

Labelling and certification of HVAC products

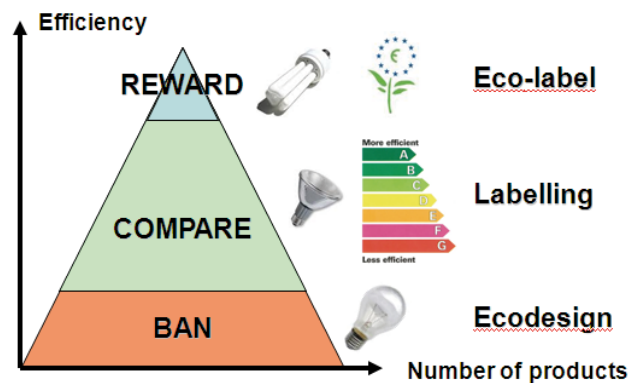


Figure 1. Overview of EU regulations regarding energy efficiency of products.

Introduction

For some years now, the European commission has pushed for energy efficient products to be sold on the European market. Currently three types of initiatives are pushing in this direction:

- The Ecodesign Directive (2005/32/EC and recast 2009/125/EC) on Energy Related Products (ErP) which aims to set minimum energy efficiency requirements for products sold in the European market.
- The Energy Labelling Directive (92/75/EEC and recast 2010/30/EU) which aims to set uniform labels for products of the same type.
- The Ecolabel Directive which aims to reward the most energy efficient products. The two first directives are closely linked as they cover identical product groups. The last one is a voluntary scheme and concern few products within the HVAC sector.

This article will first provide an overview of current and future EU product labelling related to the HVAC sector. Then an overview of current voluntary energy labels that are established by voluntary certification schemes which preceded and/or complete the EU labels is presented. Finally interactions between private voluntary labels and mandatory EU labels are assessed.

EU energy labels

EU regulation on energy labels is dealt by the so-called “Energy Labelling” directive (Council Directive 92/75/EEC¹) and the subsidiary directives. The first set of directives arose in the 1990s and in the beginning of the century. The products concerned by these directives were, at that time, only household appliances like dishwashers, refrigerators, lamps, etc. The only products within the HVAC&R industry impacted by this first set of directives were the household air-conditioners (Commission Directive 2002/31/EC²) with a cooling capacity up to 12 kW.

A recast of this labelling directive was published in 2010³. The scope of this new directive was extended to energy related products which have a significant impact on the consumption of energy. This new directive together with the Ecodesign directive and the

1 Council Directive 92/75/EEC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0075:EN:NOT>
 2 Commission Directive 2002/31/EC, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0031:EN:NOT>
 3 Directive 2010/30/EU, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0001:01:EN:HTML>

Ecolabel regulation forms a complete European regulation scheme:

- Ecolabel regulation allows rewarding the most environmental friendly products;
- The labelling directive allow comparing products on an energy efficiency basis with a comprehensive A to G scale;
- Ecodesign aims at banning the less efficient products on the market.

Residential air conditioners

These products which were already concerned by the first set of Labelling directives were also the first product from the HVAC&R family to be concerned by the recast of this directive. The legal document has not been published yet (September 2011) but is likely to be in the following months. The scope of this directive still covers air-conditioners up to 12 kW in cooling capacity. Cooling only and reversible units are both covered. Contrary to the previous legislation, the energy efficiency is based on seasonal efficiencies: Seasonal Energy Efficiency Ratio (SEER) in cooling mode and Seasonal Coefficient of Performance (SCOP) in heating mode (see the corresponding label in **Figure 2**). This seasonal efficiency is calculated by integrating the efficiency of the product over all the cooling (res. heating) season. This method will be soon standardized in the up-coming new version of CEN standard EN14825.

It has to be noted that in heating mode three different climates are considered: warm, average and cold climates which corresponds to Athena, Strasbourg and Helsinki Climates respectively.

Water boilers and heaters

The corresponding directive has not been published yet. The scope covers all types of water boilers and water heaters including biomass, solid fuels, gas and heat-pumps. This label will therefore be able to compare units with different technologies having the same purposes. As for air conditioners, the energy grade is given for three standard climates (see corresponding label in **Figure 3**). For heat-pumps the energy class is based on the SCOP.

EU energy labels in preparation

Other HVAC products are likely to be covered by an EU energy label in the near future:

- Exhaust and balanced ventilation systems;
- Air conditioners with a cooling capacity higher than 12 kW (including rooftop units);
- Chillers;
- Air handling units;
- Fan Coils.

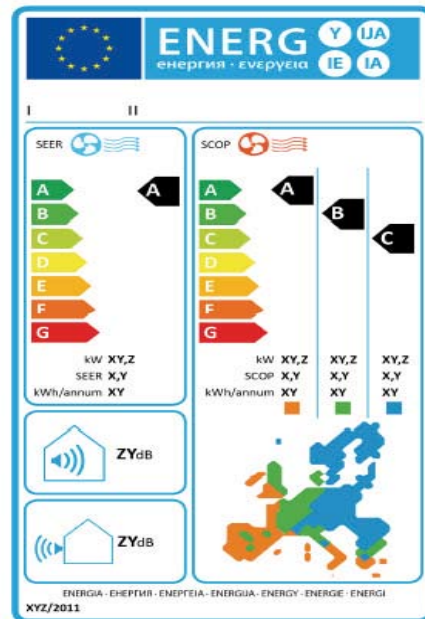


Figure 2. Proposed European Label for residential air conditioners.

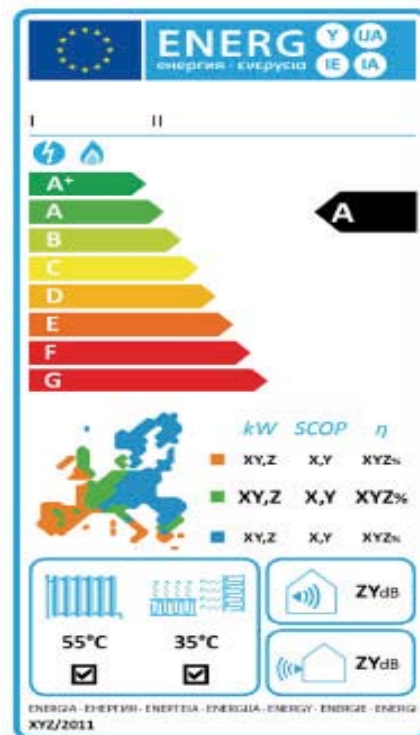


Figure 3. Proposed European Label for water heaters.

It is to be noted that all type of functions will be considered (ventilation, heating, cooling). Some products may then be covered by several directives as they can cover more than one function.

Voluntary energy labels

The European commission is not the solely body to develop energy labels. In the HVAC&R industry some organisms created voluntary labels in order to promote energy efficient products. This is the case of Eurovent Certification which put in place several labels in the past few years.

Chillers and hydronic heat-pumps

As soon as 2004 Eurovent certification defined energy efficiency classes for chillers and hydronic heat-pumps based on Energy Efficiency Ratio (EER) and Coefficient of Performance (COP) at standard conditions (see corresponding label and the definition of the energy classes in **Figure 5**).⁴ This system covers both air-source and water-source units.

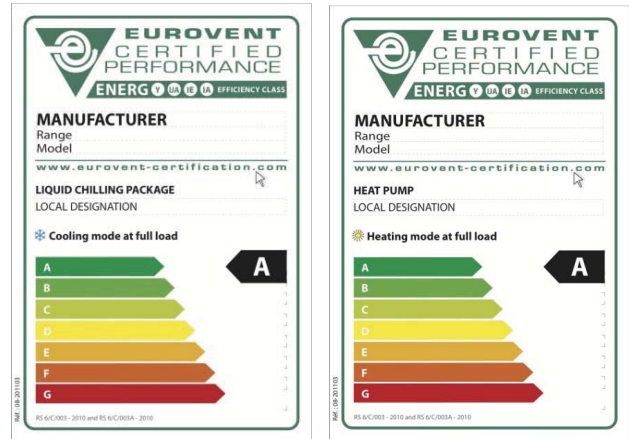


Figure 4. Eurovent Certification Chillers and hydronic heat-pumps labels.

Heat exchangers for refrigeration

Eurovent Certification Energy classes for Air cooled condensers units and Dry coolers were defined in 2005. The one for Dx air coolers arose in 2011. The energy efficiency is based on the energy ratio R which is equal to the nominal capacity in kW divided by the total power input of the fan motors in kW at standard rating conditions.

4 Eurovent Certification Company, <http://www.eurovent-certification.com/>

Cooling Mode					
Air-cooled condenser on roof	Air cooled condenser in a duct	Air-cooled, Floor *	Water-cooled	Water-cooled	EER Class
LCP/A/././N/..	LCP/A/././D/..	LCP/A/././N/..	LCP/W/././N/..	LCP/W/././N/..	
Air conditioning application	Air conditioning application	Cooling Heating Floor application	Air conditioning application	Cooling Heating Floor application	
≥ 3.1	≥ 2.7	≥ 3.8	≥ 5.05	≥ 5.1	A
2.9 ≤ EER < 3.1	2.5 ≤ EER < 2.7	3.65 ≤ EER < 3.8	4.65 ≤ EER < 5.05	4.9 ≤ EER < 5.1	B
2.7 ≤ EER < 2.9	2.3 ≤ EER < 2.5	3.5 ≤ EER < 3.65	4.25 ≤ EER < 4.65	4.7 ≤ EER < 4.9	C
2.5 ≤ EER < 2.7	2.1 ≤ EER < 2.3	3.35 ≤ EER < 3.5	3.85 ≤ EER < 4.25	4.5 ≤ EER < 4.7	D
2.3 ≤ EER < 2.5	1.9 ≤ EER < 2.1	3.2 ≤ EER < 3.35	3.45 ≤ EER < 3.85	4.3 ≤ EER < 4.5	E
2.1 ≤ EER < 2.3	1.7 ≤ EER < 1.9	3.05 ≤ EER < 3.2	3.05 ≤ EER < 3.45	4.1 ≤ EER < 4.3	F
< 2.1	< 1.7	< 3.05	< 3.05	< 4.1	G
Heating Mode					
Air-cooled condenser on roof	Air cooled condenser in a duct	Air-cooled, Floor *	Water-cooled	Water-cooled	COP Class
LCP/A/R/./N/..	LCP/A/R/./D/..	LCP/A/R/./N/..	LCP/A/R/./N/..	LCP/A/R/./N/..	
Air conditioning application	Air conditioning application	Cooling Heating Floor application	Air conditioning application	Cooling Heating Floor application	
≥ 3.2	≥ 3.0	≥ 4.05	≥ 4.45	≥ 4.5	A
3.0 ≤ COP < 3.2	2.8 ≤ COP < 3.0	3.9 ≤ COP < 4.05	4.15 ≤ COP < 4.45	4.25 ≤ COP < 4.5	B
2.8 ≤ COP < 3.0	2.6 ≤ COP < 2.8	3.75 ≤ COP < 3.9	3.85 ≤ COP < 4.15	4 ≤ COP < 4.25	C
2.6 ≤ COP < 2.8	2.4 ≤ COP < 2.6	3.6 ≤ COP < 3.75	3.55 ≤ COP < 3.85	3.75 ≤ COP < 4	D
2.4 ≤ COP < 2.6	2.2 ≤ COP < 2.4	3.45 ≤ COP < 3.6	3.25 ≤ COP < 3.55	3.5 ≤ COP < 3.75	E
2.2 ≤ COP < 2.4	2.0 ≤ COP < 2.2	3.3 ≤ COP < 3.45	2.95 ≤ COP < 3.25	3.25 ≤ COP < 3.5	F
< 2.2	< 2.0	< 3.3	< 2.95	< 3.25	G

* Air source condenser units for heating floor applications (+30/+35°C in heating mode and +23/+18°C in cooling mode)

Figure 5. Definition of Eurovent energy classes for Chillers and Hydronic Heat-Pumps. (LCP: Liquid chilling packages, A: air source, W: water source, N: Non ducted, D: Ducted.)

Rooftop units

Energy efficiency classes for Rooftop units were defined in 2010 within the corresponding Eurovent Certification programme. The definition of the classes is based on the levels of the first EU energy label for air conditioners of the packaged type. These levels were found to be consistent with the values found on the market (see distribution of Rooftop units in **Figure 7**).

Fan Coil units

Eurovent Energy efficiency classes for fan coil units are available since January 2011. This scheme covers ducted and non-ducted units, two pipes and four pipes. The energy classes are based on “FCEER” and “FCCOP” (Fan Coil Energy Efficiency Ratio and Fan Coil Coefficient of Performance) for cooling and heating mode. These characteristics correspond to a weighted average efficiency of the unit at the low, medium and high speeds (see formula in **Figure 8**)

The scale is very ambitious as currently a small part of the market can reach A class (see **Figure 9**). However, in view of the up-coming of EC fan motors units in the near future, the A class might be reached more often.

$$FCEER = \frac{5\% \cdot Pc_{high} + 30\% \cdot Pc_{med} + 65\% \cdot Pc_{low}}{5\% \cdot Pe(c)_{high} + 30\% \cdot Pe(c)_{med} + 65\% \cdot Pe(c)_{low}}$$

$$FCCOP = \frac{5\% \cdot Ph_{high} + 25\% \cdot Ph_{med} + 70\% \cdot Ph_{low}}{5\% \cdot Pe(h)_{high} + 25\% \cdot Pe(h)_{med} + 70\% \cdot Pe(h)_{low}}$$

Figure 8. Formula of FCEER and FCCOP.

Air filters for ventilation

Energy efficiency classes for air filter intended for ventilation were recently defined in the Eurovent Document 4/11 ⁵ (downloadable free of charge).

This method defines an annual energy consumption of an air filter in kWh/year based on the average pressure drop of the filter and standard airflow conditions.

⁵ Eurovent Document 4/11 “ENERGY EFFICIENCY CLASSIFICATION OF AIR FILTERS FOR GENERAL VENTILATION PURPOSES”, www.eurovent-association.eu

Class	Energy consumption	Condensers, Dry coolers	Dx Air Coolers
		$R_{\text{Condensers, Dry coolers}} = \frac{\text{Capacity SC wet}}{\text{Fan power cons}}$	$R_{\text{Dxaircoolers}} = \frac{\text{Capacity SC2 wet}}{\text{Fan power cons}} \times \sqrt{\frac{\text{fin spacing}}{4.5}}$
A++	Remarkably low	$R \geq 240$	$R \geq 45$
A+	Extremely low	$160 \leq R < 240$	$35 \leq R < 45$
A	Very low	$110 \leq R < 160$	$27 \leq R < 35$
B	Low	$70 \leq R < 110$	$21 \leq R < 27$
C	Medium	$45 \leq R < 70$	$16 \leq R < 21$
D	High	$30 \leq R < 45$	$12 \leq R < 16$
E	Very high	$R < 30$	$R < 12$

Figure 6. Eurovent Certification Energy Classes for Heat Exchangers.

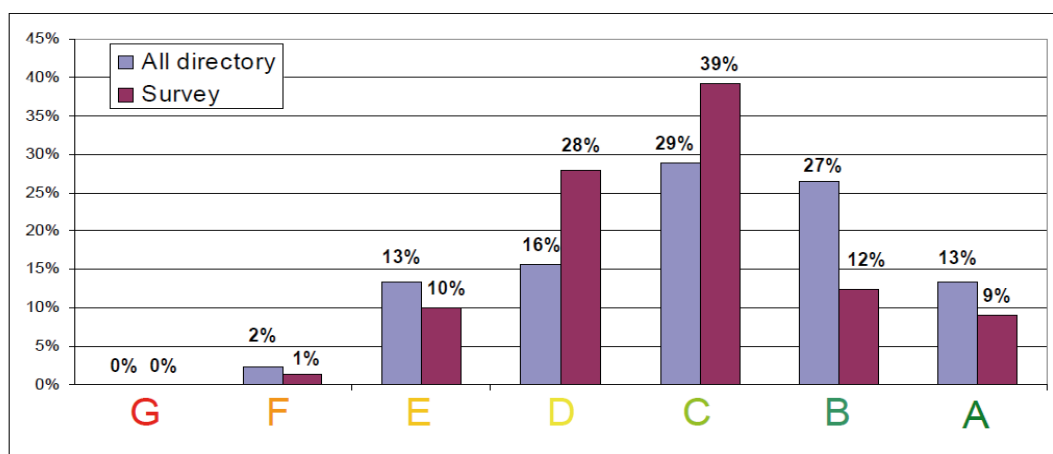


Figure 7. Distribution of Eurovent certified Rooftops units in 2010 according to the energy classes.

Interactions between EU labels and voluntary labels

Both positive (numerous) and negative (less numerous) interactions can be observed between the two approaches.

EU labels accelerate the standardization process

The EU commission is able to send mandates to CEN in order to create or modify existing standards allowing supporting published directives. This was the case notably regarding the directives on air conditioners and heat-pumps which will be based on seasonal efficiency. The corresponding CEN standard EN14825 has to take into account the method proposed by the directives and to include it. The new version of this standard is expected to be published at the end of 2011.

Voluntary labels prepare the work for EU labels

Sometimes voluntary labels precede EU labels. In such cases it is obvious that the work of the commission is facilitated as an already existing scheme is in place and used by the industry. For example, some references to the Eurovent energy labels are present in the studies to set-up a European label for Fan Coils, Rooftops and Chillers.⁶

Voluntary labels provide market data on energy efficiency

Voluntary energy labels like Eurovent Certification energy labels allow providing to EU commission useful data on energy efficiency. These data are crucial in order to prepare the most adequate regulation in terms of energy efficiency levels to be reached.

Case where EU labels and voluntary labels have different requirements

This case can be illustrated by the air conditioners up to 12 kW (AC1 programme within Eurovent Certification). As said before these products are in the scope of a labelling directive since 2002. This directive refers to a standard allowing 15% tolerance on energy efficiency. The corresponding Eurovent Certification programme considers a tolerance of 8% for exactly the same product. This means that some non certified products declared as class A, can only be rated B within the corresponding Eurovent Certification programme due to the stricter tolerance. This situation is not easy to manage for a certification scheme as some manufactur-

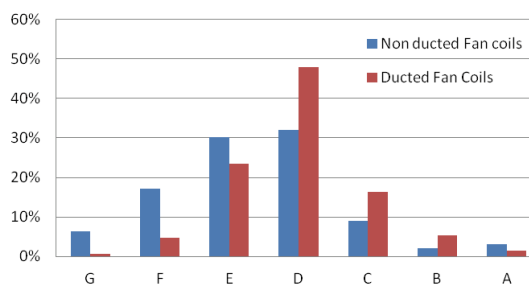


Figure 9. Distribution of Eurovent certified Fan Coil units in 2011 according to the energy classes.

ers are tempted to leave the certification programme in order to gain one energy class.

Voluntary labels complete the market surveillance activity

Member states have the responsibility of the market surveillance regarding the Labelling directive. This market surveillance consists of checking the declaration of the performance of the products (correct labelling display on site) but also perform product testing. According to a study carried out in 2009 by the Fraunhofer institute⁷ it can be estimated that between 0 and 10 tests are performed per year in Europe on air conditioners up to 12 kW. At the same time, a voluntary third party certification scheme like Eurovent Certification performs more than 120 tests per year since 2000 on this type of products.

Given this role sharing out, market surveillance activities from member states should focus on non-certified products in order to complete the testing activity of voluntary certification bodies.

Conclusion

Energy efficiency labelling is a boiling subject. The impact it has on customer behaviour makes it a powerful marketing tool but also more and more a powerful regulation tool. Both public and private sector can be at its initiative. We have seen that the two approaches were complementary if well-coordinated. EU labels provide an impetus to standardization work at the European level whereas voluntary certification labelling schemes can accelerate the work of creation of EU labels if they are created before and allow for a given pool of products to have accurate market surveillance as soon as the EU label is put in place. Finally regarding market surveillance activity there is a clear possibility to have coordination between the two approaches in order to benefit from their complementarities. **3E**

6 "Ecodesign Preparatory Study ENTR Lot 6 Air Conditioning and Ventilation Systems" Task 1 Lot 6, <http://www.ecohvac.eu/documents.htm>

7 Survey of Compliance Directive 92/75/EEC (Energy Labelling), Fraunhofer Institute (2009)