3500. We believe that the use of high GWP HFCs should be reduced for a number of reasons:

- If released into the atmosphere, they have a significant impact on global warming.
- The energy and emissions involved in manufacture and distribution of refrigerants is significant - typically about 12% of its GWP, plus the emissions associated with handling, transporting, decanting, etc.
- During manufacture, certain intermediate stages involve the production of HCFCs (e.g. HCFC 133a in the case of R134a); these inevitably leak out and therefore HFCs have in "indirect" ODP associated with them.
- One of the decomposition products of HFCs in the atmosphere is trifluoroacetic acid (TFA), which - although played down by the chemical manufacturers - is bioaccumulative and is believed to cause harm to certain plants and animals, since it is rained out of the atmosphere.

Therefore, we propose that the GWP of refrigerants should be limited to a maximum of 150. The figure of 150 (which is consistent with the limit in the f-gas directive for car air conditioning) still allows some

HFCs, such as R152a, and new fluorocarbon blends from some refrigerant manufacturers, rather than allowing only natural refrigerants.

If a higher GWP refrigerant is to be used, then the maximum should be 2000, but in this case the SPF must be significantly higher. A report from Nordic Ecolabelling shows that the highest SPF achieved in tests of heat pumps was 3.5, so the ecolabel should specify a value of SPF = 3.3. Discussions with large European heat pump manufacturers confirmed that it is easy to achieve high efficiency heat pumps at no extra cost.

We also suggest that the next revision should address the major reduction in GWP of refrigerants by restricting these to natural refrigerants only.

Criterion 3: Cooling medium/secondary refrigerant

Environmental, physical and health hazardousness of the cooling medium/secondary refrigerant is an important issue to address in the ecolabel. However, the criterion only requires that this not be classified as an environmental or health hazard. The assessment and verification requirement for health hazard classification should be made clearer, since it vaguely relates to 'relevant regulations'.

Also, the criterion does not address hazardousness levels, which a future revision should consider as a priority issue.

Criterion 4: Coefficient Of Performance (COP)

According to Article 1, heat pumps heating sanitary hot water are within the scope of this eco-label, as well as gas driven heat pumps. Therefore, the relevant test standards must be stated. The relevant standard for sanitary hot water testing is EN 255-3. Also, as we have asked several times, the test standard for gas-motor driven heat pumps must be specified (DIN 33831, Part 1 and 2).

Criterion 5: The heat production efficiency, SPF_{prod}

This criterion aims at determining and limiting the "Seasonal Performance Factor" and thus we think the criterion should be called that and not "heat production efficiency". Seasonal Performance Factor is the term most widely used and also we think it should be renamed as the criterion no more deals with the total efficiency from primary energy source to useful heat in the building.

We also find the suggested limits to the Seasonal Performance Factor to be too low, particularly as almost all heat pumps will pass the current limits. The third discussion draft of the criteria included a Primary Energy Ratio of 2.5 kWh of primary energy per kWh of produced electricity (according to the EU Directive on Energy End-Use Efficiency). A good environmental target for heat pumps would be to achieve a total efficiency (from primary energy source to useful heat in the building) of more than 100%. With the suggested PER this occurs when the Seasonal Performance Factor of the heat pump is larger than 2.5. Thus we suggest that all heat pumps must achieve an SPF of at least 2.5.

It must be more specifically described how to determine the Seasonal Performance Factor, including which method and input data to use. In the background report from SVEP (Heat pumps – technology and environmental impact) examples are given of different calculation programs and methods. One other possibility is to use the method developed by CEN in the course of the standardisation work performed for the European Performance of Buildings Directive, prEN 15316-4-2, which is currently out for Formal Vote. However, the problem for this standard is the same as for any other method as described below.

In the current ecolabel draft criteria it is stated that "The applicant have the possibility to use an own calculation program. The test results shall be used. In such cases the program shall be verified by the independent laboratory". No matter if only one method is allowed or if the manufacturers' programmes may be used, the criteria do not clearly state the boundary conditions for the calculations, which make the current criterion wording useless.

Necessary boundary conditions are:

- Climate (outdoor air temperature)
- Dimensioning Outdoor Temperature
- The variation of the ground-temperature over a year (for ground-source heat pumps, both with vertical and horizontal collectors)
- Desired temperature indoors
- Temperature level of hydronic heating systems
- Annual energy demand for space heating

- Annual energy demand for domestic hot water

These conditions must be stated for each of the prescribed climate zones. If allowing institutes and competent bodies in different countries to apply their own input data and calculation methods the result will probably vary considerably depending on where the application for an ecolabel is handled. This will result in the loss of transparency, and therefore credibility, for this particular ecolabel.

Criterion 6.1: Construction for refrigerant with GWP > 100

The construction of the heat pump is important, particularly as the aim of the ecolabel is to reduce climate change impacts which can result from leakage in the system during usage and as a result of poor installation.

The criterion on construction should apply to all heat pumps, regardless of refrigerant GWP level, and should aim to reduce leakage as much as possible. Leak data from supermarket systems show that flare connections are responsible for 30 – 40 times more leakage than brazed connections. As an example, a refrigeration system with 20 connections can reduce leakage from around 20% to 5% by using brazed, instead of flared, joints. Therefore we propose that brazed connections be required, and where this is not possible, that a maximum of 2 flared connections per system be allowed.

We also propose that all components used in the system must conform to prEN YYYY, on Refrigerating systems and heat pumps — Qualification of tightness of components (once it is published) and must be subject to the leakage tests prescribed in EN 378-2, Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation.

Criterion 7: Competence

Omit the sentence stating that "If the application contains a refrigerant with a GWP-factor > 100 a competent installer shall always install the heat pump, if the circuit will be open". No matter which refrigerant used or design of the unit, it must always be installed by a competent installer. If installed in the wrong way the unit may malfunction or use more electricity than necessary due to lower efficiency. This is always a draw-back both for the user as well as the environment. The installer must always be competent. Without a standard on certification, this criterion cannot be implemented in a regulatory setting. Therefore, we suggest this criterion be deleted and that the importance of the competence of the installer be clearly communicated in the user manual.

Criterion 9.2: Installation manual and maintenance instruction

Given the potential environmental impacts of poor installation and inefficient use of the heat pump, we agree with the subjects in the list of bullet points provided in the 4th discussion draft of the criteria.

Two modifications we suggest are that the third bullet point on the information provided in the manual, 'emphasise the importance of installation…' should explicitly mention that this is due to refrigerant leakage and inefficient system setting.

Additional maintenance instructions should inform users on how to change settings in the control systems as well as a trouble-shooting scheme. These should of course specify which items can be changed by the owner and which items must be changed by the installer/retailer only.

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Annex 1

Key data from the International Energy Agency's Heat Pump Centre website

(http://www.heatpumpcentre.org/)

How heat pumps achieve energy savings and CO_2 emissions reduction - an introduction

- if the fuel used by conventional boilers were redirected to supply power for electric heat pumps, about 35-50% less fuel would be needed, resulting in 35-50% less emissions;
- around 50% savings are made when electric heat pumps are driven by CHP (combined heat and power or cogeneration) systems;
- the fuel consumption, and consequently the emissions rate, of an absorption or gas-engine heat pump is about 35-50% less than that of a conventional boiler.

A large and worldwide potential

Of the global CO2 emissions that amounted to 22 billion tonnes in 1997, heating in building causes 30% and industrial activities cause 35%. The potential CO2 emissions reduction with heat pumps is calculated as follows:

- 6.6 billion tonnes CO2 come from heating buildings (30% of total emissions).
- 1.0 billion tonnes can be saved by residential and commercial heat pumps, assuming that they can provide 30% of the heating for buildings, with an emission reduction of 50%.
- A minimum of 0.2 billion tonnes can be saved by industrial heat pumps (estimation based on a study by Annex 21).

The total CO2 reduction potential of 1.2 billion tonnes is about 6% of the global emissions! This is one of the largest that a single technology can offer, and this technology is already available in the marketplace. And with higher efficiencies in power plants as well as for the heat pump itself, the future global emissions saving potential is even 16%.

Key data from the Energy Saving Trust website

http://www.est.org.uk/myhome/generating/types/groundsource/

Are there any environmental impacts?

The main environmental impacts are:

• **Pollution from using national grid electricity generated through fossil fuel.** Measures can be taken to reduce these impacts - for example, you could purchase dual tariff green electricity from a choice of energy suppliers. However, even if national grid electricity is used to run the compressor, the system will still produce less CO2 emissions than even the most efficient condensing gas or oil boiler with the same output.

• **Use of refrigerants in the system.** Refrigerants are present in GSHP systems and can pose a threat to the environment through being toxic, flammable or having a high global warming potential. However, new types and blends of refrigerant with minimal negative impacts are being developed. A correctly fitted system will also greatly reduce the potential for leakage, which is why using a professional installer is highly recommended.

Annex 2

EU's 6th Environmental Action Plan noise objectives

According to the Commission's Communication on the 6EAP: 'In Europe, noise is a growing problem that is estimated to affect the health and quality of life of at least 25 % of the EU population. It raises stress levels, disrupts sleep and can lead to an increased risk of heart disease.' The objective in the 6EAP relating to this issue is 'To achieve a reduction of the number of people regularly affected by long term high levels of noise from an estimated 100 million people in the year 2000 by around 10% in the year 2010 and in the order of 20% by 2020.

WHO factsheet on occupational and community noise

http://www.who.int/mediacentre/factsheets/fs258/en/

WHO has developed and promoted the concept of noise management, and drawn up community noise guidelines. The field is marked by a scarcity of literature, especially for developing countries. Some 20 years after its last publication on noise, WHO has issued Guidelines for Community Noise. This publication, the outcome of a WHO expert task force meeting in London in March 1999, includes guideline values for community noise (listing also critical health effects ranging from annoyance to hearing impairment), for example: (ref Guidelines p. XVIII)

Environment	Critical health effect	Sound level dB(A)*	Time hours
Outdoor living areas	Annoyance	50 - 55	16
Indoor dwellings	Speech intelligibility	35	16
Bedrooms	Sleep disturbance	30	8
School classrooms	Disturbance of communication	35	During class
Industrial, commercial and traffic areas	Hearing impairment	70	24
Music through earphones	Hearing impairment	85	1
Ceremonies and entertainment	Hearing impairment	100	4

*The ear has different sensitivities to different frequencies, being least sensitive to extremely high and extremely low frequencies. (ref Fundamentals of Acoustics p. 19) Because of this varied sensitivity, the term "A weighting" is used: all the different frequencies, that make up the sound, are assessed to give a sound pressure level. The sound pressure level measured in dB is referred to as "A-weighted" and expressed as dB(A). (ref Guidelines p.IX and X).

The guidelines also offer recommendations to governments for implementation, such as extending (and enforcing) existing legislation and including community noise in environmental impact assessments. The role of WHO is to provide leadership and technical support.