

June 11th 2008

Eco-design Directive (2005/32/EC)

Comments on the Working document on possible ecodesign requirements for fans (Part of Lot 11)

1. Introduction:

BAM and UBA welcome and support the introduction of mandatory ecodesign requirements for fans.

Ambitious goals and a full realisation of efficiency potentials, e.g. through top runner approaches as demanded by the Council (Environment) on 28th of June 2007¹ are urgently necessary to reach the EU's common energy efficiency goal (20 percent improvement by 2020 across all sectors). To implement the top runner principle within the frame of the ecodesign directive the following elements are necessary:

- Ambitious requirements for which the best-performing products or techniques available on the market, including on international markets, should be taken as reference. The level of ecodesign requirements should be established on the basis of technical, economic and environmental analysis.
- Dynamic requirements by regular revision.
- Technology independent definition of requirements.
- Coupling of the Implementing measures with energy efficiency labelling wherever this is adequate and
- Parallel adoption of labelling regulation.

¹ "The Council STRESSES that substantial progress has still to be made and that concrete outcomes need to be delivered, particularly in the areas of climate change, and in this context RECALLS the EU's firm commitments, as decided at the Spring 2007 European Council, to ambitious targets in the context of an integrated climate and energy policy; LOOKS FORWARD to Community measures and to agreeing on an internal burden-sharing and to the proposals for implementing the Energy package, in particular in relation to energy efficiency; (...) STRESSES that governments should act to provide the adequate framework and incentives to overcome barriers that prevent Europe from fully tapping the potential of eco-efficient technologies; EU and national Environment policy must provide industry with environmental legislation setting ambitious and realistic standards, which take into account small-scale industry, and that provide benchmarks and trigger innovation, while using a creative mix of push and pull instruments that support energy and resource efficient innovations on a broad basis; POINTS TO (...) environmental regulation with lead standards such as supported by "top runner approaches" that take into account that industries need reliable and appropriate framework conditions, inter alia through implementing the Directive on eco-design requirements for energy using products" (Doc. 10796/07)

2. General Remarks

Definitions

The different types of fans (axial flow, centrifugal flow,...) can be used for various purposes besides ventilation, e.g. in electrical cabinets or for air conditioning. Therefore the Implementing Measure should cover all kinds of application (except the exclusions for special purposes, see remarks to the explanatory notes) of the defined fans. Hence we suggest to change the name of the working document into "...on possible ecodesign requirements for fans".

This Implementing Measure should cover fans as stand alone products or embedded in an application (except excluded fans for special purposes). Therefore the fan categories 1-5 and 8 cover all types of fans. The fan categories 6 "box fans" and 7 "roof fans" can be covered with one of the other fan categories as they include one of those fans as a component. Removing categories 6 and 7 would make the implementing measure more consistent as all remaining categories would have the same level of complexity.

Conformity Assessment

For all energy using products containing fans also the parts and components for which individual MEPS exist must be compliant with the corresponding measure: CE-labelling for all fans put on the market in the European Union must be mandatory. This would avoid disadvantages for European fan manufacturers.

Dynamic approach / regular Revision

BAM and UBA support a dynamic approach to ecodesign regulation and a review of this IM depending on technical progress and not later than 5 years after its entry into force.

Providing data

The Commission should be enabled to review efficiency requirements regularly with little effort. Therefore industry and importers should be required to provide information regularly to an institution authorised by the commission. This information should cover data on product features of all products placed on the market to facilitate review and ensure a balanced set of data.

Regarding the necessity of gaining a significant data base it is useful to exclude fan category 6 and 7 because all types of fans can be covered with the fan categories 1-5 and 8. Double counts should be avoided.

3. Proposed Options

Timing of requirements

Regarding the fact that it is not exactly clear at this moment when the IM will enter into force, it would be better to indicate timing in the form of “years from entry into force” instead of fixed dates.

Fans are products that are in most cases not used as “standalone products” but installed in different kinds of appliances. Therefore a change in the design of the fans – in order to comply with the proposed ecodesign requirement – in most cases also means a change of the design of the appliance. This is especially important when whole categories may be phased out (cross-flow fans). Hence other industries are affected by the implementing measure on fans. The development, planning and conversion of new or different production lines in these industries take some time. Therefore we suggest a period of two years for the first stage and four years for the second stage of requirements.

A third step should be taken much earlier than in 2020.

Level of ambition

Discussions with stakeholders gave the impression that the requirements are demanding but achievable. For category 8 however, the second step may result in a ban on cross-flow fans, which should be taken into account carefully in the impact assessment, because manufacturers using this type of fan may have difficulties in adapting their products to use other fan types (see above “timing”). On the other hand category 8 fans have very low efficiencies that a shift to the use of other fan types should be stimulated as far as possible.

The third step should give a relative increase of requirements rather than the 4 % absolute increase proposed in the working document. Stakeholders suggested a relative increase of 5 % (meaning multiplication of the efficiency requirements in table 2 by 1.05), six to eight years after the implementing measure comes into force. Another relative increase could be foreseen for a later date, to be fixed in the first revision of the implementing measure.

4. Comments on the Document “Possible ecodesign requirements for fans”

Annex I: Ecodesign requirements

The tables state minimum energy performance requirements. It should be indicated that these are the efficiency values in percent, as obtained by measurements and calculations laid out in Annex II.

Stakeholders remarked that the efficiency values for categories 4 and 5 might be interchanged, as fans with housing should have higher efficiency than those without. In tables 1 to 3, cat. 5 fans have higher performance requirements than cat. 4 fans.

It is not entirely clear why cat. 7 requirements show a small change in the calculation of requirements between tables 1 and 2. This has only a small effect on the lower end of the power range. The same values are used in the preparatory study.

Exclusions

Regarding the preparatory study “Final Report Lot 11 - Fans for ventilation in non-residential buildings” the following fans for special purposes should be excluded as they have not been part of the examination and may have very different characteristics:

- fans for smoke and emergency smoke extraction
- fans for solid material transport
- fans for automotive application, trains, planes etc.
- fans for transport of other gases than air
- fans with an electrical input power above 500 kW
- fans as defined in the ATEX Directive 94/9/EC.

The proposed changes have been incorporated in blue colour in the attached copy of the working document.

Contact:

Federal Institute for Materials Research and Testing (BAM)

Franz-Georg Simon, Division IV.3 Waste treatment and remedial engineering

franz-georg.simon@bam.de

Floris Akkerman, Division IV.3 Waste treatment and remedial engineering
Phone: +49-30-8104-1438

floris.akkerman@bam.de

Federal Environment Agency (UBA)

Ines Oehme, Section III 1.1 Fundamental Aspects of Products and Technology

Phone: +49-340/2103-2585

ines.oehme@uba.de

Reinhard Albert, Section I 4.4
Rational Energy Use

Phone: +49-340/2103-2635

reinhard.albert@uba.de

Annex 2

Working document on possible ecodesign requirements for fans.

Table of Contents

Subject matter.....	6
Definitions	6
Eco-design requirements	7
Information requirements for components and sub-assemblies	7
Conformity Assessment	7
Market surveillance	7
Review	7
Annex I: Ecodesign requirements	8
a) Minimum energy efficiency requirement.....	8
b) Minimum energy efficiency requirement	8
c) Minimum energy efficiency requirement.....	9
c) Product information requirement	9
Annex II: Measurement and calculation method for fans ..	10
Explanatory Notes ..	12
Form of the implementing measure	12
Scope	12
Exclusions	12
Ecodesign requirements	12
Energy efficiency levels	13
Benchmarks	13
Definitions	13
Measurement method	14
Market structure	14
International dimension.....	14
Impact on other EU legislation.....	14
Voluntary agreements	14

Subject matter

This implementing measure pursuant to Directive 2005/32/EC establishes eco-design requirements related to fans with power range 125 W – 500 kW [as stand alone product or embedded in other products; excluding special purpose fans](#). The Lot 11 preparatory study shows that energy in use phase is the only significant environmental aspects. Ecodesign parameters referred to in Annex I, Part 1 of Directive 2005/32/EC, are not considered as significant.

Definitions

'Fan' means a rotary bladed machine that is used to maintain a flow of a gas, typically air, and which is driven by an electric motor. The types of fans falling within the scope of this implementing measure include power range 125 W – 500 kW.

'Axial flow fan' means a fan having a static pressure development. This definition refers to fan categories 1 and 2 in Annex I.

'Centrifugal fan' means a radial flow fan comprising an impeller where the direction of the entry air flow is vertically to the direction of the exit air flow. This definition refers to fan categories 3, 4 and 5 in Annex I.

~~'Box fan' means a fan with a box casing installed in a duct run. This definition refers to fan category 6 in Annex I.~~

~~'Roof fan' means fans to be mounted on the roof of building by the provision of a curb for a flat roof or a purlin for a sloping roof. This definition refers to fan category 7 in Annex I.~~

'Cross flow fan' means a forward curved centrifugal fan with impeller of an increased axial length. The air entry to the casing is positioned on the scroll such that the air traverses the impeller. This definition refers to fan category 8 in Annex I.

Other expressions used in this implementing measure shall have the same meaning as in Directive 2005/32/EC.

Eco-design requirements

Products falling under the definitions of paragraph "Definitions" above in this document shall meet the ecodesign requirements set out in Annex I.

Special purpose ~~ventilation~~ fans are excluded from the scope of the implementing measure including:

- fans for smoke and emergency smoke extraction
- fans for solid material transport
- fans for automotive application, trains, planes etc.
- fans for transport of other gases than air
- fans with an electrical input power above 500 kW
- fans as defined in the ATEX Directive 94/9/EC².

Information requirements for components and sub-assemblies

Information requirements on manufacturers are made based on the Lot 11 study.

Conformity Assessment

For all energy using products containing a fan as defined in this IM, that fan must be compliant with this IM.

A conformity assessment shall be carried out according to Article 8(2), and Annex IV (Internal design control) or Annex V (Management system for assessing conformity) of Directive 2005/32/EC.

Market surveillance

When performing the market surveillance checks referred to in Directive 2005/32/EC, Article 3 (2), Member State authorities shall apply the verification procedure set out in Annex II of this implementing measure.

Review

A review of this implementing measure shall be presented to the Consultation Forum depending on technological progress and not later than 5 years after its entry into force.

² Directive 94/9/EC of the European Parliament and of the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres, OJ L 100 of 19.4.1994.

Annex I: Ecodesign requirements

Fans covered by the implementing measure shall meet the ecodesign requirements set out in this Annex. The requirements specified are related to the fan product as defined, including motor and transmission. The efficiency values shall be determined by the method defined in Annex II.

a) Minimum energy efficiency requirement

two years after the proposed IM comes into force ~~1 January, 2010 onwards~~, the minimum energy performance requirements for fans are those described in table 1.

Table 1: Minimum energy performance requirements for fans (two years) ~~on 2010~~

Fan Category	Power Range		
	0.125-1 kW	1-10 kW	10 -500 kW
MEL1 - Axial $\leq 300\text{Pa}$	$(3.42 \cdot \ln(P_{el}) + 27.12) \%$		$\geq 35 \%$
MEL2 - Axial $> 300\text{Pa}$	$(2.28 \cdot \ln(P_{el}) + 29.75) \%$		$\geq 35 \%$
MEL3 - Centrifugal forward with housing	$(2.74 \cdot \ln(P_{el}) + 28.69) \%$		$\geq 35 \%$
MEL4 - Centrifugal backward free wheel	$(4.68 \cdot \ln(P_{el}) + 47.23) \%$		$\geq 58 \%$
MEL5 - Centrifugal backward with housing	$(4.56 \cdot \ln(P_{el}) + 44.49) \%$		$\geq 55 \%$
MEL8 – Cross-flow fans	$\geq 8 \%$	$(11.73 \cdot \ln(P_{el}) + 8) \%$	$\geq 35 \%$
Results should be rounded to one digit, P_{el} to be entered in kW			

b) Minimum energy efficiency requirement

four years after the proposed IM comes into force ~~1 January, 2012 onwards~~, the minimum energy performance requirements for fans are those described in table 2.

Table 2: Minimum energy performance requirements for fans (four years) ~~on 2012~~

Fan Category	Power Range		
	0.125-1 kW	1-10 kW	10 -500 kW
MEL1 - Axial <=300Pa	(3.42*ln(P _{el}) + 27.12) %		=35 %
MEL2 - Axial > 300Pa	(2.28*ln(P _{el}) + 29.75) %		=35 %
MEL3 - Centrifugal forward with housing	(2.74*ln(P _{el}) + 28.69) %		=35 %
MEL4 - Centrifugal backward free wheel	(4.68*ln(P _{el}) + 47.23) %		=58 %
MEL5 - Centrifugal backward with housing	(4.56*ln(P _{el}) + 44.49) %		=55 %
MEL8 - Cross-flow fans	(2.74*ln(P _{el}) + 28.69) %		=35 %
Results should be rounded to one digit, P _{el} to be entered in kW			

c) Minimum energy efficiency requirement

six years after the proposed IM comes into force ~~1 January, 2020 onwards~~, the minimum energy performance requirements for fans are those described in table 3.

Table 3: Minimum energy performance requirements for fans (six years) ~~on 2020~~

Fan Category	Power Range		
	0.125-1 kW	1-10 kW	10 -500 kW
MEL1 - Axial ≤300Pa	$\frac{3.42 \cdot \ln(P_{el}) + 31.12}{([3.42 \cdot \ln(P_{el}) + 27.12] \times 1.05) \%}$		$\frac{=39}{= 36,75 \%}$
MEL2 - Axial > 300Pa	$\frac{2.28 \cdot \ln(P_{el}) + 33.75}{([2.28 \cdot \ln(P_{el}) + 29.75] \times 1.05) \%}$		$\frac{=39}{= 36,75 \%}$
MEL3 - Centrifugal forward with housing	$\frac{2.74 \cdot \ln(P_{el}) + 32.69}{([2.74 \cdot \ln(P_{el}) + 28.69] \times 1.05) \%}$		$\frac{=39}{= 36,75 \%}$
MEL4 - Centrifugal backward free wheel	$\frac{4.68 \cdot \ln(P_{el}) + 51.23}{([4.68 \cdot \ln(P_{el}) + 47.23] \times 1.05) \%}$		$\frac{=59}{= 60,90 \%}$
MEL5 - Centrifugal backward with housing	$\frac{4.56 \cdot \ln(P_{el}) + 49.49}{([4.68 \cdot \ln(P_{el}) + 44.49] \times 1.05) \%}$		$\frac{=62}{= 57,75 \%}$
MEL8 - Cross-flow fans	$\frac{2.74 \cdot \ln(P_{el}) + 32.69}{([2.74 \cdot \ln(P_{el}) + 28.69] \times 1.05) \%}$		$\frac{=39}{= 36,75 \%}$
Results should be rounded to one digit, P_{el} to be entered in kW			

c) Product information requirement

two years after the proposed IM comes into force ~~1 January, 2010 onwards~~, overall static efficiency of the product, including motor and transmission, must be indicated in the product catalogues according to ISO 5801, including the test standard and tolerance levels in accordance with ISO 13348:2006.

Noise level of the product must be indicated according to ISO 13347.

Annex II: Measurement and calculation method for fans

The measurement standard for the measurement of the efficiency of the fan is ISO 5801. Tolerance classes shall be used according to ISO 13348:2006: AN1 $P > 500$ kW, AN 2 $P > 50$ kW, AN 3 $P > 10$ kW, AN 4 $P \leq 10$ kW.

When a fan ~~product~~ includes the ~~fan~~, transmission and motor, ~~the product~~ this combination shall be measured in taking into account the overall static efficiency of the actual product.

When a fan is sold alone (without the motor), product efficiency must be calculated with default values as follows:

Motor:

- Motor efficiency η_M to be assumed, when the motor is not included in the fan product:
 - If $P_{el} > 1.1$ kW use motor efficiency η_M as required to achieve EFF2 rating. The rating to be replaced by IE1 after the new IEC 60034-30 Ed. 1 efficiency classes have come into force.
 - If $P_{el} < 1.1$ kW calculate motor efficiency η_M by the following formula:
 $\eta_M = 0,0629 \cdot \ln(P_W) + 0,653$ (P_W = shaft power). This equation is based on the typical efficiencies of single phase motors with capacitor.

Transmission:

- if the fan has a direct drive, transmission efficiency η_T of 100 % is to be assumed,
- If the fan has a belt drive:
 - for $P_{el} < 1$ kW: assumed transmission efficiency η_T of 75 %;
 - for $1 \text{ kW} < P_{el} < 5 \text{ kW}$: assumed transmission efficiency η_T of 83 %;
 - For $P_{el} > 5 \text{ kW}$: assumed transmission efficiency η_T of 90 %.

Controls:

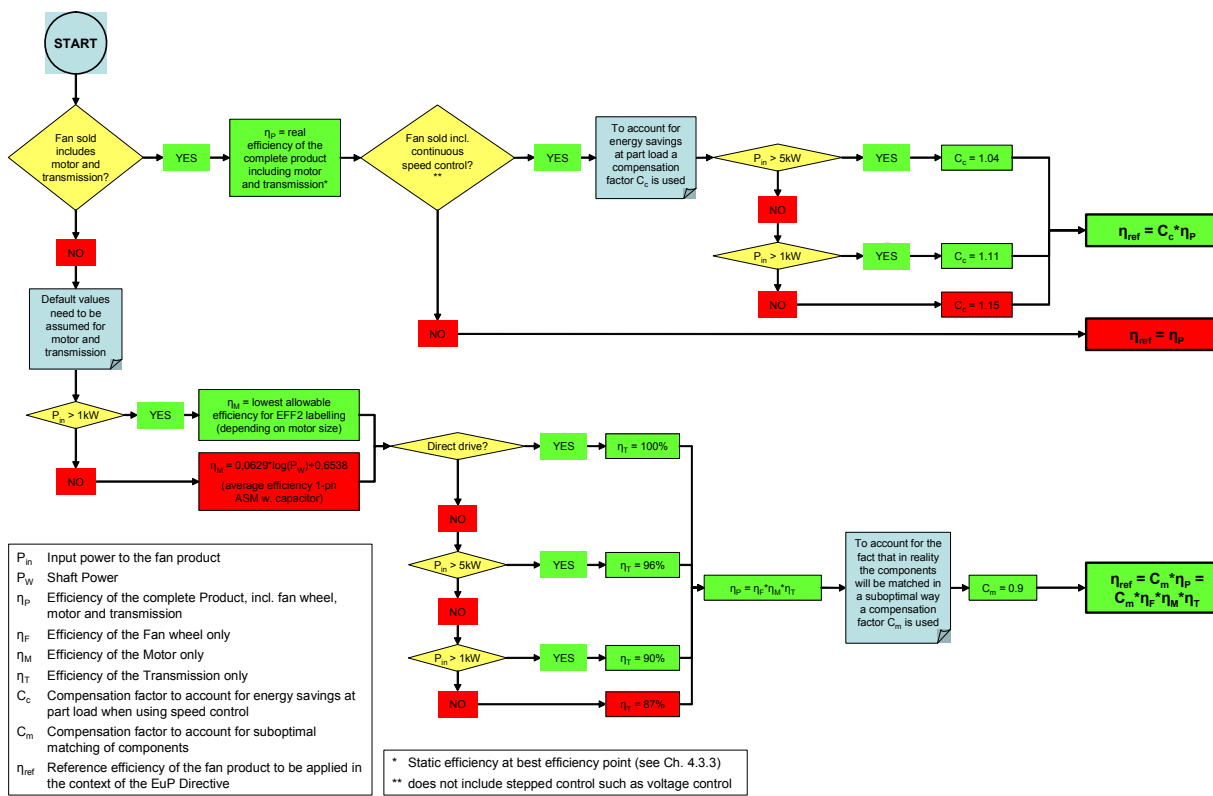
- for $P_{el} < 1$ kW: assumed control compensation factor C_c of 1.15;
- for $1 \text{ kW} < P_{el} < 5 \text{ kW}$: assumed control compensation factor C_c of 1.11;
- for $P_{el} > 5 \text{ kW}$: assumed control compensation factor C_c of 1.04.

Losses:

- Assumed compensation factor for losses is ($C_m = 0.9$).

The Chart 1 shows the calculation procedure for fans sold without the drive.

Chart 1: Calculation procedure for fans without drive.



Explanatory Notes

The implementing measure is meant to contribute to achieving the requirements of Article 16.2 of Directive 2005/32/EC in relation to "**ventilation** fans".

Form of the implementing measure

The intention is to give to the implementing measure the form of a directly applicable decision or regulation.

Scope

The scope of the implementing measure includes fans with power range 125 W – 500 kW, as specified above under 'Definitions'. Fans under 125 W will be covered by an implementing measure based on Lot 10 preparatory study.

On top of the proposed eco-design requirements the Commission recommends complementary measures to be taken at national, regional and local authorities: in their public procurement procedures, they would be encouraged to require for fans the minimum energy efficiency values of the third introduction already from the beginning of this measure.

Exclusions

Special purpose **ventilation** fans are excluded from the scope of the implementing measure including:

- fans for smoke and emergency smoke extraction
- fans for solid material transport
- fans for automotive application, trains, planes etc.
- fans for transport of other gases than air
- fans with an electrical input power above 500 kW
- fans as defined in the ATEX Directive 94/9/EC³.

Ecodesign requirements

The implementing measure sets specific **ecodesign** requirements in form of minimum energy efficiency requirements. The preparatory study also identified the need to make generic requirements for the provision of information by manufacturers.

Depending on changes in fan markets and technological development, it is proposed to consider possible tighter **ecodesign** requirements no later than 5 years from the entry into force of this measure.

³ Directive 94/9/EC of the European Parliament and of the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres, OJ L 100 of 19.4.1994.

Energy efficiency levels

The Lot 11 preparatory study has shown that the proposed energy efficiency levels lead to reduction in least life cycle cost to the consumer under average operating conditions of 4000 hours pa over 15 years of average life time and with 0,075 euros/kWh electricity price for industry. As the impact of the electricity price dominates in the total life cycle cost, possible increase in electricity prices would lead to increased least life cycle cost savings from the proposed minimum energy efficiency requirements.








Benchmarks

Fans cover a broad range of fan sizes, types and power ranges, which make it unpractical to specify benchmark values for the best products on the market. Instead of one benchmark value per product group, hundreds of values would have to be defined.

Definitions

For fans covered by this implementing measure, definitions are restricted to commonly agreed technical parameters such as power rate, pressure increase or velocity of the flow. The Lot 11 preparatory study classifies ventilation fans in eight categories, as shown in Table 1, based on relevant Prodcom classifications and European and international measurement standards. Fans belonging to these categories – **excluded product category 6 and 7** - are used in all types of applications, although some fan types may be preferred in certain applications. **Products of category 6 and 7 may include different types of fans from other categories.**

Table 1: Definition of product categories for ventilation fans 125 W – 500 kW

Product Category	Direction of flow	Type	Typical Sizes [mm]	Example
1	Axial	<= 300 Pa (static pressure)	200 - 1,400	 Source: Helios
2		> 300 Pa (static pressure)	200 - 1,400	
3	Centrifugal	forward curved blades (with casing)	120 - 1,600	 Source: Nicotra
4		backward curved blades (no casing)	120 - 1,600	 Source: ebmpapst
5		backward curved blades (with scroll housing)	120 - 1,600	 Source: Ziehl-Abegg
6	Other	Box fans	100 - 1,000	 Source: Fläktwoods
7		Roof fans	250 - 1,000	 Source: Gebhardt
8		Cross-flow fans	60 - 120	 Source: ebmpapst

Measurement method

The measurement standard for the measurement of the efficiency of the fan is ISO 5801, which currently is under revision. As the non-revised standard does not set the level of uncertainty for the motor, which is part of the product to be analysed, an assumed uncertainty level of 4 % must be used, except if the revised standard sets this level specifically.

The Tolerances to be used in the measurement tests are those specified in ISO 13348:2006 standard as indicated in Annex II. An additional calculation method is included for the measurement of the efficiency of fans, which are sold without motor, transmission and drives in order to ensure level playing field in the measurement tests.

Market structure

The lot 11 preparatory study has shown that the total European sales volume for ventilation fans covered by this implementing measure is about 1.2 Billion Euro, with an increasing sales trend and decreasing average prices. Most ventilation fans are traded within the EU27 but important trading between the EU and third countries takes place, that is, the ventilation market is global.

International dimension

Fan market is global in nature. Given that minimum energy efficiency requirements only exist in China, the proposed implementing measure could lead to similar measures in other third countries with beneficial global environmental impacts, particularly in the light of the existing Energy Star programme on residential ventilation in the US.

Impact on other EU legislation

The proposed ecodesign requirements will support the objective of the Energy Performance of Buildings Directive 2002/91/EC (EPBD) in helping to increase the efficiency of the building's ventilation system.

Voluntary agreements

There are no EU wide voluntary agreements. There is a national level voluntary agreement in Denmark and the Energy Star programme for residential fans ($P_{el} < 125 \text{ W}$) in the US.