Topten Product Criteria Paper on

# Tumble driers

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Revision, based on the criteria paper of 20.11.2011 from

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ADEME

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## The Project in brief

Topten is part of the international Euro-Topten-Max initiative supported by the European programme Intelligent Energy Europe and several national institutions (energy agencies, WWF, consumer associations, research institutes). On global level, Topten is coordinated by TIG, the Topten International Group. This association promotes to the Topten Charter, TIG statutes and Rules of Procedure (www.topten.eu).

Topten is a service that supports the market for energy efficient products. It aims at making energy efficient products the first choice for consumers, by offering them a user-friendly tool for product comparison and selection. The key element is an online information platform for consumers presenting the most energy efficient appliances currently available in various product categories, including household appliances, office equipment, consumer electronics and cars. Information on energy consumption and performance of products as well as several other characteristics (i.e. brand, model, price, picture) is provided. Product data is based on labels and standardized declarations as well as tests from accepted well-known institutions. The service is independent of manufacturers and retailers.

## Consortium

The project is co-ordinated by the Agence de l'Environnement et de la Maitrise de l'Energie (ADEME). The other 19 project partners are:

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# Criteria Paper for Tumble Driers

## Contents

# 1 Introduction

The criteria papers provide a central tool for the national partners to collect and analyse product data and to establish a national Topten selection. Appropriate selection criteria and technical specifications are a crucial precondition for meaningful and well-accepted Topten websites. The purpose of this criteria paper is to provide a common basis for the definition of technical specifications of tumble driers. Within the European wide Topten project, an aligned approach for technical specifications for all national Topten websites is aimed at. A high level of uniformity and congruency of the different national websites will enhance the awareness amongst manufacturers. Good quality product data at national level furthermore allows to analyse the situation at European level and to make policy recommendations, which are shown on www.topten.eu.

This paper contains information for the product specification for Topten.eu qualified tumble driers, as well as suggestions for criteria for national sites. A product should meet criteria described in Chapter 4 in order to be Topten product. Hopefully this paper can be used as a guide in adding tumble driers in national websites.

# 2 Product Specification - overview on most relevant product types and characteristics

This chapter provides an overview of tumble driers in the market and drying technologies covered in this criteria paper.

## 2.1 Product Definition

There are two main types of tumble driers: **Vented tumble driers** and **condenser tumble driers**.

**Vented tumble driers** intake compartment air, possibly heat it, use it to dry the clothes inside the drum, and blow out the humid air through an exhaust pipe (to the atmosphere instead of back into the room).

**Condenser tumble driers**, with circulating airflow, process the amount of air available inside the drum only. They do not have an air exhaust pipe connection: the water, which is removed from the clothes, will either be collected in a reservoir or pumped into the drain as with washing machines.

## 2.2 Product Types

**Vented tumble driers**
In air vented tumble driers, heat is generated using electricity and resistors. Compartment air is heated by a heating element and forced through the laundry, dehumidifying it. The humid air is blown out to the atmosphere, so there is no necessity for a condensate reservoir or a drain.

**Compact driers**
Compact driers are prevalently air vented tumble driers with resistive heat generation, although condenser types do exist. From a technical point of view, they share the problems of their full-size counterparts. Furthermore, they are less energy efficient than full-size driers. Compact driers are generally much smaller and cheaper than full-sized appliances, making them interesting for a completely different segment of the market.

**Gas tumble driers**
Gas tumble driers work similar to electric air vented tumble driers, but the heat source is a gas flame. With the exception of heat generation, gas tumble driers consume electricity to rotate the drum, supply the control circuitry, etc. A gas port is needed to operate a gas tumble drier. Gas tumble driers have a rather small market share in Europe, contrary for example to the US, where they are widespread. Possible reasons for the difference are the lack of infrastructure, the requirement that the installation be carried out by a professional, and safety concerns on the part of the customer.

### Condenser tumble driers

In condenser driers, the air is heated electrically as in an electric air vented drier. Yet, instead of blowing out the humid air once, it has passed through the laundry, the air moisture condensates in a heat exchanger. A heat exchanger is a device, which brings into thermal contact two media of different temperatures without mixing them. Heat is transferred from the hotter to the cooler medium. In current condenser driers, the hotter medium is humid air. Hot air can carry much more water than cool air. When the hot air is cooled, the moisture it carries condensates inside the heat exchanger, from where the water is removed by force of gravity and/or a pump into a reservoir or the drain. When the air has cooled down and dried, it is circulated through the electric heater again, and the cycle starts over.

Some conventional (without heat pump; see below) condenser tumble driers have achieved a Class A Energy Label thanks to a combination of design features allowing improving heat and mass transfers in the drum, limit heat losses and energy waste at the end of the cycle.

### Heat pump condenser tumble driers

The operation principle of heat pump driers is shown in Figure 1. The heating element and the humidity removing facility are the hot and cool sides of a heat pump, respectively (labelled “1”, in the bottom part of the Figure 1.). A heat pump generates heat on its primary side by compressing the working fluid (left, labelled “2”). The thermal energy is transferred to the air blowing through the laundry (middle, label “3”). That way, the working fluid cools down. On the second side of the heat pump, the cool working fluid is expanded (bottom right, label “4”). Due to the decreasing pressure, the working fluid gets colder. So does the secondary side of the heat pump, on which the water contained in the humid air condensates. The water is collected or drained. Once cooled and dry, the air is recirculated through the primary side of the heat pump.

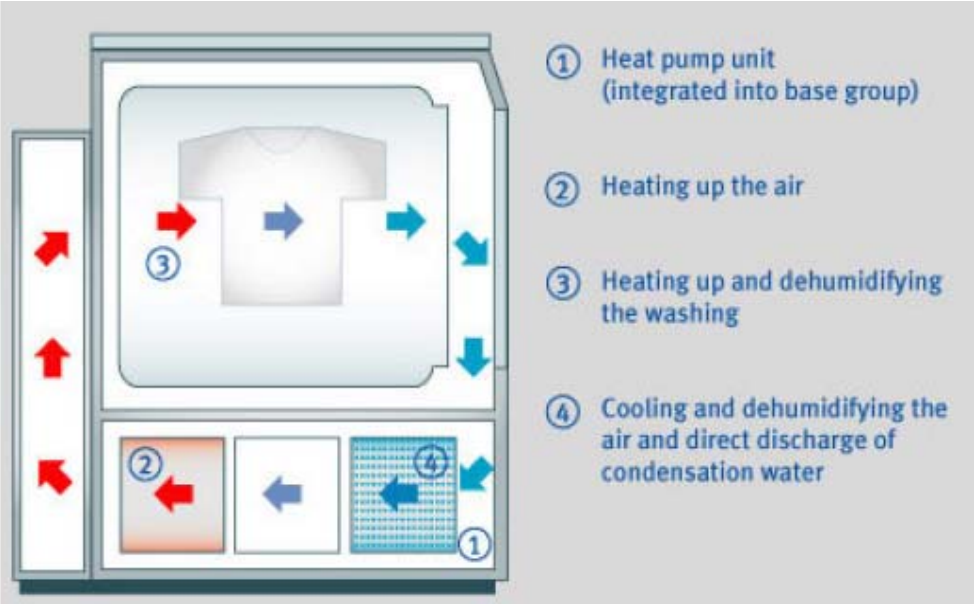



Figure 1. Heat pump tumble drier principle

Heat pump driers consume less energy than conventional condenser driers. Most of them are much better than the class A limit and reach the new classes A+, A++ or A+++.

## 2.3 Best Available Technology

Only heat pump electric tumble driers can achieve the energy class A++ or better.
Gas fired household tumble driers, currently a niche market, could achieve class A+ and beyond, at a lower price but may not always be appropriate for end-users as they are only air vented and need appropriate installation including the availability of gas supply to dwellings.
An innovation on the market are especially quiet tumble driers: There are models at least from one manufacturer with inverter technology that use brushless motor technology which causes less friction.
Also in the area of the tumble driers the Smart Grid Technology has entered. Smart Grid can enable tumble driers to start automatically when the electricity price is the most favourable. Or the tumble drier is tied together with the in-house energy supply technology, e.g. a photovoltaic system. It starts the programme automatically at the time when most energy is available.

## 2.4 The Ecodesign-regulation for household tumble driers

With the Commission Regulation (EU) No 932/2012 of 3 October 2012 requirements were established for the placing on the market of electric mains-operated and gas-fired household tumble driers and built-in household tumble driers, including non-household-driers.
For the adoption of the resultant requirements a revision of the energy labelling scheme and a coordinated approach of the Ecodesign requirements have been made.
The aim of the Ecodesign regulation is to phase out the least efficient driers (in two phases):

- From 1 November 2013 the energy efficiency index (EEI) shall be less than 85 (class C or better)
- From 1 November 2015 the EEI shall be less than 76 (class B or lower)

The household tumble driers shall also comply with the following requirements with regard to the condensation efficiency:

- From 1 November 2013 the weighted condensation efficiency shall be not lower than 60%
- From 1 November 2015 the weighted condensation efficiency shall be not lower than 70%

The Ecodesign regulation includes also generic eco-design requirements:

- That shall apply as of 1 November 2014
- They relate to information that shall be mandatorily reported in the manufacturers booklet of instructions:
    - Information about use of the standard cotton programme;
    - The power consumption of the off-mode and the left-on mode;
    - Indicative information on the programme time and energy consumption for the main drying programme at both full, and, if applicable, partial load.

- Information to the "standard cotton programme[1]"

For more comments on the regulation, see Topten Policy recommendations on tumble driers which will soon be updated [5].

## 2.5 The Energy labelling of tumble driers

**Background information on the changing of the energy labelling**
In 1995 the first energy label for household tumble driers was implemented with Directive 95/13/EC implementing Council Directive 92/75/EEC.
In 2012 with Commission delegated regulation 392/2012 a new energy label was implemented, replacing the old one on 29 May 2013 because of the improved efficiency of tumble driers.
Due to technologies that were either newly available or were not considered when the old label was adopted tumble driers were on the market (heat pump tumble driers)[2], which consume up to 60% less energy than the limit for the old class A.

### 2.5.1 Energy labelling of tumble driers (new)

Commission delegated regulation 392/2012 covers the same products as the eco-design regulation 932/2012. It comes into a fact on 29 May 2013 and establishes the energy efficiency classes A+++ to D for household tumble driers. The revised labelling creates labels for three types of driers: air-vented, condenser and gas-fired. Energy efficiency classes are the same for all types, condenser type drier labels show also the condensation efficiency.

**Energy efficiency classes [4]**

The energy efficiency class of a household tumble drier will be determined based on its Energy Efficiency Index (*EEI*) as set out in Table 2.

For the calculation of the Energy Efficiency Index (*EEI*) of a household tumble drier model, the weighted Annual Energy Consumption of a household tumble drier for the standard cotton programme at full and partial load is compared to its Standard Annual Energy Consumption (SAEc) for 160 cycles. Whereby the SAEc for vented driers is calculated in a different way than for condenser driers [4, see annex VII].

Table 2: Energy efficiency classes [4, 5]

| Energy efficiency class | Energy Efficiency Index | Specific efficiency (kWh/kg)* | Old labelling class |
|---|---|---|---|
| A+++ (most efficient) | EEI < 24 | ~ 0.15 | BAT, Heat pump driers/Solar driers |
| A++ | 24 ≤ EEI < 32 | ~ 0.23 | Heat pump driers (A) |
| A+ | 32≤ EEI < 42 | ~ 0.3 | Heat pump driers (A) |
| A | 42 ≤ EEI < 65 | ~ 0.46 | Low efficiency HP driers |

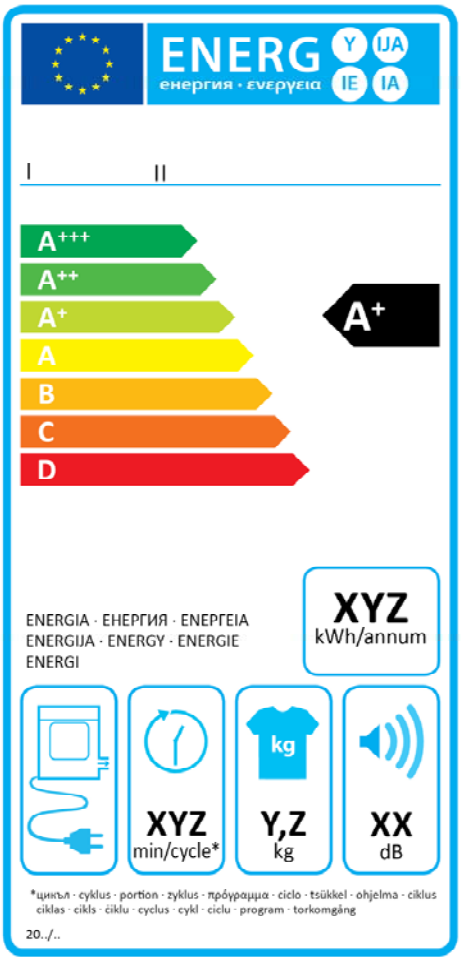
[1] "Standard cotton programme" means the cycle which dries cotton laundry with an initial moisture content of the load of 60% to a remaining moisture content of the load of 0%.

[2] Heat pump driers are the only technology with which energy class A++ or better can be reached.

| | | | (A) |
|---|---|---|---|
| B | 65 ≤ EEI < 76 | ~ 0.56 | Class B |
| C | 76 ≤ EEI < 85 | ~ 0.64 | Class C and some B |
| D (least efficient) | 85 ≤ EEI | | Class C and D |

*Specific efficiency is (always) based on full load measurement with 60% initial moisture content and helps to compare the EEI of the new label to that of the old label

**Label for air-vented household tumble driers [4]**

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Information included in the label for **air-vented** household tumble driers:

I. Supplier's name or trademark

II. Supplier's model identifier

III. The energy efficiency class

IV. Weighted annual energy consumption in kWh/year, rounded up to the nearest integer, based on 160 drying cycles of the standard cotton programme at full and partial load, and the consumption of the low-power modes. Actual energy consumption per cycle will depend on how the appliance is used.

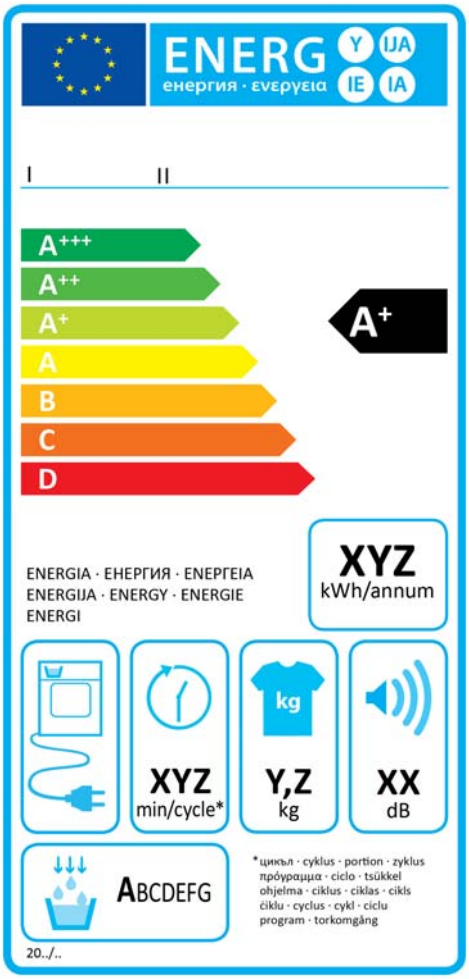
V. Information on the type of household tumble drier (air-vented, condenser or gas-fired).

VI. Cycle time corresponding to the standard cotton programme at full load in minutes and rounded to the nearest minute

VII. Rated capacity, in kg, for the standard cotton programme at full load

VIII. Airborne acoustical noise emissions, during the drying phase, for the standard cotton programme at full load, expressed in dB(A), rounded to the nearest integer

**Label for condenser household tumble drier [4]**

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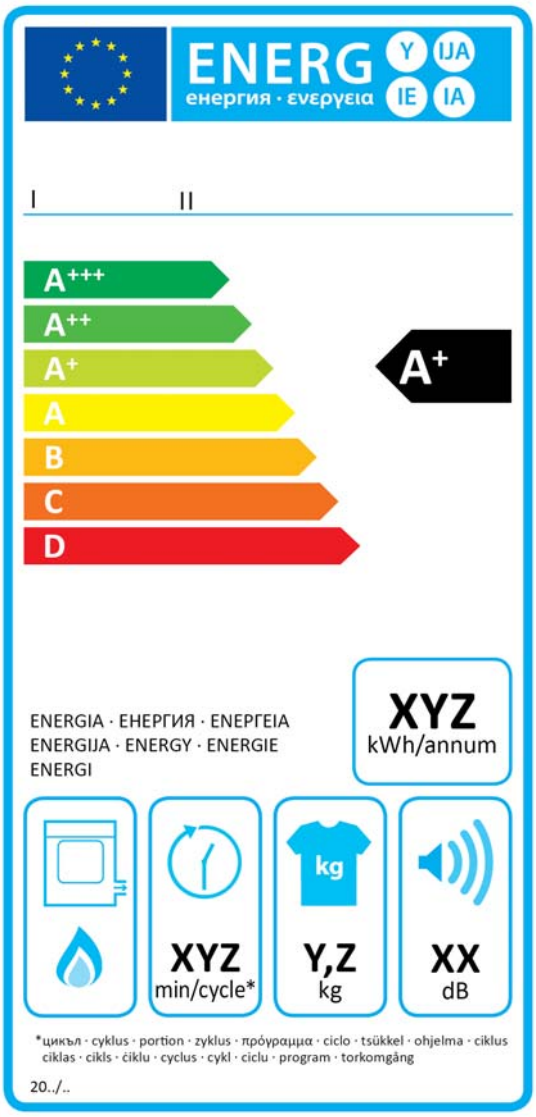
In addition to the information listed for air-vented driers, the label for **condenser** household tumble driers shall include

IX. The condensation efficiency class

**Label for gas-fired household tumble driers [4]**

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The information listed before for air-vented driers shall be included in the label for gas fired household tumble driers.

### Condensation efficiency classes [4]

To define the condensation efficiency of a condenser household tumble drier, the mass of moisture condensed during the cycle and removed from the filling property at the end of the cycle is put in relation. The condensation efficiency indicates how much of the moisture is not collected or drained but remains in the room, where it can cause damage. The condensation efficiency class is determined based on the weighted condensation efficiency ($C_t$) as set out in Table 1.
For calculating the weighted condensation efficiency, the average condensation efficiency for the standard cotton programme at both full and partial load is considered [4, see annex VII, point 3.].

Table 1: Condensation efficiency classes

| Condensation efficiency class | Weighted condensation efficiency |
|---|---|
| A (most efficient) | $C_t$ >90* |
| B | 80< $C_t \leq$ 90 |
| C | 70< $C_t \leq$ 80 |
| D | 60< $C_t \leq$ 70 |
| E | 50< $C_t \leq$ 60 |
| F | 40< $C_t \leq$ 50 |
| G (least efficient) | $C_t \leq$ 40 |

*A condensation efficiency of 90 means that 10% of the humidity is released to the laundry room.

The condensation class A or B is added as criteria because the less humidity is released during use to the room where the tumble dryer stands the less potential damage this will cause to the building.

### 2.5.2 Energy labelling of tumble driers (old)

The in 1995 published first energy label for household tumble driers launched the energy classes A to G.The previous energy label for tumble driers [6] showed the following:

I. Supplier's name or trademark.

II. Supplier's model identifier.

III. The energy efficiency class shown with an arrow mark (energy efficiency class was determined by the energy efficiency index, separate scales exist for condenser and vented driers).

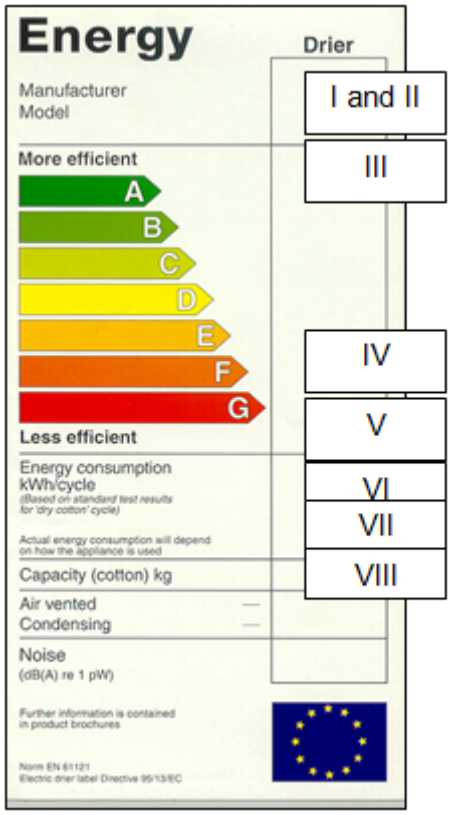
IV. A copy of the eco-label may have been added here.

V. Energy consumption in kWh per cycle, for 'dry cotton cycle'.

VI. Rated capacity of cotton, in kilograms.

VII. The type of appliance, air vented or condensing, mark with an arrow.

VIII. Where applicable, noise measured in accordance with Council Directive 86/594/EEC. The noise declaration was voluntary.




### Energy efficiency scales for tumble driers (previous label)

For tumble driers the energy efficiency scale was calculated using the cotton drying cycle with a maximum declared load. The energy efficiency index or calculated the energy consumption (c) was kWh per kilograms of laundry, measured according to the standards set in the directive [6].

Table 1 Different scales applied for condenser and vented dryers.

| Vented driers | | Condenser driers | |
|---|---|---|---|
| **Energy efficiency class** | **Energy consumption per kg of laundry** | **Energy efficiency class** | **Energy consumption per kg of laundry** |
| A (most efficient) | C ≤ 51 | A (most efficient) | ≤ 55 |
| B | 0,51 < C ≤ 0,59 | B | 0,55 > C ≤ 0,64 |
| C | 0,59 < C ≤ 0,67 | C | 0,64 < C ≤ 0,73 |
| D | 0,67 < C ≤ 0,75 | D | 0,73 < C ≤ 0,82 |
| E | 0,75 < C ≤ 0,83 | E | 0,82 < C ≤ 0,91 |
| F | 0,83 < C ≤ 0,91 | F | 0,91 < C ≤ 1,00 |
| G (least efficient) | C > 0,91 | G (least efficient) | C > 1,00 |

### 2.5.3 Main differences between the two labels (summarized)

The main differences between the two labels are shown in Table 1.

Table 2 The main differences between the old and the new energy label of tumble driers

| | New label (Commission delegated regulation 392/2012) | Old label (Directive 95/13/EC) |
|---|---|---|
| **Energy efficiency classes** | A+++ - D | A - G |
| **Energy efficiency index (EEI)** | Calculated by comparing the energy consumption to the reference energy consumption of a model of the same capacity | Calculated by assessing in relation the energy consumption (at full load) to the capacity |
| **Energy consumption** | Weighted annual energy consumption in kWh/year | Energy consumption in kWh per cycle |
| **Condensation efficiency class** | A - G | - |
| **Cycle time** | Corresponding to the standard cotton programme at full load in minutes | - |
| **Determination of the energy demand** | Weighted annual energy consumption at full and partial load plus the energy consumption in “off mode” and “left on mode” | Energy consumption per cycle in full load |

# 3 Market data

The following presents a short market data analysis of tumble driers in the EU, based on *Preparatory studies for Ecodesign requirements of Energy-using-Products (EuP) – Lot 16, 2009 [1].*
The stock of tumble driers in the European Union (EU) was estimated at 41 million units in 2000. An increase of over 20 million units was estimated by 2010 (2).

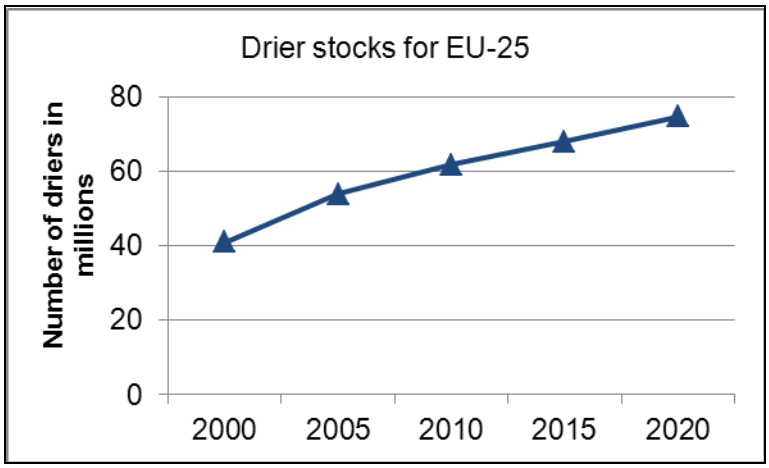



Figure 2. Drier stock development in the EU25 [1]

Within the European stock, the share of the ten new Member States (Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, Slovakia) is expected to grow from 0.3% in 2000 to 6% in 2020 [1].

This shows that there are significant differences in the penetration of driers between East and West. This also applies for the North-South relation. To give an example, the number of driers sold in a year is about the same in Italy as in Switzerland [2], although the population of the two countries differs significantly (in 2010: 60.5 million and 7.8 million respectively) [3). In Germany already tumble driers with the energy class A+++ are sold.
In southern Europe, warmer countries, electrical drying is less important since the laundry can be dried outside in the sun during a longer period than in northern Europe.

Round about 10 % - 12% of residential household energy consumption is caused by household tumble driers. There is great potential to reduce their energy consumption further by improving their energy efficiency. In 2005, 90% of appliances sold in the EU-25 were class C appliances. In 2007 it dropped to 75% of all driers sold in the EU-20[3]. 16.7% thereof were class B. The share of class A was still very small with 1%. In 2008, class A had already a significant market share in some EU Member States, such as Italy (more than 10%) (Figure 3) [7].

[3] Incl. AT, BE, BG, CZ, DE, DK, ES, FI, FR, GB, GR, HU, IT, NL, PL, PT, RO, SE, SI, SK.

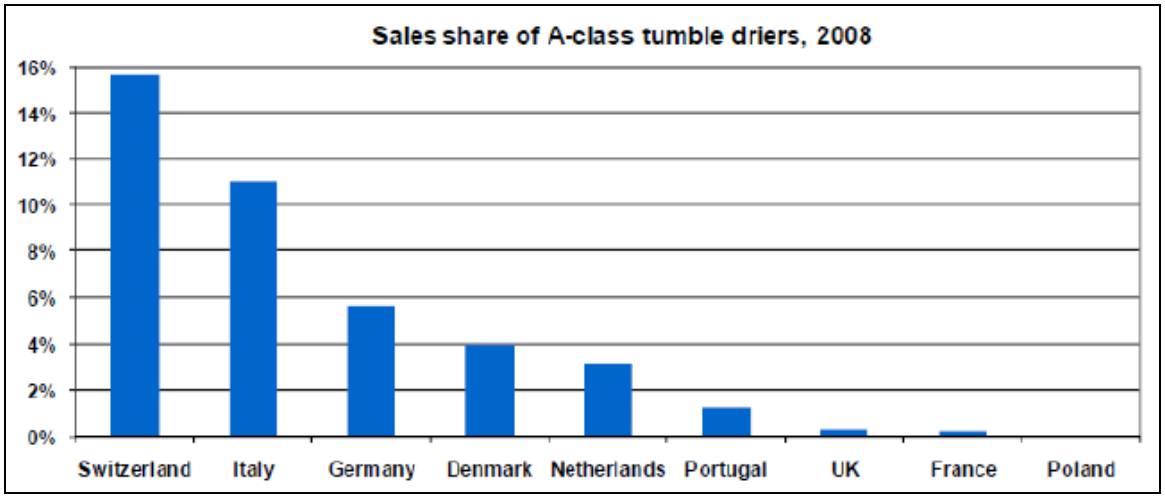
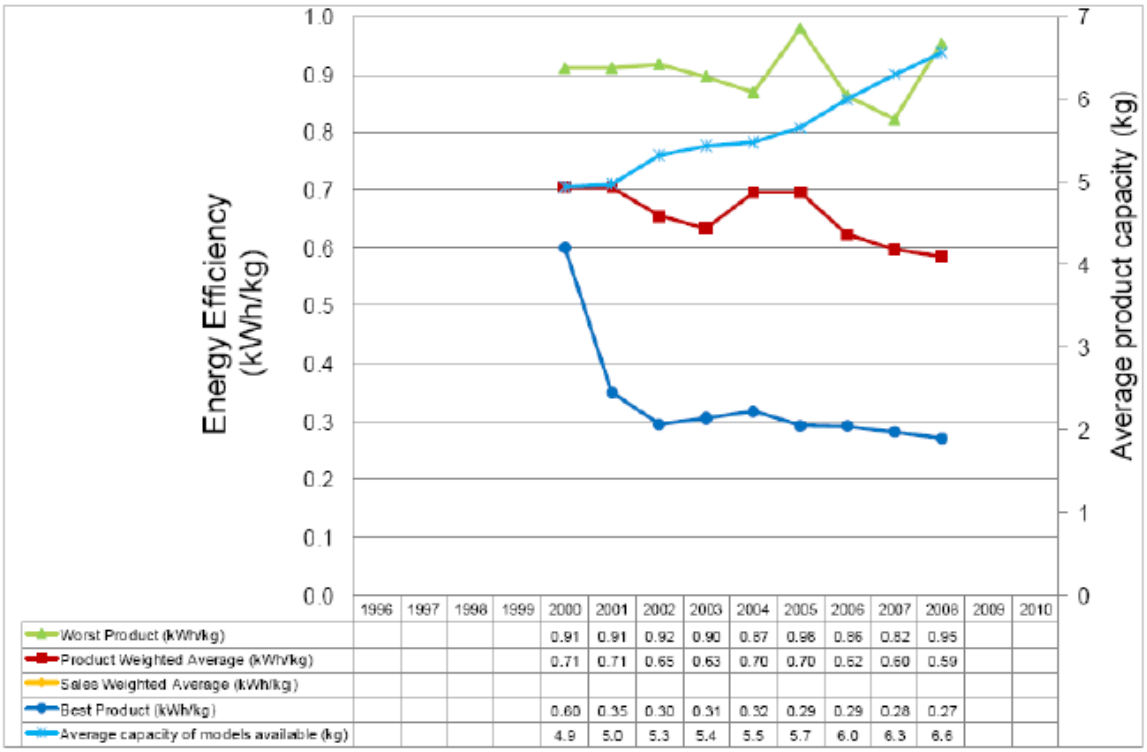



Figure 3. Sales share of A-class laundry driers, 2008 [7]
In addition to this the average loading capacity has been increasing from 4.9kg in the year 2000 to 6.6kg in 2008. The efficiency during this period increases from 0.71 kWh/kg to 0.59 kWh/kg. This improvement might be due to the higher capacity [7].

Between the best product and the worst product on the market there are significant differences in energy efficiency (4).




| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worst Product (kWh/kg) | | | | | 0.91 | 0.91 | 0.92 | 0.90 | 0.87 | 0.98 | 0.86 | 0.82 | 0.95 | | |
| Product Weighted Average (kWh/kg) | | | | | 0.71 | 0.71 | 0.65 | 0.63 | 0.70 | 0.70 | 0.62 | 0.60 | 0.59 | | |
| Sales Weighted Average (kWh/kg) | | | | | | | | | | | | | | | |
| Best Product (kWh/kg) | | | | | 0.60 | 0.35 | 0.30 | 0.31 | 0.32 | 0.29 | 0.29 | 0.28 | 0.27 | | |
| Average capacity of models available (kg) | | | | | 4.9 | 5.0 | 5.3 | 5.4 | 5.5 | 5.7 | 6.0 | 6.3 | 6.6 | | |

Figure 4. Energy efficiency of new laundry driers in Europe [7]

The efficiency of heat pump driers on the market 2013 is illustrated in Figure 5.

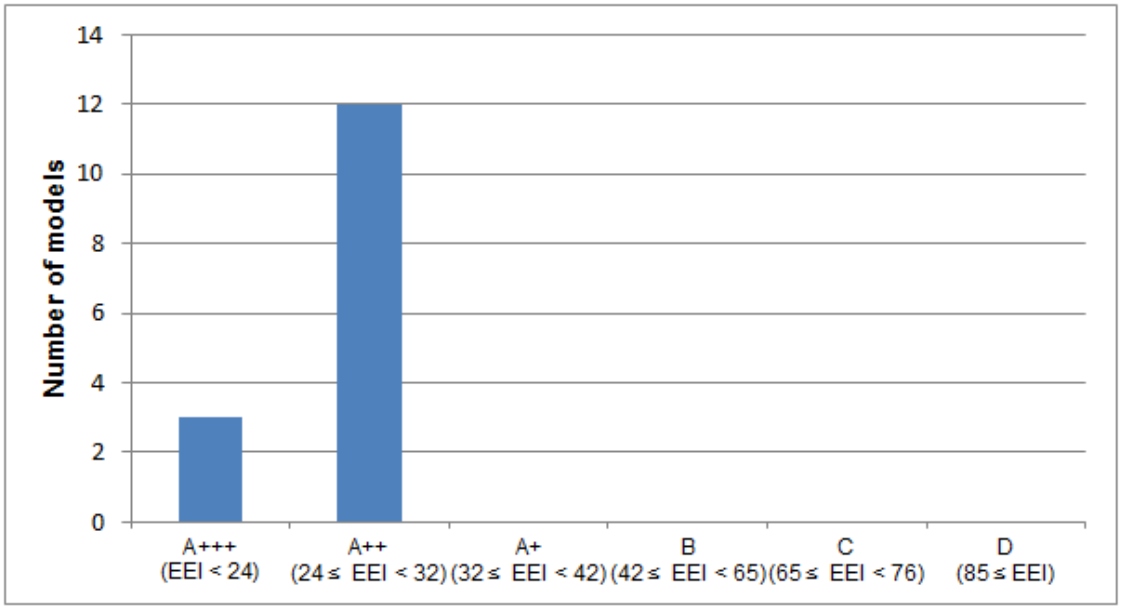



Figure 5: Efficiency of heat pump driers on the market based on www.topten.eu, Septmeber 2013, "15 residental heat pump driers"[4] [5]

## 3.1 Switzerland

In Switzerland the heat pump driers reached a market share of 47% in 2011. Swiss policy makers decided to ban all drier models below class A from the Swiss market, starting in 2012. Since 1st January 2012, only (old) class A (or better) driers can be sold in Switzerland. The prices are decreasing and the number of efficient drier models on the market has been increasing what can lead to considerable electricity savings.

[4] CH, DE and "on demand"

# 4 Concept and Criteria

## 4.1 Topten Europe

Topten Europe (www.topten.eu) lists the most energy efficient household electric tumble driers of Europe:

- The energy class according to the EU energy label must be A++/< EEI 32[5] or better. In general, only heat-pump tumble driers meet this criteria.
- Additionally the Condensation efficiency class shall be B or A[5].

Three tumble driers's categories are presented on Topten.eu:

- for residential use (driers designed for one apartment, 7-9kg load)

**Order of presentation**

The products are presented according to their energy efficiency class (A+++ to A++ according to EU energy label). The presentation order can be changed by clicking on headings (brand, model, electricity cost etc).

Presented information:

- Brand and Model
- Capacity in kg
- Drying time in minutes full load
- Energy class
- Energy Consumption (kWh/year)
- Electricity costs
- Condensation class
- EEI
- Availabilty

[5] According to Commission Delegated Regulation (EU) No 392/2012 of 1 March 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of household tumble driers.

## 4.2 Test Standards

The following standards are relevant for the assessment of tumble driers.

| Reference / date | Title | Main points |
|---|---|---|
| EN 61121: 2005<br>IEC 61121 ed. 3.1: 2005 (A1:2005) | Tumble driers for household use – Methods for measuring the performance | Defines test methods for measuring performance of tumble driers as regards the: drying performance, evenness of drying, condensation efficiency (for condenser driers), water and electric energy consumption, programme time.<br><br>Watch out: Measurements are based on an initial moisture content of 60. The current labelling scale still on 70% - multiplication with a factor of 1.14 is required to obtain the label class from the measured efficiency).<br><br>The EN standard represents the basis of the current European energy labelling system for tumble driers. |
| EN 60704-2-4:2001,<br>IEC 60704-2-4:2001 | Household and similar electrical appliances. Test code for the determination of airborne acoustical noise. Particular requirements for washing machines and spin extractors | Relevant noise measurement standards |
| EN 60704-3<br>IEC 60704-3:2006 | Household and similar electrical appliances - Test code for the determination of airborne acoustical noise - Part 3: Procedure for determining and verifying declared emission values | Relevant noise measurement standards |

## 4.3 Tumble drier criteria for national Topten sites

In order to be displayed on Topten, tumble driers must meet the following criteria**:**

- Tumble drier energy efficiency class at least A++/EEI < 32 (according to the existing energy labelling)
  - o If there are no A+ class/EEI < 42 or better tumble driers in the market, the product group should not be promoted on Topten. Topten should not therefore promote heavy consuming products.
- Condensation efficiency class shall be B or A
- The tumble drier should be equipped with humidity sensors[6].

### 4.3.1 Additional information

Additional product information displayed on Topten can give the consumer a more thorough outlook on the product. Additional product information is not additional selection criteria, but can give more wider view of the product. This and general information on the energy efficiency of tumble driers can also be used on the recommendations for tumble driers.

- noise

The consumers should be encouraged to familiarize themselves with the instruction manual of the product.

- The drier instruction manual should include a table of main drying programmes and their attributes, such as:
  - o suitability for different textiles
  - o load capacity
  - o drying time
  - o energy consumption
  - o residual moisture

- Instruction manual should also include information on:
  - o cleaning the lint trap,
  - o cleaning the condenser unit,
  - o cleaning other elements of the product,
  - o requirements for placements such as ambient temperature and moisture,
  - o installation-related issues, such as electrical and water connections as well as any exhaust air requirements, and
  - o energy saving tips for energy efficient use of the product

[6] The opposite is a “non-automatic tumble drier” which switches off the drying process only after a predefined period, usually controlled by a timer.

- power consumption of the off-mode and the left-on mode
- Indicative information on the programme time and energy consumption for the main drying programme at both full, and, if applicable, partial load
- Information to the “standard cotton programme[7]”.

### 4.3.2 Energy efficiency of tumble driers

The practical energy efficiency of tumble driers is also affected by the following issues related to device placement, use and management:

- **Efficiency of the washing machine spin cycle**: to ensure efficiency, washing machine should have A class spinning efficiency or B if no drier is used. A high spinning speed with at least 1400 U/min should be used when when using a drier.

- **Drier Type:** Heat pump drier function is currently the most energy efficient. Some heat pump operated tumble driers consume up to 60% less electricity than conventional tumble driers .

- **Ambient temperature:** Electricity consumption of a condenser tumble drier could double if the room temperature rises above 30 degr ees Celsius. This is important when placing a condenser drier: air flow from the drier can heat the ambient air and cause consumption to rise, especially in closed quarters (small rooms with inadequate ventilation).

- **Regular cleaning of the drier lint trap and condenser unit** is essential, because otherwise the air circulation is reduced and the drying time is longer and the energy consumption increases.

[7] ”Standard cotton programme“ means the cycle which dries cotton laundry with an initial moisture content of the load up to a remaining moisture content of the load of 0%.

# 5 References

[1] PricewaterhouseCoopers. *Ecodesign of Laundry Driers. Preparatory studies for Ecodesign requirements of Energy-using-Products (EuP) – Lot 16*. Final Report March 2009. Can be downloaded at: www.ecodriers.org

[2] Sophie Attali, Eric Bush, Anette Michel. *Factors influencing the market penetration of energy efficient electrical appliances into national markets in Europe*. Report for Defra / the Market Transformation Programme by SoWATT and Bush Energie GmbH. Can be downloaded at: http://www.topten.eu/english/all_news.html and data from the Swiss Association of the Domestic Electrical Appliances Industry FEA)

[3] http://data.worldbank.org/country

[4] Comission Regulation (EU) No 932/2012 of 3 October 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household tumble driers

[5] Anette Michel. Topten Policy recommendations on tumble driers, October 2012 (www.topten.eu).

[6] Commission Directive 95/13/EC of 23 May 1995 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric tumble driers (*OJL 47, 24.2.1996, p. 35), (eur-lex.europa.eu)*

[7] Paolo Bertoldi, Bettina Hirl, Nicola Labanca. Energy Efficiency Status Report 2012. Electricity Consumption and Efficiency Trends in the EU-27. Ispra 2012.

[8] Intelligent Energy Europe (IEE). Yearly Appliance Energy Cost Indication (YAECI). Approach, methodology and data per country. D2.1 Report. December 2012. www.appliance-energy-costs.eu/download-library/yaeci-project-approach-methodology-and-data-per-country-defined.